

7G-TRONIC /7G-TRONIC PLUS (722.9) in the Workshop

Tips and Tricks



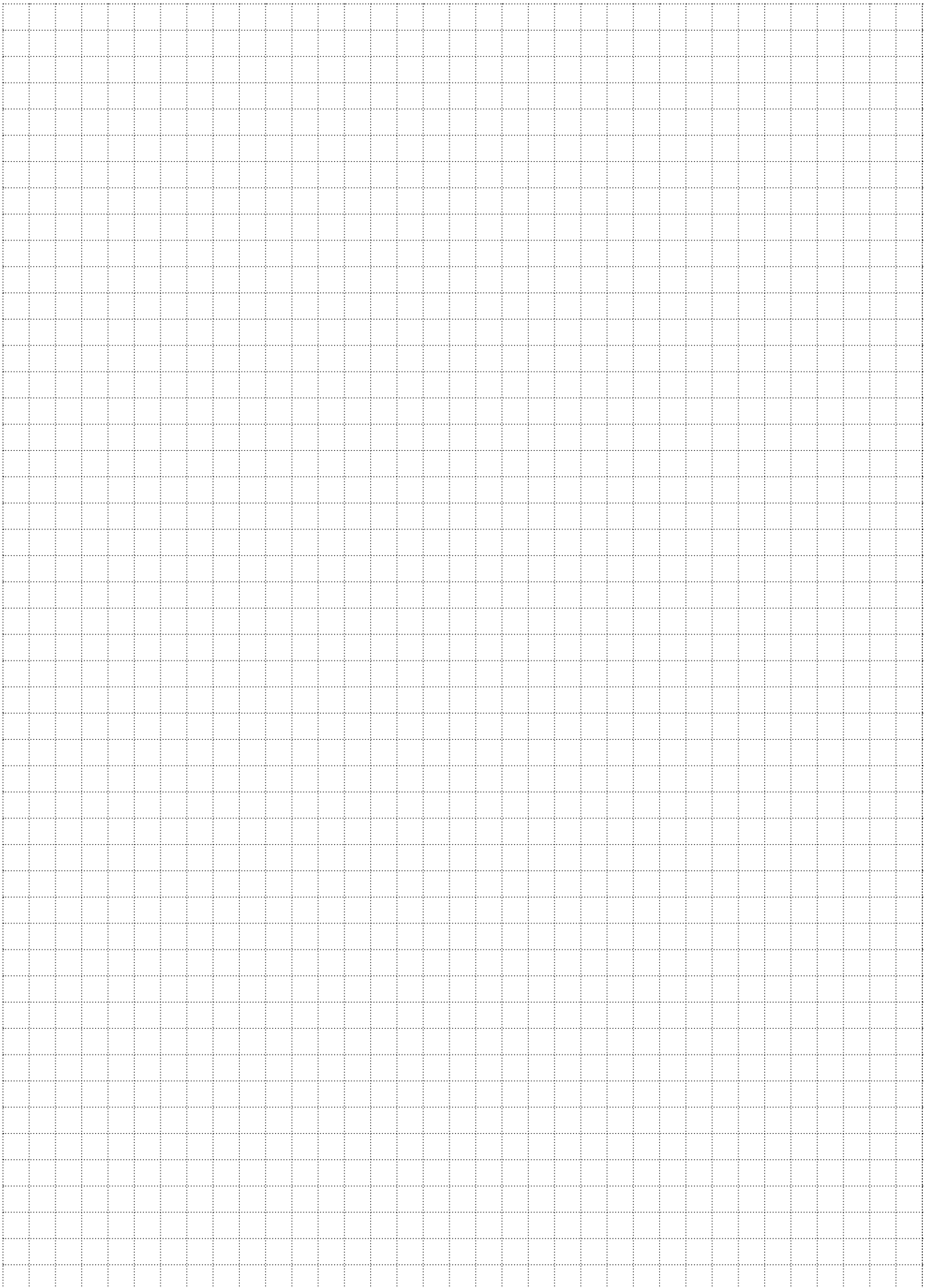
Mercedes-Benz

Mercedes-Benz Service

**7G-TRONIC/7G-TRONIC PLUS (722.9)
in the Workshop
Tips and Tricks**

Daimler AG · Retail Operation (GSP/OR) · D-70546 Stuttgart

Space for notes



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Dear Reader,

This brochure is intended as a tool to answer any questions you may have and to help you in your day-to-day work on transmission 722.9 in the passenger car model series and selected van model series.

The function descriptions are structured in a familiar way but also contain explanations of customer experiences which will help you to explain the background to the functions to the customer.

This brochure is also intended to help you diagnose and repair technical problems and to demonstrate the interrelationships between problems and remedies.

All the technical data and remedies listed in this brochure are valid as of the copy deadline in May 2013 and apply to the passenger car model series. You must first check to determine whether the specified repair descriptions and parts scopes are also applicable to the van model series.

Before performing a repair, confirm and, if necessary, modify the procedure described in this document by comparing it to the currently valid documents in WIS for your market.

Daimler AG

Retail Operation (GSP/OR)

Note

The pictures in this brochure are language-neutral where possible. If this was not possible, German or English texts appear in exceptional cases.

Milestones

The milestones provide a timeline of the most important events and developments.

Time	Milestone
2003	Start of series production of NAT2 with model series 220 and R230 with M113
November 2004	Introduction of NWG converter, across-the-board roll-out of NAT2 to all 6 and 8-cylinder engines
As of 2005	Switchover from VGS1 to VGS2
November 2005	One million 722.9 transmissions manufactured
September 2006	Start of series production of NAT2i (all-wheel drive transmission S, E, C, GLK)
November 2007	Switchover of transmission fluid from ATF 3353 to ATF 134
September 2008	Two million 722.9 transmissions manufactured
March 2008	NAT2 with wet start-up clutch (NAK) for AMG
June 2008	Start of switchover from VGS2 to VGS3
January 2009	Mild-hybrid model series 221 with auxiliary oil pump
June 2010	Across-the-board switchover from ATF 134 transmission fluid (red) to FE-ATF 134 (blue)
September 2010	Market launch of 7G-TRONIC-PLUS with FE converter with centrifugal pendulum technology
October 2010	Three million 722.9 transmissions manufactured
November 2010	Start of 2nd production line, transmission serial number 7xxxx
March 2011	Start of across-the-board switchover of 4-cylinder engines to 722.9
December 2011	Four million 722.9 transmissions manufactured
January 2012	Market launch of 722.9 in Sprinter
March 2012	Initial introduction of VGS4 in R231
June 2012	NAT2VFE+ (reinforced) SL65, G65 AMG for 463KW/1000Nm (M279)
June 2012	P2-hybrid, electric drive
December 2012	5 million 722.9 transmissions manufactured

Function and design

Transmission 722.9

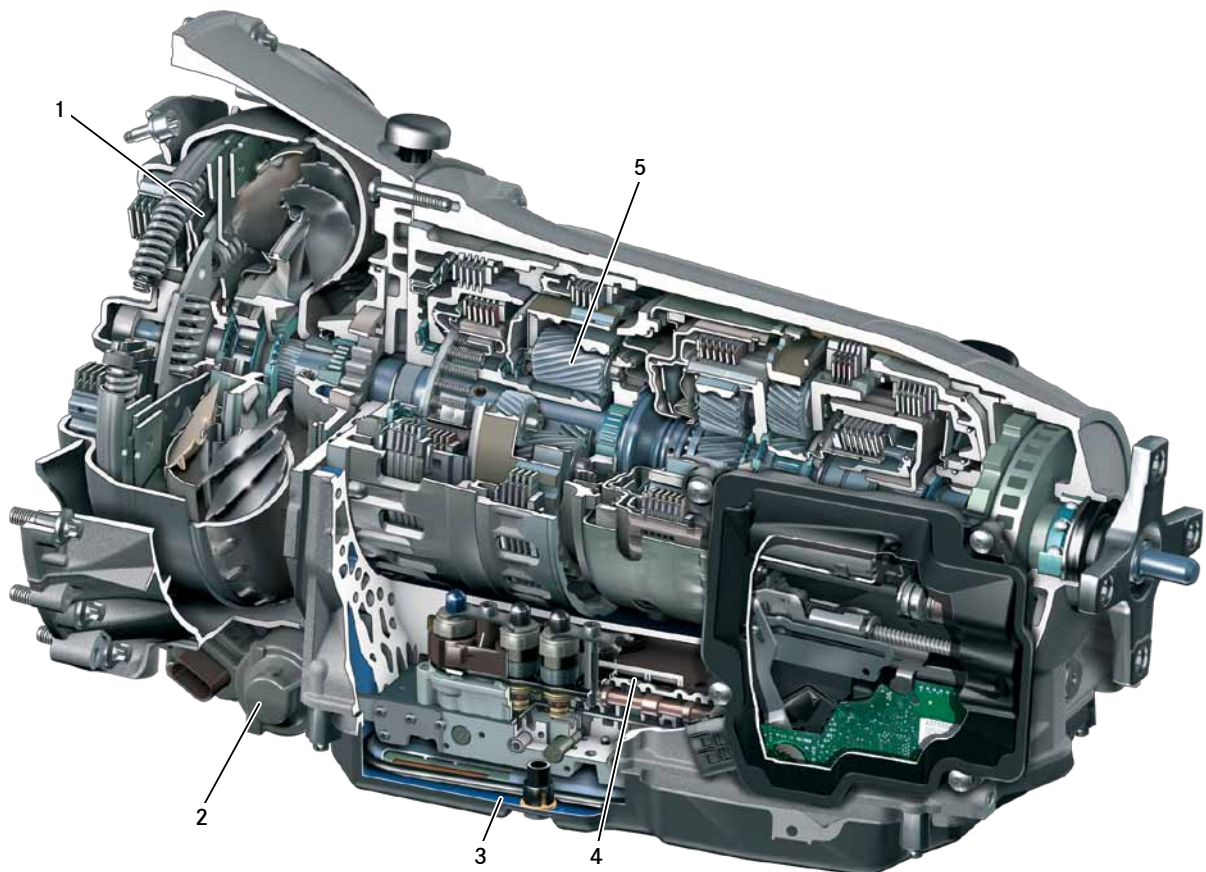
In this section, the main functions and relationships of the transmission will be explained and demonstrated to allow you to better understand the functions of the transmission.

An understanding of the function and technology of the transmission will allow you to explain customer experiences more easily. This will prevent the customer from having to wait unnecessarily while an enquiry is processed by the technical workshop support team.

Note

The complete function description of the transmission can be found in WIS.

7G-TRONIC PLUS (NAT2FE+)

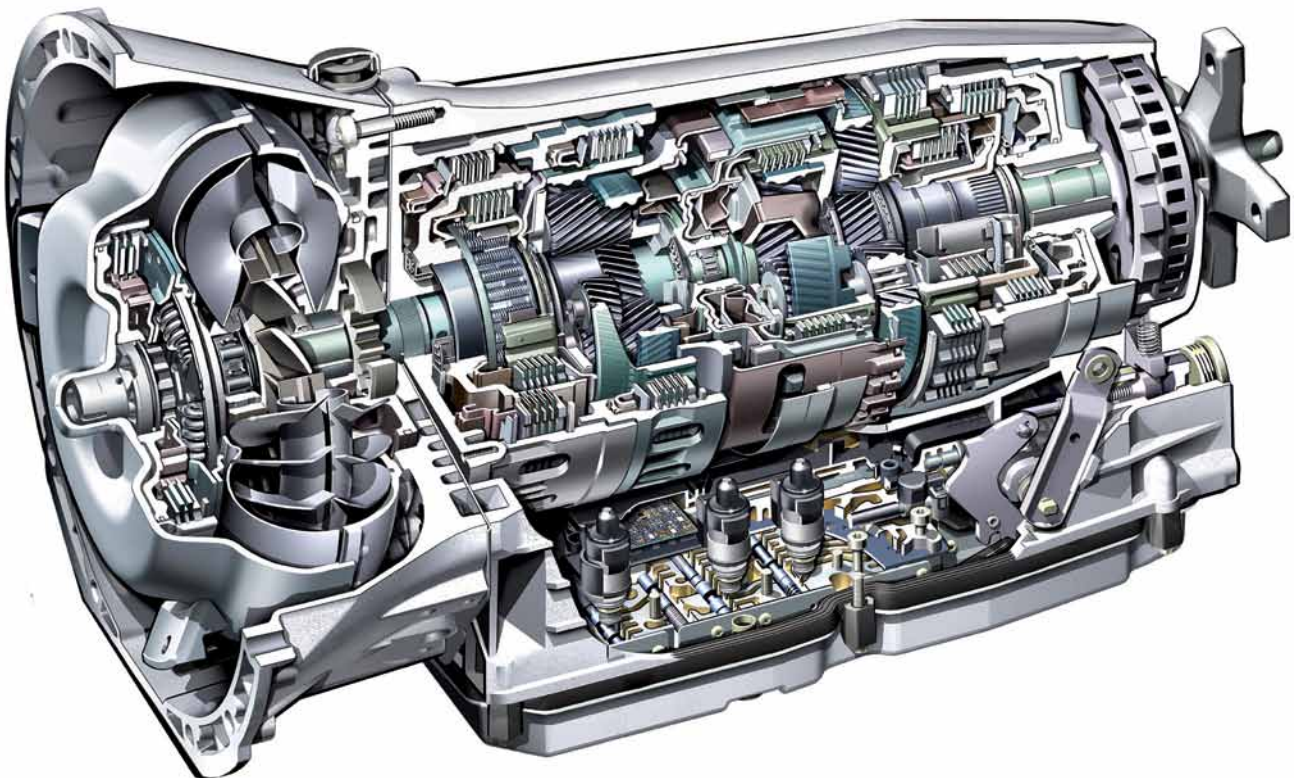


- 1 New torque converter with torsional damper and centrifugal pendulum damper
- 2 Electromotive auxiliary transmission oil pump for start/stop operation

- 3 World's lowest viscosity automatic transmission fluid (blue)
- 4 Electrohydraulic control system optimized for ECO transmission modes
- 5 Reduced-friction planetary gear set materials, bearings and seals

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7G-TRONIC (NAT2)



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Function and design

Actuated shift elements

Multidisk clutches (K1-K3)
Multidisk brakes (B1-B3, BR)

To engage a gear in the transmission, 3 shift elements must be actuated i.e. closed. The following table shows the shift elements which must be closed to engage the respective gears. Refer to WIS for the associated power flow diagrams.

Changing from one gear to the next gear up or down is only ever performed by changing one shift element i.e. one shift element is disengaged and another is engaged.

This table can also be used to derive interrelationships between components e.g. for adaptation or repair purposes.

Example:

The transmission only shifts as far as 2nd gear, 3rd gear cannot be engaged, the transmission switches to limp-home mode and a fault code is stored. If no remedy has been published for the symptom, the table can be used to determine that multidisk clutch K1 is engaged for 3rd gear. This allows an initial diagnosis to be determined, that there may be a defect in the K1 system (electrical system/hydraulic components/mechanical components).

Table of shift elements

	K1	B1	B3	K3	K2	B2	BR
1st gear			●	●		●	
2nd gear		●		●		●	
3rd gear	●			●		●	
4th gear	●				●	●	
5th gear	●			●	●		
6th gear		●		●	●		
7th gear			●	●	●		
Neutral							
1st reverse gear			●	●			●
2nd reverse gear		●		●			●

Start-off gear

Transmission 722.9 engages the start-off gear depending on the transmission mode and vehicle model.

The following start-off gear strategy currently applies (MB passenger cars, does not apply to AMG):

- S-mode, vehicle always starts off in 1st gear
- C/E-mode:
 - Diesel engines: 1st gear
 - Gasoline engines: 4-cylinder in 1st gear
6/8-cylinder in 2nd gear
- Offroad vehicles:
 - High range: 1st gear
 - Low range: 2nd gear



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Mode selection button

S16/12 Automatic transmission transmission mode button

Function and design

DIRECT SELECT module (DSM)

The DIRECT SELECT module (DSM) forms part of a shift-by-wire system together with the selector lever. The shift pulses for changing the gear range (P, R, N, D) are transferred to the DSM as electrical signals where they are implemented after a plausibility check.

As of 2008, the Intelligent Servo Module (ISM) was gradually replaced by the DIRECT SELECT module (DSM). An important difference exists in the power transmission within the module. For noise-related reasons, the drive gears were replaced with a toothed belt.

If malfunctions occur, either the message "No gear changes - Service required" or "Risk of vehicle rolling away - Transmission not in P" appears on the display depending on the model year and model series. The driver should then drive to the next workshop without changing gear range, if possible. The next time the driver attempts to change gear range, it is possible that "P" will be automatically engaged by means of an emergency mechanism. It would then no longer be possible to continue driving the vehicle.

However, this does not mean that the DSM is defective. The problem could be a malfunction in another component of the shift-by-wire system or its electrical connections.

Possible reasons for the display indication and triggering of the emergency mechanism include:

- Faulty signal transmission on CAN bus.
- Power supply failure of DSM.
- Signal line (AUX_SUPPLY, Emergency-P) for emergency mechanism conducts > 2V. Possible causes: line defect, electronic ignition lock defect.
- DSM defect. In this case, a fault which clearly indicates this will be stored in the control unit.

In all cases, the fault codes of the control units which are involved in the shift-by-wire system must be observed and the corresponding test steps must be processed. If the message "Emergency mechanism triggered" is stored in the DSM, this does not indicate that the module is defective and instead indicates one of the malfunctions specified above. If the DSM is defective, an additional specific fault entry is stored.

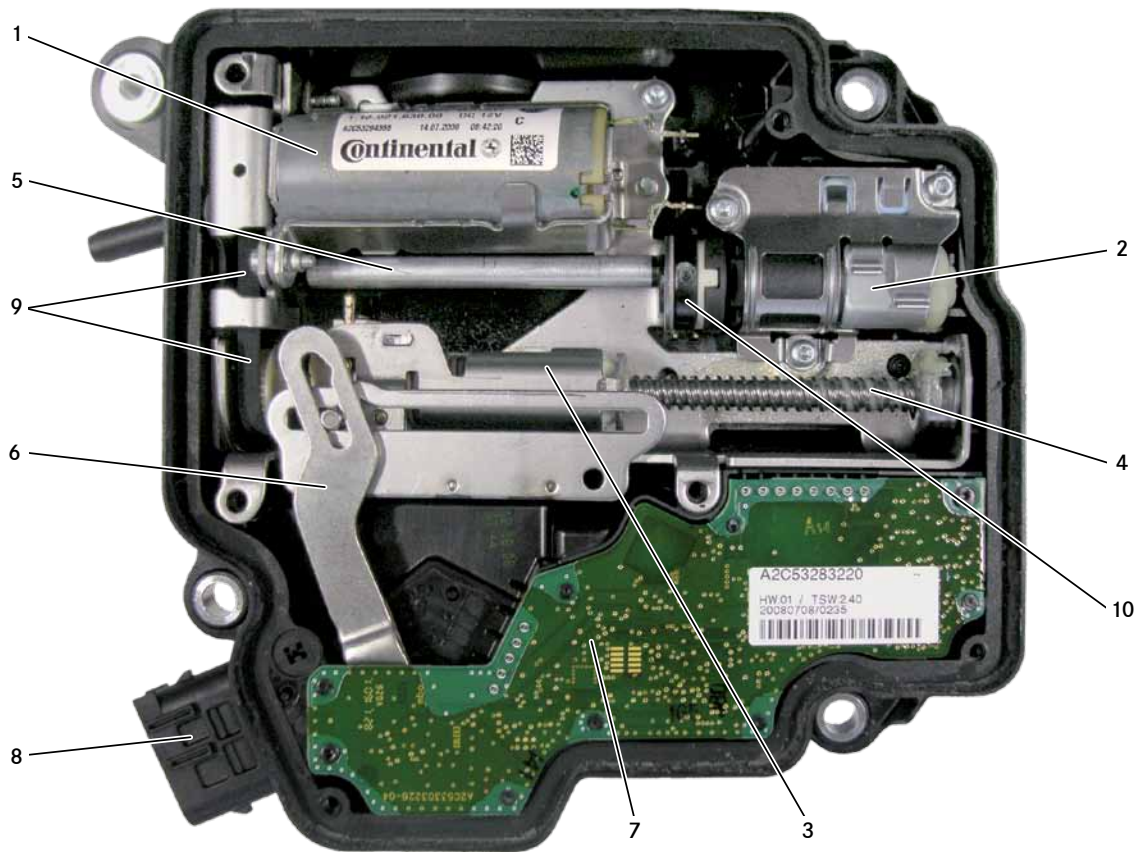
Under the following conditions, the DSM automatically performs a gear range change without storing a fault. This is carried out for reasons of convenience and does not represent a malfunction.

- 1. Ignition key is removed, "P" is engaged.
- 2. If the ignition key is moved to position 0 or 1 in gear range R or D, "N" is engaged automatically.
- 3. Driver door is opened at a low speed, "P" is engaged.

Prerequisite for 3.:

Driver did not previously shift to "N" with the ignition on. If the driver previously shifted to "N" himself/herself, "N" remains engaged after the driver door is opened (washing facility, towing). Exception: On vehicles with KEYLESS-GO, "P" is always engaged with the engine off and the driver door open.

The availability of individual functions can depend on the production date of the vehicle. Detailed information about this can be found in the operator's manual of the vehicle.



DIRECT SELECT module (DSM)

- | | |
|--------------------|------------------------------------|
| 1 Main motor | 6 Range selector lever |
| 2 Emergency motor | 7 Electronic systems |
| 3 Slider | 8 Connector plug |
| 4 Threaded spindle | 9 Toothed drive belt |
| 5 Eccentric shaft | 10 Eccentric shaft position sensor |

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Function and design

Fuel Economy (FE) torque converter

Starting as of 09/2010 on vehicles with the 7G-TRONIC PLUS automatic transmission, FE converters with centrifugal pendulum dampers (world premiere in an automatic transmission) are used on the following engines¹:

- From start of series production: M278, OM642LS, M276LA, M274, M152, M157
- Phased in as of 03/2011: OM651

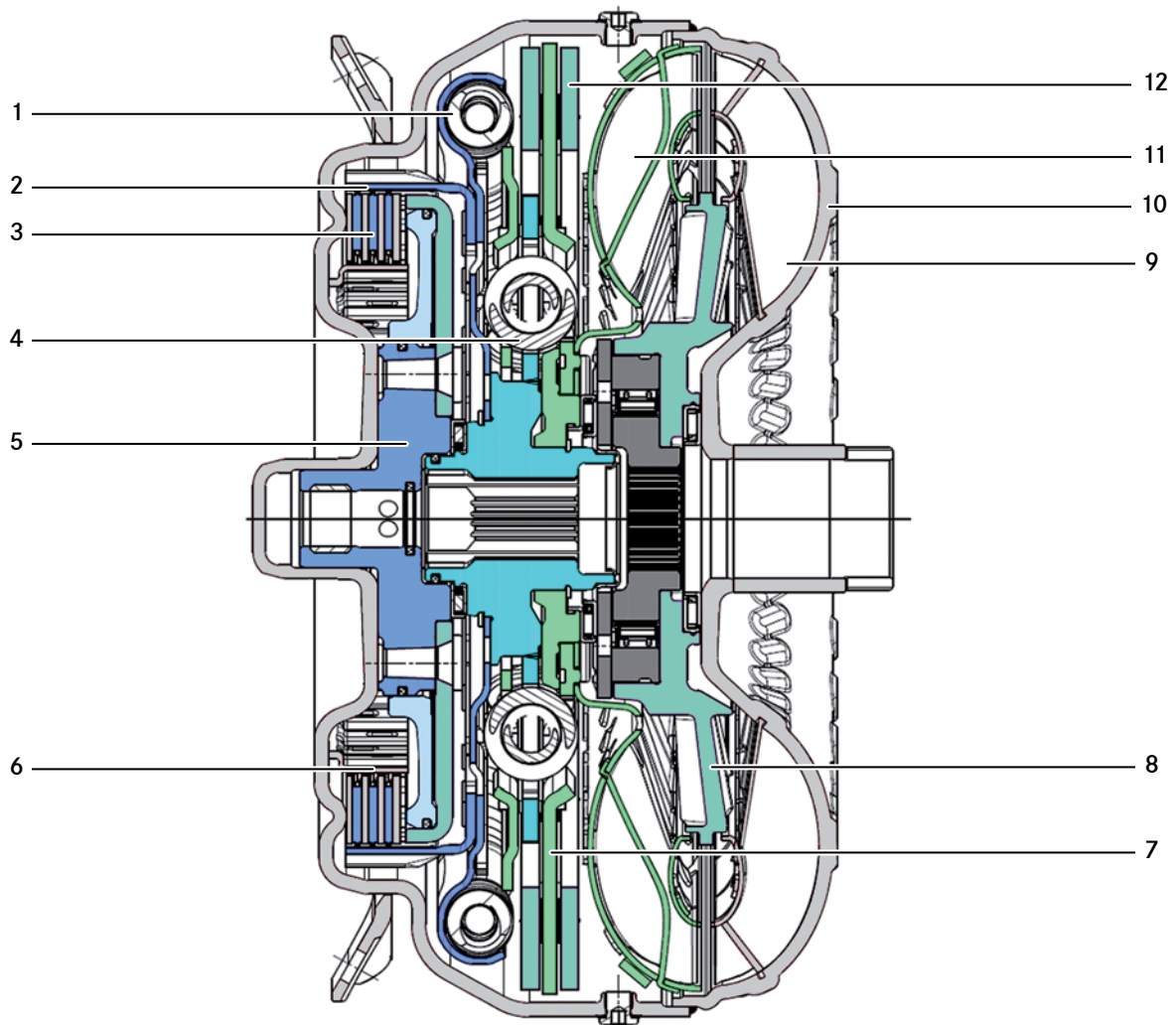
On the M279, the pendulum weights were able to be omitted due to the low level of engine excitation.

¹ Exceptions: M271evo and M276

The main features of this converter type are:

- Increased installation space
- Improved hydraulic efficiency (>90%, previously 85%)
- Torque capacity up to 1000 Nm
- Optimized cooling of torque converter lockup clutch due to targeted feed of cooling oil flow
- Reduced drag torque of torque converter lockup clutch due to forced separation of disks, which also provides optimized cold-starting characteristics
- Increased service life of torque converter lockup clutch due to design improvements and operating strategy with minimal drag
- Double turbine torsional dampers with centrifugal pendulum.
- The pendulum weights swing in opposition to the engine excitation and eliminate the non-uniform rotation.
- Through the use of a centrifugal pendulum damper, it is possible to reduce the slip at the torque converter lockup clutch to a few revolutions per minute. The consumption savings compared to previous damping concepts with significantly higher slip speeds are up to 3% depending on the engine.

FE torque converter with torque converter lockup clutch and centrifugal pendulum damper



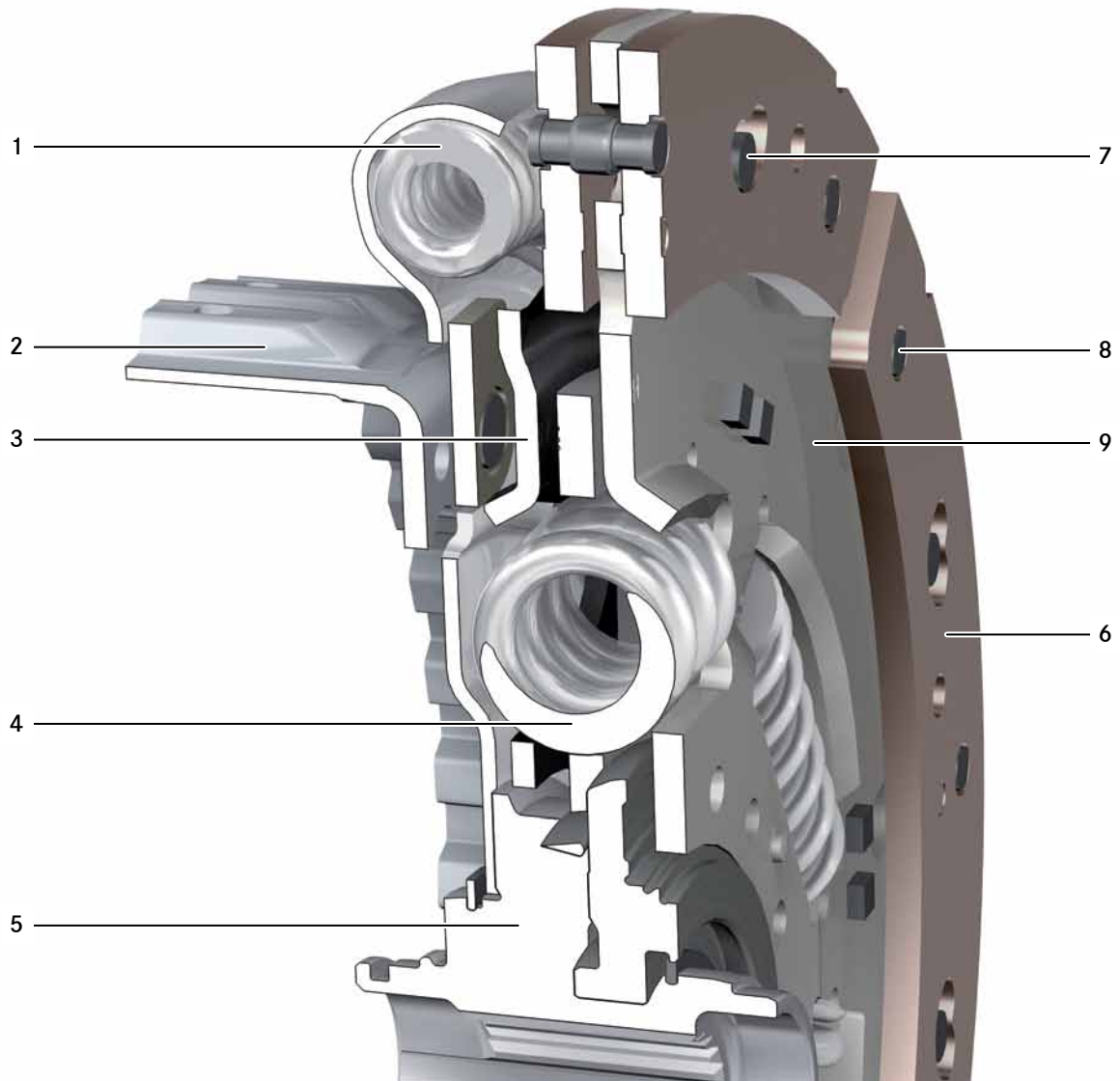
- 1 Primary springs
- 2 Outer disk carrier
- 3 Disk pack
- 4 Secondary springs
- 5 Connection to drive shaft
- 6 Inner disk carrier

- 7 Central mass with connection to turbine (centrifugal pendulum)
- 8 Stator
- 9 Impeller
- 10 Pump housing
- 11 Turbine wheel
- 12 Pendulum mass

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Function and design

Centrifugal pendulum damper



- 1 Primary springs
- 2 Torque input
- 3 Connection to central mass
- 4 Secondary springs
- 5 Connection to drive shaft

- 6 Pendulum mass
- 7 Pendulum guide
- 8 Spacer and connecting rivets
- 9 Central mass with connection to turbine

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Torque converter lockup clutch (KÜB)

In addition to the shift elements for performing gear changes, there is also a multidisk clutch for reducing converter slip inside the torque converter.

The multidisk clutch is fitted with 2 or 3 coated disks depending on the engine in the vehicle and transmission model. They are always double-sided coated disks.

- M113: 2 coated disks
- M156: 3 coated disks
- M272: 2 coated disks
- M273: Initially 2 coated disks, switchover to 3 coated disks in 02/2007-06/2007 together with introduction of additional transmission cooler
- OM629: 3 coated disks
- OM642: Initially 2 coated disks, switchover to 3 coated disks in 02/2007-06/2007 together with introduction of additional transmission cooler

Converter without centrifugal pendulum damper:

- M271: 2 coated disks
- M276: 2 coated disks
- M279: 3 coated disks

Converter with centrifugal pendulum damper:

- M152: 3 coated disks
- M157: 3 coated disks
- M274: 2 coated disks
- M276LA: 2 coated disks
- M278: 3 coated disks
- OM651: 2 coated disks
- OM642LS: 3 coated disks

Function and design

Auxiliary oil pump (ZÖP)

When the engine is shut off in start/stop mode, the auxiliary oil pump takes over the task of supplying oil to the hydraulic controller unit of the transmission from the primary pump which is then stationary.

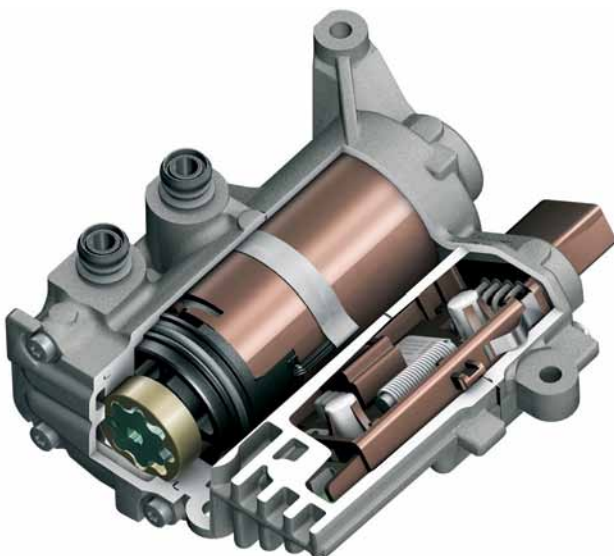
In the process, the pressure level is reduced to the extent that the shift elements remain filled with oil and cannot run empty.

This allows quick and comfortable start-offs after an ECO stop.

The auxiliary oil pump is a powertrain CAN bus subscriber. Fault codes are stored in the transmission control unit. It is an independent component with its own control unit.

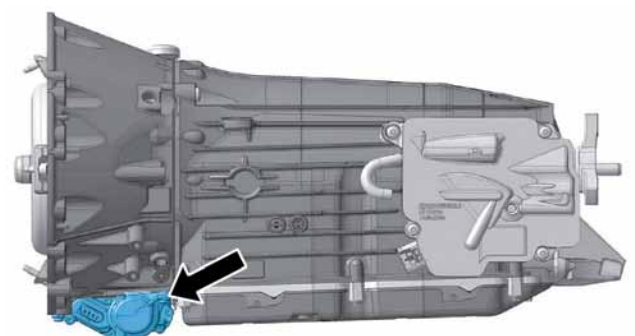
There are a variety of conditions (stop inhibitors/start requestors) which must be fulfilled for the start/stop system to be activated. If the engine does not shut off or restarts against the expectations of the customer, this does not necessarily mean that the auxiliary oil pump is defective.

An extract from the list of stop inhibitors, start requestors and the systems involved can be found in the following table and in the DAS/XENTRY system.



Auxiliary oil pump

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Auxiliary oil pump on torque converter housing

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Stop inhibitors

The on-board electrical system is not ready

The engine condition (coolant/catalytic converter temperatures) is not ready

Internal combustion engine diagnosis is active

A participating system (electric motor (EM), regenerative braking system (RBS), adaptive cruise control (ART),...) is not ready

The function has not been activated via the vehicle speed

The vehicle rolled backwards a short time previously

The engine hood is open

The accelerator pedal is actuated

The transmission has not issued an enable signal

Systems involved, stop inhibitors

Electric machine

Regenerative braking system (RBS) (brakes/Electronic Stability Program)

Engine hood (signal acquisition and actuation module, SAM)

AC

Transmission

Selector lever (intelligent servo module)

Electric parking brake

Vehicle speed (ESP)

Driver presence (seat belt buckle and door contact)

Systems involved, start requestors

On-board electrical system

Combustion engine

Regenerative braking system (RBS) (brakes/ESP)

AC

Transmission

Vehicle speed (ESP)

Driver presence (seat belt buckle and door contact)

Function and design

NAT2i

Basic information

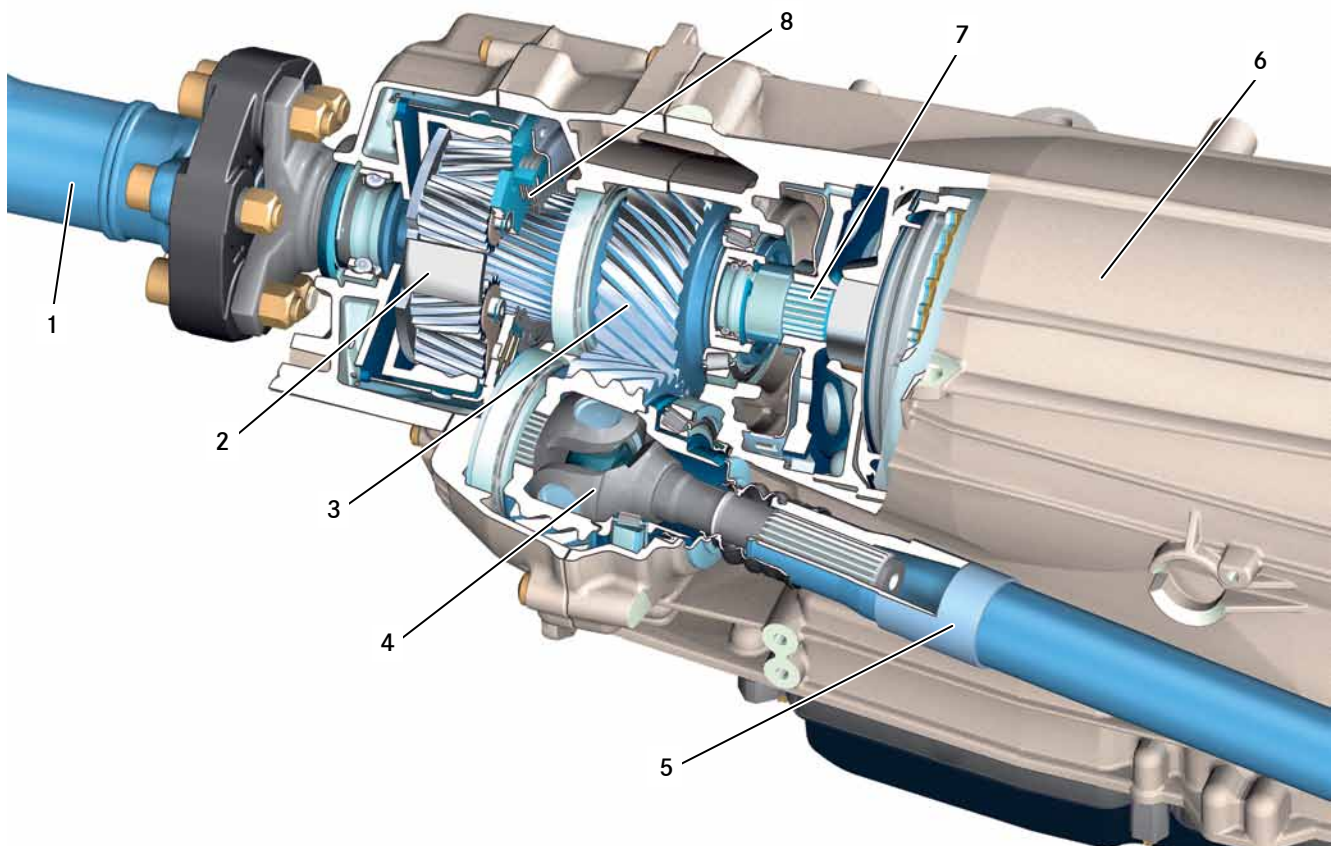
The transfer case is integrated in the rear section of the 7-speed automatic transmission. Power transmission to the front axle is carried out by means of a single-speed side output, which contains a universal joint for the propeller shaft to the front axle.

The gear ratio is designed so that 55% of the engine torque is transmitted to the rear axle and 45% is transmitted to the front axle.

The transfer case cannot currently be replaced separately. It must be completely replaced with the automatic transmission.

i Note

The complete function description of the transfer case can be found in the Introduction into Service Manual "Introduction of the new 4MATIC drive in model series 221" in SDmedia.



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Transfer case

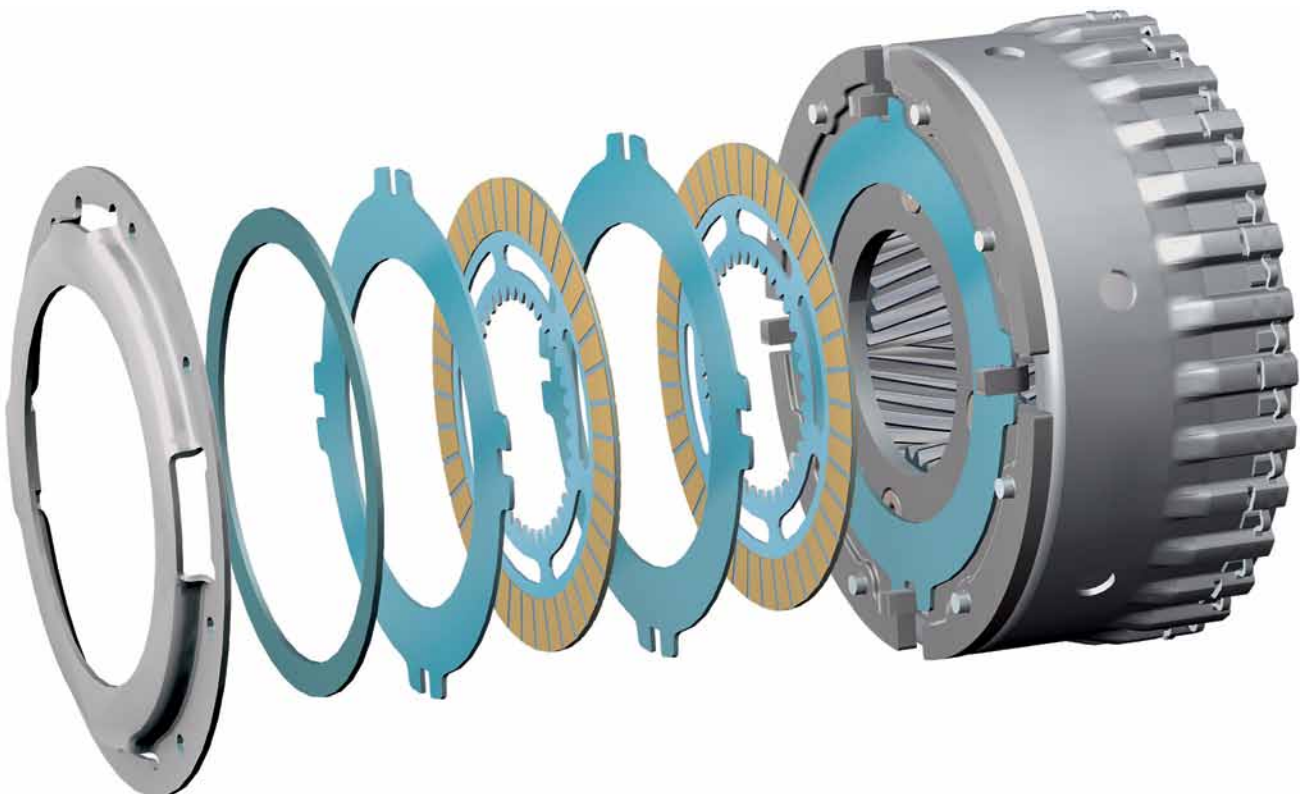
- | | | | |
|---|---|---|-------------------------------------|
| 1 | Rear axle output | 5 | Front axle propeller shaft |
| 2 | Double planetary differential (load change element) | 6 | 7G-TRONIC PLUS main transmission |
| 3 | Side output | 7 | Output shaft from main transmission |
| 4 | Integrated universal joint | 8 | Multidisk clutch |

Multidisk clutch (load change element)

A multidisk clutch is fitted to the planetary differential. This connects the front axle output (sun gear) to the rear axle output (planet carrier).

The disk pack is continuously pressurized with spring force. When the wheels spin on one of the two vehicle axles, a friction torque is transferred from the vehicle axle which is rotating more quickly to the vehicle axle which is rotating more slowly.

The pre-compressed multidisk clutch also acts as a load change damper. It reduces load change shock (when changing from acceleration to deceleration mode and vice-versa). Since the changeover play is much greater on all-wheel drive vehicles due to the additional drivetrain to the front axle, the load change is particularly harsh on these vehicles.



Load change element

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Function from customer's point of view

Omission of Last Mode

When a vehicle is restarted (ignition ON), the default transmission mode is always activated on vehicles on which the Last Mode function is omitted i.e. the vehicle always starts in transmission mode E or C.

Previously, the transmission mode last selected by the driver was always activated upon a restart.

This rule also applies to ECO mode, which is now always active when the vehicle is restarted.

The reason for omission of the Last Mode function is the consumption certification, which is always based on the transmission mode active after a vehicle is started. It is not possible to remove this function by programming.

Relaxation jolt during shutoff

Always shut off the engine in accordance with the operator's manual:

- Depress the parking brake firmly
- Shift transmission to the P position
- Turn the key in the ignition lock to position 0 or, on vehicles with KEYLESS-GO, press the start stop button.

If you do not shift the transmission to position P before you shut off the engine, you may notice a jolt from the vehicle.

Unpowered in D (KID/standstill decoupling)

Vehicles which are at a standstill in gear range D (e.g. stopped at traffic lights) have a greater transmission input torque than vehicles which are in gear range N. This problem is solved with standstill decoupling (KID). It reduces the transmission input torque when the vehicle is at a standstill by regulating a shift element to a defined slip level. This adjusts the transmission input speed (turbine) almost to the engine rpm level.

This results in a fuel saving of up to 0.4l over 100 km, improved vehicle acoustics and greater comfort at standstill (reduction of vibrations at standstill).

In practice, standstill decoupling can mean that unusual response characteristics of the automatic transmission may be noticeable during start-off because the normal transmission mode first has to be reactivated.

Decoupling and re-coupling is particularly noticeable if the transmission has decoupled at a standstill and is then prompted to re-couple by actuating "+" or "-" on the selector lever or steering wheel gearshift button. The re-coupling process may then be noticeable. In practice, standstill decoupling can be noticed, for example, when starting off quickly from traffic lights. If the driver switches quickly from a heavily depressed brake pedal to the accelerator pedal, there is a delay of up to 0.2 seconds until the transmission is re-coupled and the acceleration request is accepted. If you want to demonstrate this to your customer, you can start off quickly once in the conventional manner and the next time press "+" or "-" on the selector lever or steering wheel shift paddle before starting off from a standstill. This then means that the transmission is engaged before starting off and the delay of up to 0.2 seconds does not occur.

Certain prerequisites must first be fulfilled before standstill decoupling can be activated: The maneuvering speed of approx. 15 km/h must have been exceeded once. After this, standstill decoupling is activated if:

- the vehicle is braked to a standstill
- the accelerator pedal is not depressed
- the brake is actuated strongly enough (braking torque of at least 250N)
- transmission mode E or C is selected (also transmission mode S on vehicles with 4MATIC)
- the uphill slope which the vehicle is on does not exceed 18%
- the transmission oil temperature is between 10 °C and 110 °C
- the coolant temperature is between 0 °C and 120 °C.

Standstill decoupling is deactivated when DPF regeneration is taking place (recognizable from the significantly increased idle speed), the KID functionality is then prevented.

Note

On vehicles with ECO start/stop function, KID is deactivated as soon as ECO mode is activated. KID remains active until all of the conditions for ECO start/stop are fulfilled.

Note

See Advantages Online for further information about KID.

Function from customer's point of view

Sailing (KID+)

As a further development of the KID function (see chapter 1.2.3. "Unpowered in D (KID)"), the sailing function (KID+) has been introduced for transmissions with VGS4 control unit as of modification year 2013 (with BR 218 M276).

In the same way as with KID, the drivetrain is again decoupled from the engine but, in this case, it does not take place at a standstill but during driving operation.

When the frictional connection is restored, the transmission directly engages the optimal gear depending on the current driving situation.

The KID+ function can only be activated in transmission mode E+. The drivetrain decoupling is triggered by fully releasing the accelerator without actuating the brakes or by pulling and holding the "+" steering wheel button for at least 300 msec provided that all of the boundary conditions are fulfilled at this moment.

The most important activation conditions are:

- Transmission mode E+ selected
- Vehicle speed between 60 km/h and 160 km/h
- No temporary M mode (KZM, see chapter 1.2.5)
- Cruise control is not active (frictional connection required)

Sailing is deactivated as soon as:

- The accelerator pedal is actuated
- The brake is actuated (braking torque > 1500Nm or strong braking for a short period of time or gradual braking over an extended period)
- Steering wheel gearshift button "+" or "-" is pressed
- Vehicle speed drops below 50 km/h or increases above 160 km/h
- The transmission mode is changed

Furthermore, there are a variety of other conditions which must be fulfilled to activate KID+. If KID+ is not activated as expected on occasion, this does not necessarily mean that the system has a malfunction.

KID+ has some effects on driving characteristics which may be noticed by the customer. Since the engine is not in deceleration mode while the drivetrain is decoupled, the speed of the vehicle may reduce more slowly than expected by the driver during coasting.

Temporary M mode (KZM)

Pressing the steering wheel gearshift buttons in transmission mode E or S activates temporary M mode (as of vehicle production date 04/2013). This allows the driver to change gears using the steering wheel gearshift buttons without previously selecting M mode. The previous gear limitation/shift into optimum gear (SOG) function, which was operated by pressing the steering wheel gearshift buttons, has been discontinued.

In contrast to permanent M mode, KZM is automatically deactivated after a certain period of time. This time interval starts over again each time a button is pressed. In addition, the activity of the function is extended by wide open throttle operation and lateral acceleration.

Temporary M mode replaces manually activated gear limits on all automatic transmissions. In addition, a gearshift recommendation is displayed.



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Temporary M mode



P27.00-2404-00

Gearshift recommendation

Procedure for customer complaints

Dealing with transmission 722.9 in the workshop

To allow you to deal with transmission 722.9 more reliably in the workshop, this chapter provides you with useful information about handling customer complaints, defects and remedies.

Is it a problem or a function? ("The car starts off in first gear even in 'C/E', something isn't right")

You must first understand the customer complaint before you can decide whether there is an actual malfunction or whether the customer is simply not aware of a particular function (product characteristic).

The "Function from the customer's perspective" chapter specifies a number of functions which may be perceived as malfunctions by the customer.

If it is not possible to clarify in the workshop whether the issue at hand is a malfunction or an intended function, you should if possible first look at a reference vehicle and then consult with the technical workshop support team before attempting any repairs.

What is the problem? ("Vehicle jolted while driving")

You must obtain a precise description of the problem from the customer in order to be able to rectify the customer complaint in the workshop. For complaints that only occur in certain situations, it is often beneficial to have the customer demonstrate the problem to you during a joint test drive with Star Diagnosis connected.

In the process, you will be able to identify the affected shift operations and the boundary conditions (e.g. uphill/downhill driving, deceleration/acceleration, oil temperature of transmission, transmission mode...).

This information will help you to find a remedy and also to check whether the work that has been performed has actually eliminated the customer's problem.

This makes a significant contribution to customer satisfaction because it avoids repeat workshop visits.

General information

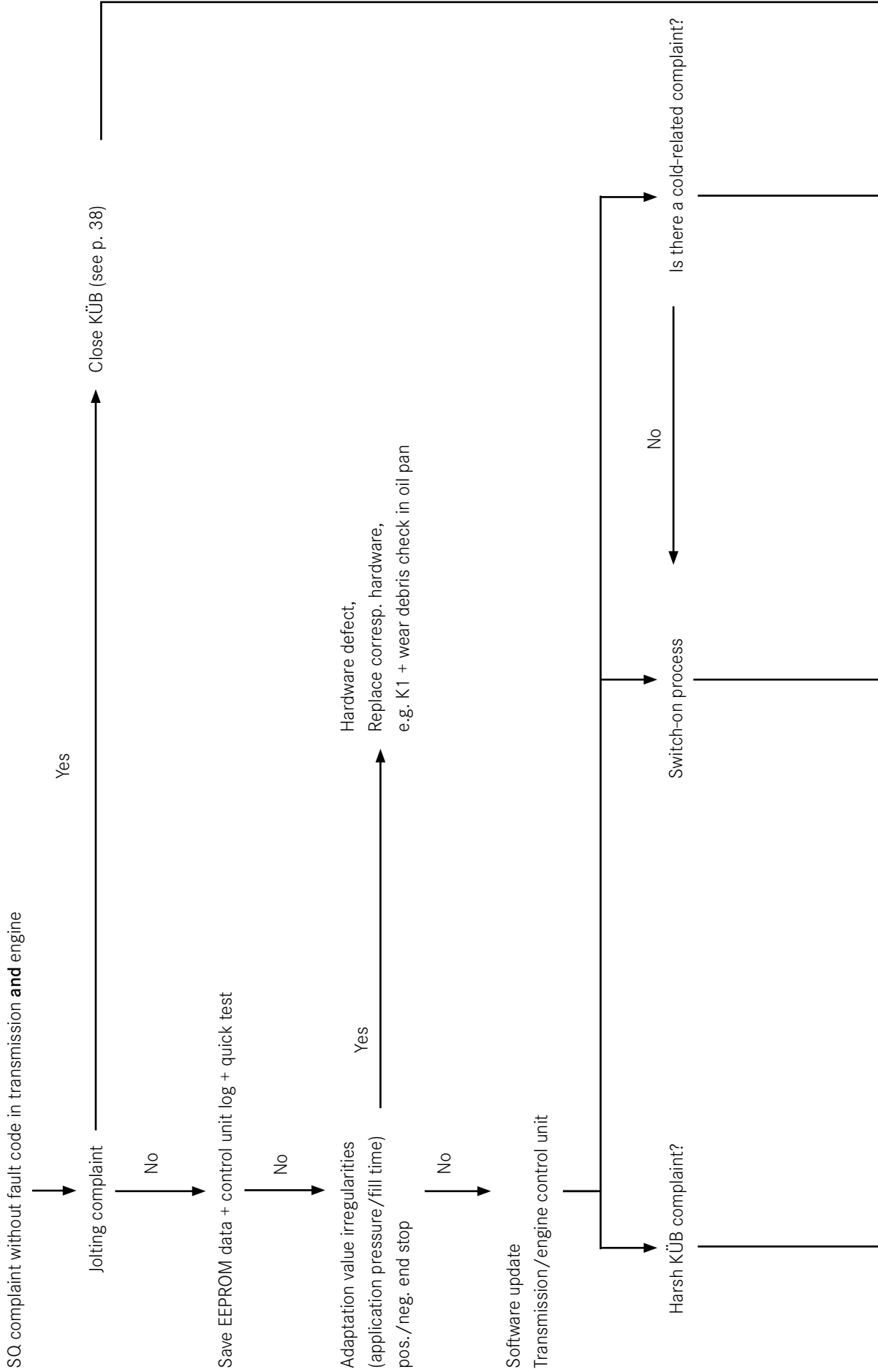
If it is determined that the complaint is caused by a malfunction, continue with diagnosing and repairing the problem.

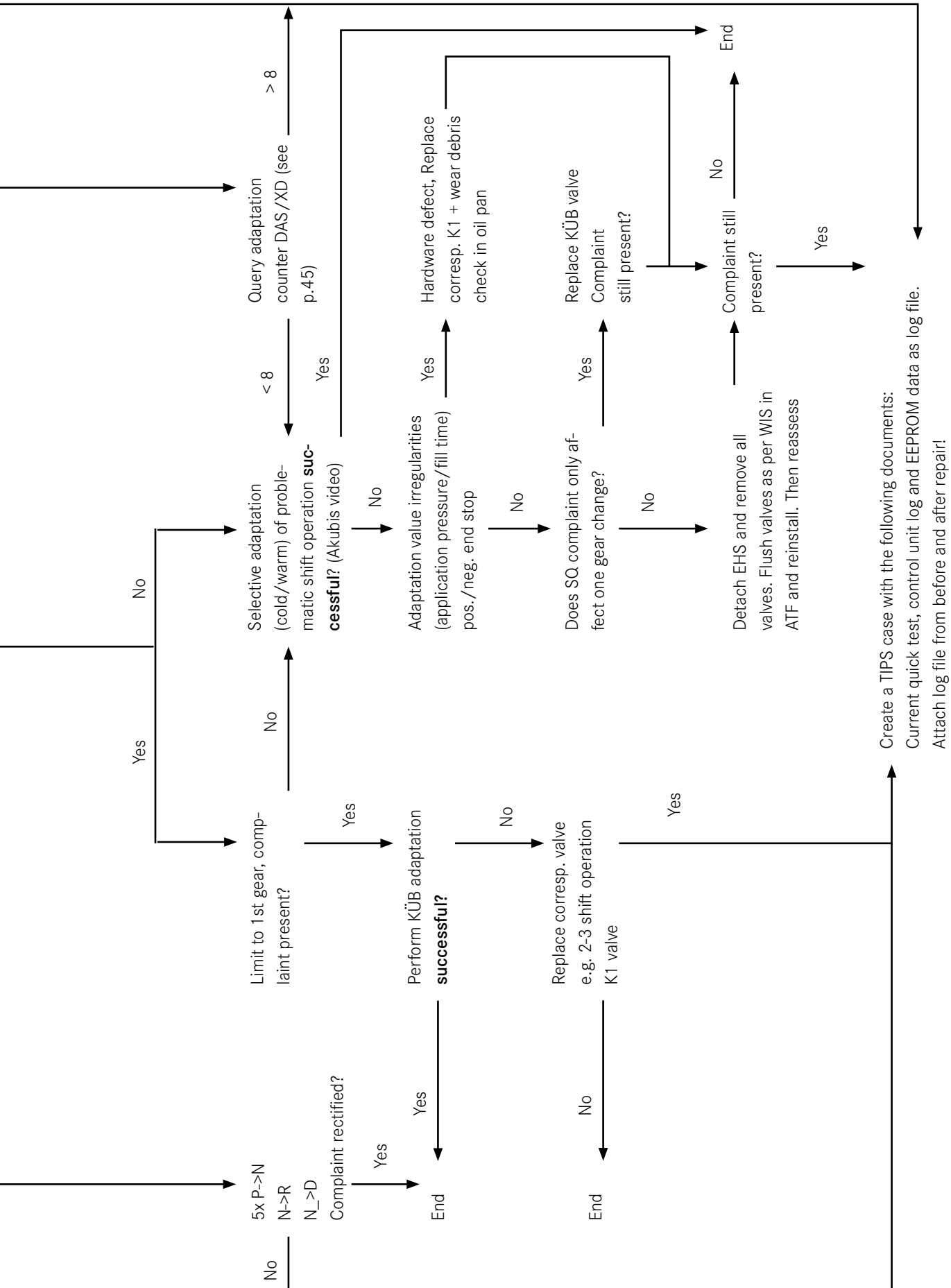
Always consult the current documents (TIPS, WIS, test steps in Star Diagnosis) and process the instructions they contain where necessary. The following descriptions differentiate between 2 types of complaints:

- With fault codes
- Without fault codes

Eliminating complaints

Diagnosis tree
 Customer complaint traceable by mechanic + actual values clearly traceable with DAS/XD + current notes about special cases via GI/LI processed!





Eliminating complaints

Information about transmission TIPS cases

When creating a TIPS case, the following documents must always be attached:

- Quick test
- Engine and transmission control unit log including fault freeze frame data - label documents (e.g. EEPROM, quick test with date and mileage)
- EEPROM data as log file (from before and after repair!)
- Complete the status data in the TIPS case module.

If photos are attached to the TIPS case, make sure that they are useful and of good quality (no pictures which are blurred, out of focus, over or under exposed!). Avoid photographs and scans of documents written by hand.

The customer complaint should be noted, ideally in the customer's exact words. It is also important to state whether the customer complaint can be traced and reproduced in the workshop and whether the vehicle is currently in the workshop.

Comfort-related complaints in torque converter lockup clutch (KÜB)

If the vehicle jolts during driving operation when the torque converter lockup clutch engages and not during gear changes, the fault must be processed differently.

If you have trouble determining whether the problem is caused by shift operations or by uncomfortable torque converter lockup clutch engagement, this can be identified as described below.

Example: If the jolting generally occurs at the same time as the 1-2 shift operation, during the next attempt limit the shift range to the first gear using the selector lever or steering wheel gearshift buttons. If the jolt is still noticeable just after starting off even though the transmission has not shifted up, the problem is highly likely to be related to torque converter lockup clutch engagement.

If a jolt occurs during start-off (up to approx. 10 km/h) or just before the vehicle comes to a standstill, the fault is usually not related to the torque converter lockup clutch. Possible sources of fault can be starting off from KID or may be engine-related.

If the engine stalls during driving operation or when stopping, the actual values for the engine torque in gear range N and D with the vehicle at a standstill and the transmission at operating temperature should be compared to each other. If the difference between the two engine torques is less than 50Nm, you should look for the cause on the engine.

Noticeable engagement of torque converter lockup clutch

The first step is to read out the fault memory and process it if necessary. If no faults are stored, perform a complete adaptation of the torque converter lockup clutch. Engagement and control of the torque converter lockup clutch can also be influenced by adaptation data to compensate for deviations in engine torque or changes in friction values.

Torque converter lockup clutch faults (fault codes: 0741 or 2783). With this fault code, the controller cannot adjust the lockup clutch to the specified slip that has been calculated. Possible symptoms include: Temporary humming Power loss Jolting Will not shift up Jolts during startoff Engine indicator lamp (MIL) is on Causes of this can include: Disks of lockup clutch worn Friction value of these disks has changed Hydraulic actuation not possible If there is a significant amount of wear debris in the transmission oil pan (see "Wear debris patterns"), it must be assumed that the torque converter lockup clutch is already seriously damaged. In this case, it is recommended that the entire transmission including torque converter be replaced because the shavings will have spread out within the transmission. In addition, the oil cooler must be flushed.

Note

On transmissions with a deep oil pan (i.e. all 722.9 transmissions as of 07/10) it can be sufficient to replace the damaged component, clean the valves and install the latest oil filter.

Complaints

Shuddering/jolting of torque converter lockup clutch (KÜB):

If shuddering or jolting occurs during driving operation with the torque converter lockup clutch engaged (status "slipping"), it is easy to determine the cause using the lock-up diagnosis function. For function description, see "KÜB-LockUp".

If the complaint is rectified in LockUp mode, either KÜB valve y8/n8 or the KÜB is the cause. If the complaint is still present in LockUp mode, then the components of the transmission are unlikely to be the cause.

Humming/droning during torque converter lockup clutch operation:

Vehicles with 7G-TRONIC PLUS: This complaint is no longer caused by the torque converter. With the exception of incorrect installation or serious mechanical defects.

Vehicles with transmission 722.9 before 7G-TRONIC PLUS: On vehicles with a mileage of <80,000km the cause will generally be a component other than the torque converter (regeneration, HFM, O2 sensor, drive shafts, propeller shaft, leaking exhaust system, tension, engine mounts, wheels...).

On vehicles with a mileage of >80,000km, we recommend creating a TIPS case with 2-3 screenshots of the Star Diagnosis actual value screen "Torque converter lockup clutch" in the event of a complaint.

Transmission switches to limp-home mode while driving (rpm sensor fault)

Complaint:

Automatic transmission 722.9 switches to limp-home mode while driving (shift operations no longer possible) and/or one or more of the following fault codes are stored or current:

- On vehicles with VGS1 control unit: 2200, 2201, 2204, 2205, 2206, 2207
- On vehicles with VGS2 control unit, VGS3: 0717, 0718, 0722, 0723, 2767, 2768
- On vehicles with VGS4: P071700, P071800, P072200, P072300, P276700, P276800

Remedy:

If there are one or more VGS1-FC, always replace the entire EHS (observe SI27.19-P-0007B).

If there are one or more VGS2, VGS3 or VGS4-FC, please fully process the rpm sensor FC using the DAS/XENTRY guided test. An EHS repair may additionally be required. In this case, Star Diagnosis automatically initiates the guided test and automatically reads out the adaptation data and characteristics from the old control unit.

In the event of repair, the transmission control unit, which is bolted on to the electrohydraulic controller unit (EHS), may only be replaced using the EHS repair set. Always order the EHS repair set via EPC with the full vehicle information (entry of full FIN/VIN).

Please use DC 53376 73 Internal transmission rpm sensor fault or 27257 73 Turbine rpm sensor.

Shift mechanism does not move out of P

You will find a possible remedy in the chapter "DIRECT SELECT module". On vehicles with center shifter console and ESM, check whether the shift rod is hooked in/secured properly. On vehicles on which the EHS has been replaced, make sure that the selector valve is correctly mounted in the selection range detent plate.



Correctly engaged selector valve in selection range detent plate

P27.19-2642-00

Complaints

Shift quality complaint limited to one shift operation

If a complaint only applies to one shift operation or to two shift operations with an identical engagement element (see chapter "Actuated shift elements"), replacing the corresponding control solenoid valve may remedy the problem. In addition, the oil pan and magnets should be cleaned and the oil filter and B3 oil guide pipe replaced.

Replacing more than three valves is not permissible because the adaptation requirements increase as more valves are replaced. Every valve has its own specific characteristic which is stored on the transmission control unit during production. When a valve is replaced, the new valve characteristic cannot be transferred to the transmission control unit in the workshop, which increases the adaptation requirements.

When replacing valves, make sure that the correct valve is installed. There are two different types of valves:

- Blue cap, rising characteristic for shift elements B2/BR, B3, K1, KÜB
(part no.: A220 270 09 98)
- Black cap, falling characteristic for shift elements B1, K2, K3, AD
(part no.: A220 270 10 98)

If multiple shift operations are causing problems, a SmartRepair solution makes more sense (see chapter "SmartRepair").

Shift quality complaints on vehicles with OM629

On vehicles with engine OM629, a complete EHS replacement or an EHS repair may be necessary depending on the EHS installed. An EHS repair is only permissible on vehicles which are already equipped with a VGS3 control unit, EHS item no. A 220 270 24 06. For all other EHS object numbers, an EHS replacement is necessary.

However, Star Diagnosis will also automatically take you to a test in this case.

- VGS1-FC: 2200, 2201, 2204, 2205, 2206, 2207, complete EHS replacement is always required (please install EHS A 220 270 24 06 / 80)
- VGS2-FC: 0717, 0718, 0722, 0723, 2767, 2768, in this case, Star Diagnosis checks whether a complete EHS replacement is required as described above. If Star Diagnosis indicates that replacement is necessary, always install EHS A 220 270 24 06 / 80.
- VGS3-FC: 0717, 0718, 0722, 0723, 2767, 2768, in this case, Star Diagnosis checks whether an EHS repair is required as described above. If Star Diagnosis indicates that a repair is necessary, always use the EHS repair set.

Jolting during start-off and stopping

This may be a KID or engine-related issue (see chapter 1.2.3. "Unpowered in D (KID)").

Jolting during acceleration (engines M272, M276)

Complaint:

When accelerating with the engine temperature above 60°C, vehicle jolting is noticeable in the rpm range from 1000 rpm to 1600 rpm under partial load. The jolting is comparable with harsh torque converter clutch engagement or uncomfortable shift operations.

The cause is a jump in torque during switchover of the engine operating mode from homogeneous to stratified operation (function depends on national version).

Remedy:

Check the complaint:

- 1. Trace the complaint with a test drive
- 2. Disconnect the connector on the sensor of the NOx storage catalytic converter (this suppresses stratified operation and may activate the engine diagnosis warning lamp)
- 3. Check the traceability of the complaint with a test drive
- 4. Plug the connector on the sensor of the NOx storage catalytic converter back in and erase the fault memory

Once you have carried out this test and have been able to trace the complaint, proceed as follows:

- For M272: Update the engine control unit software with DAS/Xentry as of DVD 01/2011 and add-on 1704. Then perform a test drive. If the complaint is still present, create a TIPS case.
- M276: Check the engine control unit software release in the control unit log. If a software release lower than VC8 is flashed onto the engine control unit, please update the engine control unit to the current software release (VC9 or higher).

3-2 downshift is hard

In this case, adaptation of the 1-2 shift operation can remedy the problem. The reason for this is the fact that vehicles on which Last Mode is omitted (see chapter "Omission of Last Mode") always start in E mode and thus always start off in 2nd gear. This can mean that the 1-2 shift operation is adapted extremely rarely or not at all. Since the B1 shift element is the engaging element for this shift operation, as it is for the 3-2 downshift, this adaptation can solve the problem here.

Jolt after standstill after heavy braking

On vehicles with KID, a clearly noticeable jolt may be felt after braking the vehicle heavily to a standstill.

The recommended remedy is to grease the sliding piece of the propeller shaft (e.g. rolling-element bearing grease A 002 989 00 51 / 10). To do so, disconnect the shaft, clean the gears and apply the grease very generously. Make sure that the grease is primarily applied to the seals. If it is only applied to the gears, the seal "wipes off" the majority of the grease.

Complaints

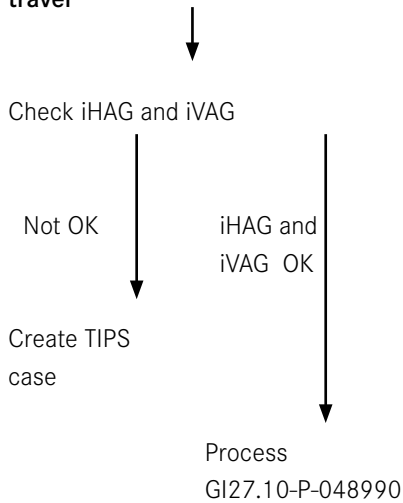
NAT2i

Shuddering during cornering

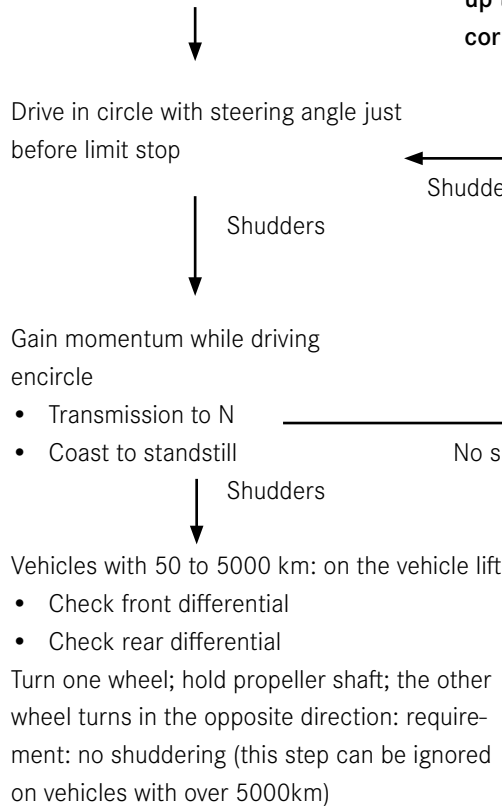
This complaint involves a low-frequency noise and/or vibrations in the vehicle, which can only be heard or felt with the steering wheel at a high angle or turned all the way to the limit stop. The shuddering is intensified by a high engine torque when accelerating out of a corner. To better trace the complaint, depress the accelerator while cornering and actuate the brakes lightly. This increases the engine torque and intensifies the shuddering. See the diagnostic tree for the further procedure.

Procedure for vehicle shuddering

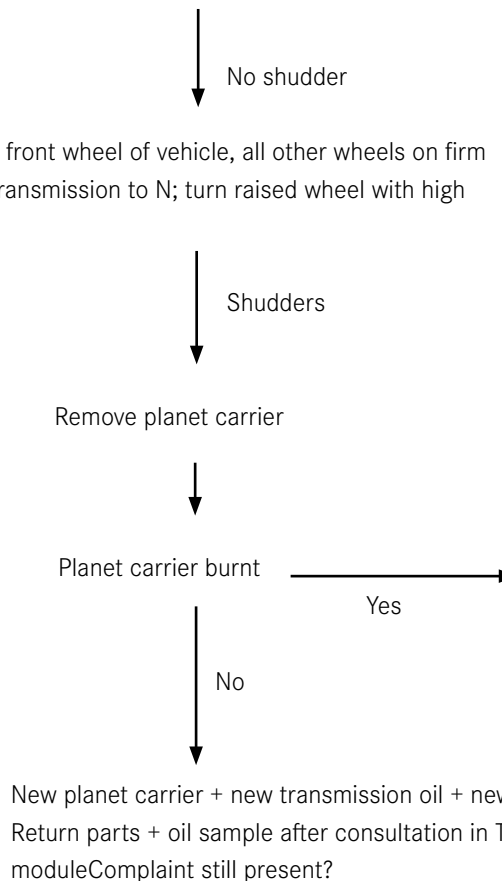
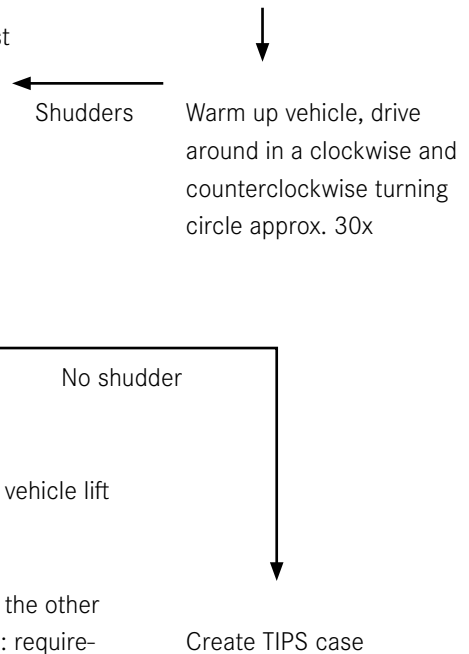
Shuddering during straightahead travel



Shuddering during cornering



Special case for new vehicles with up to 50 km Shuddering during cornering



Continue cause analysis on other vehicle components Complaint rectified

Complaints

Grinding noise (pittings)

If a grinding noise can be heard under load, the oil in the transfer case must be checked for wear debris. If there is wear debris in the oil in addition to the noise, there is a high probability of pitting damage to one or more tapered roller bearings of the transfer case. To identify the damage beyond doubt, the transfer case must be unscrewed.

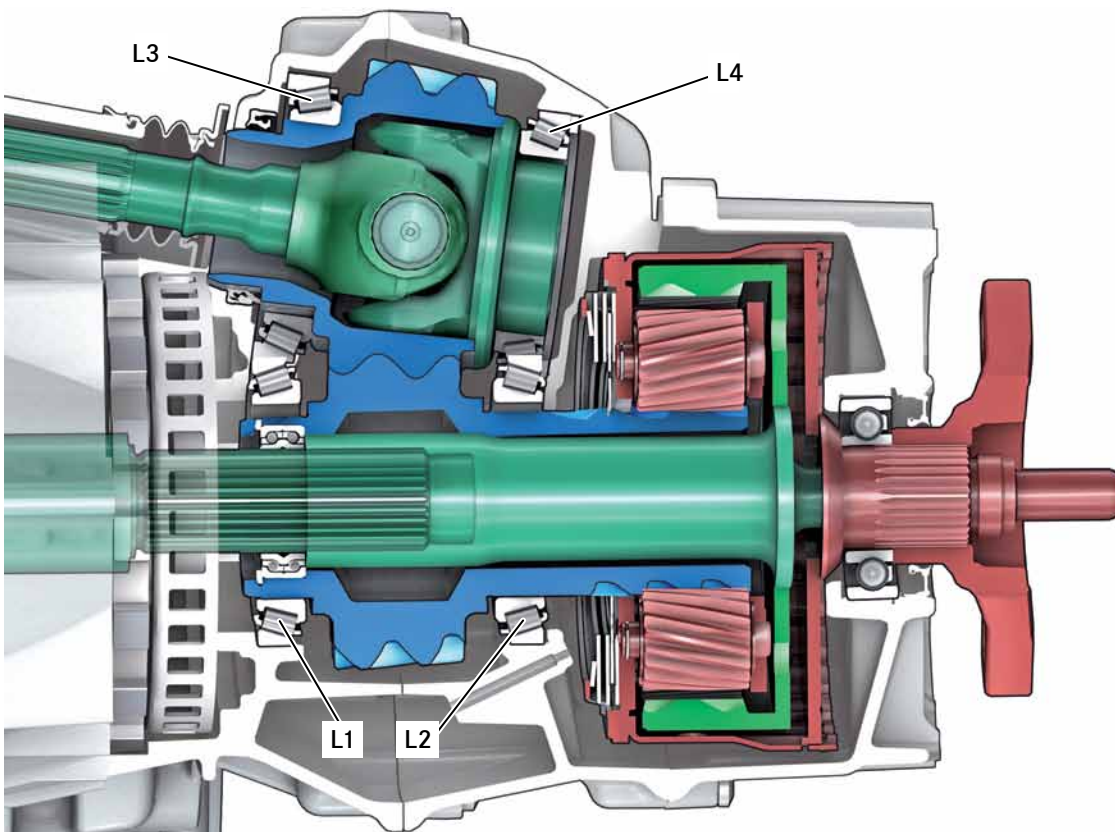
At the moment, the entire transmission must be replaced in the event of this type of damage, repair is not possible.

The damage must be coded to damage code 28001 "Transfer case", damage type G5 "Noises in entire vehicle speed range"!



Pitting damage

P27.00-2393-00



Bearing designations in transfer case

P28.50-2219-00

Closing the torque converter lockup clutch (fully closing the torque converter lockup clutch for one ignition sequence)

It is possible to activate a "LockUp mode" using Star Diagnosis in order to analyze complaints about vibrations and jolting. In doing so, the torque converter lockup clutch is closed in the regular manner and actuated at maximum pressure during the slip control phase (standard operation). This condition is maintained until a certain vehicle speed is dropped below and then restored when the vehicle starts off again. In the phase of maximum pressure actuation, influences resulting from torque converter lockup clutch control (behavior of solenoid valves, friction linings) are blocked out. This allows the aforementioned complaints to be investigated for their cause and eliminated using the Noise Vibration Harshness diagnostic tree.

Note

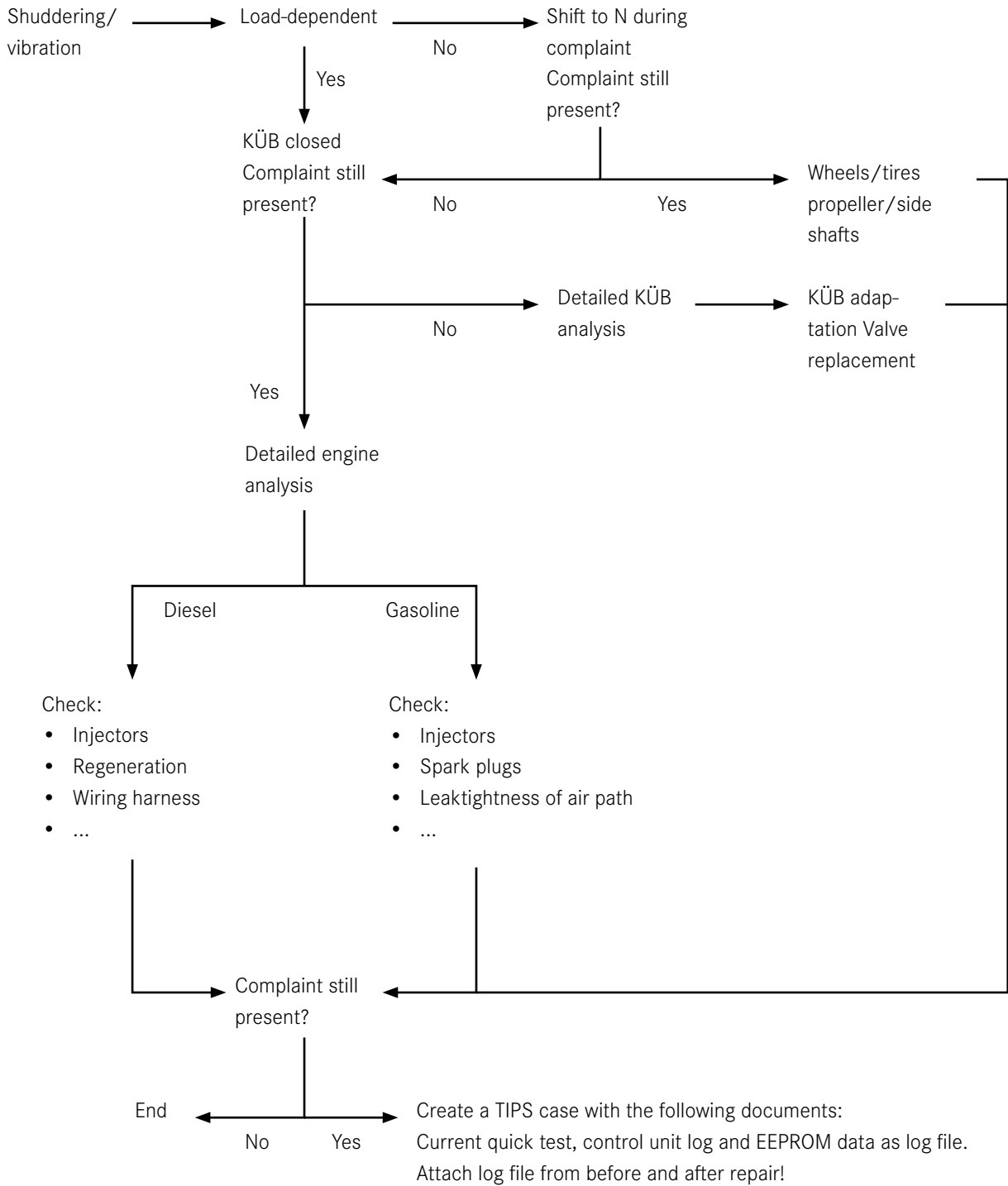
Closing the torque converter lockup clutch is not used to analyze complaints about humming/droning.

The torque converter lockup clutch closing function is only possible on vehicles produced as of 07/2008.

Note

Closed torque converter lockup clutch mode is always active for one ignition sequence and is only deactivated once the engine is shut off. You must therefore make sure that the engine is switched off once before the vehicle is handed over to the customer.

Closing the torque converter lockup clutch



Often, a defective auxiliary oil pump is assumed to be the cause for the complaint "Hard start-off from stop mode" without a stored fault code.

To check this and rule out the possibility of incorrect diagnosis, drive the vehicle onto a pit and set the engine to ECO stop mode. You can now perform an acoustic check of the function of the auxiliary oil pump using a resonator, by holding it against the housing of the auxiliary oil pump.

This allows you to detect a physical blockage of the auxiliary oil pump or electric motor e.g. due to soiling (wear debris). When the auxiliary oil pump operates, a running noise can be clearly heard.

If the pump is not operating properly, you should also check whether the power supply is OK.

After replacing the auxiliary oil pump, any oil residues should be removed from the housing. The best method is to blow the housing clean using compressed air so that you can reliably inspect the auxiliary oil pump for leaks.

Transmission serial number



Position of transmission number

P27.00-2394-00

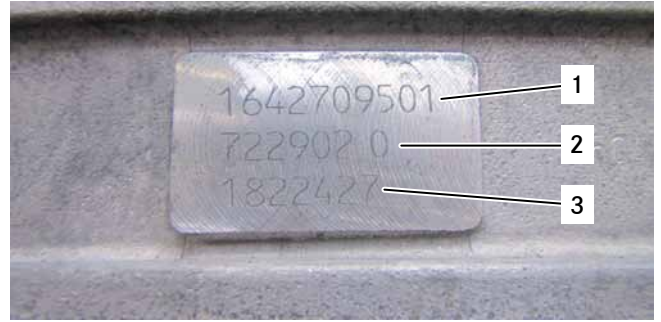
The transmission number is located at the bottom of the transmission housing on the left when viewed in the direction of travel. The badge has three lines and indicates the part number of the overall assembly, the transmission model and the transmission serial number.

In this example, the transmission number is
722902 01 822427

This badge has the same design on all NAT1, NAT2, NAT2FE+ and NAT2i transmission models and is always located in this position!

On genuine Mercedes-Benz reconditioned transmissions, the badge is ground blank and a replacement label is glued on next to it. Please note that reconditioned transmissions as of April/May 2012 now have a nine-digit number, whereby the last 6 digits represent the transmission serial number and only these numbers have to be entered in VeDoc!

On older reconditioned transmissions, there is only a 6-digit transmission serial number which must be entered in VeDoc when the transmission is installed!



Transmission number

P27.00-2395-00

- 1 Part number of overall assembly
- 2 Transmission model and variant
- 3 Transmission serial number



New reconditioned part badge - 9 digits

P27.00-2396-00

- 1 Transmission serial number



Old reconditioned part badge - 6 digits

P27.00-2397-00

- 1 Transmission serial number

Shift adaptation

The shift adaptation process, which runs during every shift operation that meets the conditions, determines correction values for the basic data set in the control unit with the intention of producing the ideal shift pattern.

Various types of adaptation data are obtained during the process, two of which are described here:

Each of these adaptation values is determined for 3 temperature ranges. If values for a temperature range are not yet available, the existing values for other temperature ranges are converted.

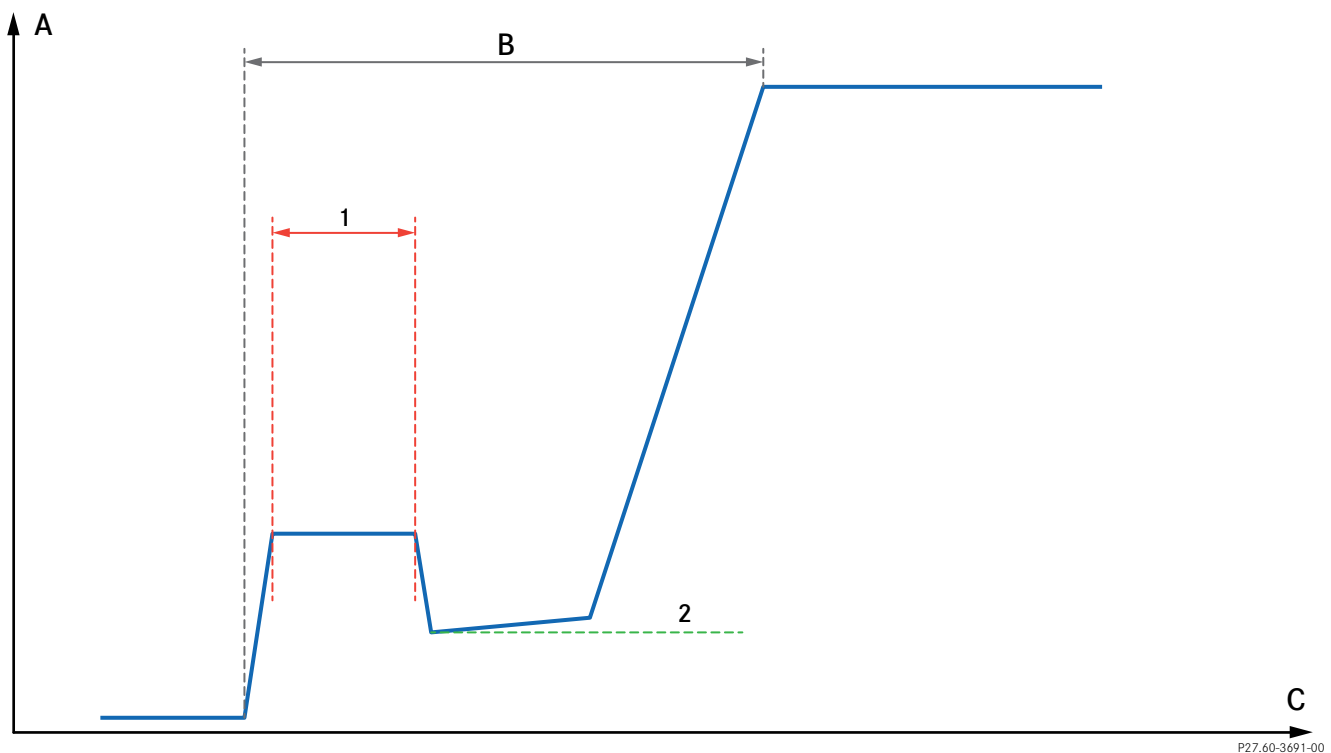
Transfer of the correction values determined during adaptation to the permanent memory (EEPROM) takes place cyclically.

Fill time adaptation (FZA): Correction of time value for filling the shift element being engaged (displayed in Star Diagnosis, values in cycles (=10 ms))

Application pressure adaptation (ADA): Correction of pressure value for applying the shift element being engaged (displayed in Star Diagnosis, values in mbar).

After the adaptation with Star Diagnosis is finished, the current adaptation values are automatically stored in the EEPROM on a permanent basis.

The following graphic provides a schematic illustration of the influence of the adaptation types on the pressure curve of a shift element being engaged (shift pattern of an acceleration upshift).



P27.60-3691-00

Shift adaptation

- 1 Fill time
- 2 Application pressure

- A Pressure
- B Shift operation
- C Time

Adaptation

Performing shift adaptation

If a shift operation is subject to complaint and in need of adaptation, the adaptation must be selected in the transmission adaptation menu of Star Diagnosis.

After selecting transmission control, the shift type which is faulty and needs to be adapted must be selected.

Upshifts: Shift operations to the next gear up can be adapted here.

Downshifts: Shift operations to the next gear down when the vehicle is decelerated with or without braking can be adapted here. The accelerator pedal is not actuated.

Acceleration downshifts: Shift operations to the next gear down when the vehicle is accelerated again or further by depressing the accelerator pedal can be adapted here.

Direct adaptation is not possible for these acceleration downshifts. As a result, the shift element being engaged must be adapted during an acceleration upshift. Star Diagnosis automatically switches to the adaptation menu for the 1-2 upshift if the 3-2 acceleration downshift is selected.

Warning

Always pay attention to the safety information about performing adaptation in Star Diagnosis.

Note

For the 3-2 acceleration downshift, multidisk brake B1 engages under load. This is also the case for the 1-2 upshift, which is why the same adaptation values apply.

Note

It is only necessary to reset the adaptation data if mechanical repairs (adjustment operations or component replacement) were performed on the shift elements. If adaptation only needs to be performed, the data must not be erased first because this would mean that data collected over several thousand kilometers is lost.

Step-by-step performance of an upshift adaptation

1. Select the shift operation for adaptation in the menu
2. A temperature threshold of 60°C must be exceeded for transmissions with red fluid or 40°C for transmissions with blue fluid
3. Using the selector lever or steering wheel gearshift buttons, restrict the transmission to the start gear of the shift operation. Example: For a 2-3 adaptation, restrict to "2".
4. Drive and bring both indicators (torque and rpm) into the green range. First "set" the rpm to approx. 2000 rpm and then bring the engine torque up to the indicated range.
5. Initiate the upshift using the selector lever or steering wheel gearshift buttons.
6. Pay attention to the acoustic and visual adaptation feedback; adaptation was only completed if feedback was given
7. Repeat steps 3-7 a total of 5x, then evaluate the change in shift quality

The next Star Diagnosis screen shows the values from before and after the adaptation so that the changes are documented. When you switch to this screen, the adaptation values are permanently stored.

	Good	Better, but not yet good	No change or worse
Shift quality after 5 adaptations			
Further measures	Store data	Perform 5 more adaptation shift operations	Process fault tree/diagnostic tree

Adaptation

Step-by-step performance of a downshift adaptation

1. Select downshift menu
2. A temperature threshold of 60°C must be exceeded for transmissions with red fluid or 40°C for transmissions with blue fluid
3. Adjust transmission to the upper gear of the shift operation subject to complaint and allow vehicle to roll unbraked until the problematic shift operation takes place.

Example: To adapt the 4-3 shift operation, accelerate the vehicle to 4th gear and then allow it to roll until 3rd gear is reached.

4. Pay attention to the acoustic and visual adaptation feedback; adaptation was only completed if feedback was given

5. Repeat steps 3-7 a total of 5x, then evaluate the change

The next Star Diagnosis screen shows the values from before and after the adaptation for all downshifts so that the changes are documented. When you switch to this screen, the adaptation values are permanently stored.

If it is difficult to perform adaptation on the vehicle, change the transmission mode E/C or S.

i Note

On vehicles with the "M" shift program, this program may not be used because the adaptation function is disabled in this case. (sporty driving style)

	Good	Better, but not yet good	No change or worse
Shift quality after 5 adaptations			
Further measures	Store data	Perform 5 more adaptation shift operations	Process fault tree/diagnostic tree

Step-by-step performance of an acceleration downshift adaptation

This is performed in the same way as an upshift because Star Diagnosis switches to the corresponding screen for the respective upshift.

TIP: If adaptation does not take place with the transmission mode currently set, change the transmission mode and thus the downshift points (e.g. E/C to S).

What if there is no "beep"?

If a shift operation is performed in the green range (or a downshift without braking) and there is no confirmation beep from Star Diagnosis, this can have various causes, both simple and complicated.

The list below is intended to explain the possible causes and demonstrate possible solutions.

The adaptation counter indicates how many adaptations have been carried out for the respective shift operation.

The screenshot shows the XENTRY Diagnostics interface for a Mercedes-Benz vehicle. The main display area shows the status of the transmission adaptation process. A table at the bottom, titled "Adaptionswerte der Schaltung 2-3", provides the following data:

Häufigkeitszähler 'Adaption'	Werte vor Durchführung der Adaption	Werte nach Durchführung der Adaption	Anzahl der Adaptionvorgänge
KALT	7	9	2
WARM	4	4	0
HEISS	1	2	1

Adaptation counter

Adaptation

No change in adaptation data

1. The adaptation data were not changed because the current adaptation data for the shift operation are ideal.

Explanation: Star Diagnosis cannot determine whether a computation cycle has taken place in the control unit, it can only detect whether there has been a change within the adaptation data range. This check monitors the entire data range meaning that, for example, an audible beep will still be output in the menu of the 2-3 shift operation if a downshift adaptation takes place. It is not possible to restrict monitoring to the selected shift operation.

Star Diagnosis speaker

2. The Star Diagnosis speaker is switched off or too quiet.

Solution: Activate speaker

Engine torque

3. The engine torque during the shift operation was too high or too low although the bar of the engine torque indicator was in the green area.

Explanation: Star Diagnosis can only display the engine torque on the screen but the control unit performs calculations based on the turbine torque which is usually similar but can be different.

Solution: Perform the shift operations in the red areas at the edge of the green area and not in the green area.

Deactivation of transmission control unit

4. Adaptation was deactivated temporarily in the transmission control unit.

Explanation: Transmission control deactivates the adaptation function on vehicles with diesel engine if, for example, diesel particulate filter regeneration is active because there can be signal deviations during this period.

Solution: Wait for regeneration cycle to end (regeneration is complete when the exhaust temperature upstream of the diesel particulate filter in the partial-load range is less than 250 °C). Adaptation can then be performed again.

Note

A message is currently being added to Star Diagnosis to indicate if a regeneration cycle is active during adaptation.



Engine torque indicator

1 Engine torque

P01.00-3473-00

Adaptation of torque converter lockup clutch (KÜB)

Just as shift operations can be adapted, the torque converter lockup clutch can also be adapted. This is necessary if there are comfort-related complaints when the torque converter lockup clutch is engaged because components were previously replaced e.g. the torque converter.

Always pay attention to the safety information about performing adaptation in Star Diagnosis.

There are 3 procedures for adapting the torque converter lockup clutch.

- Minimum pressure adaptation
- Fill time adaptation
- Deceleration mode adaptation

Minimum pressure adaptation (Star Diagnosis guided):

This adaptation involves teaching in the lowest pressure range at which the torque converter lockup clutch starts to transfer torque. This value forms the basis for all other adaptations and should therefore be set very carefully.

Boundary conditions: temperature >20°C, 3rd gear (or higher), engine torque 1200 - 2500rpm, torque converter lockup clutch status slipping

Adjust to the torque window displayed by Star Diagnosis every 6 seconds. Repeat this cycle as per Star Diagnosis. The process always starts at the highest torque and adaptation is carried out downwards i.e. first adjust to the medium torque values in each case (e.g. 80-100Nm) and at the end of the respective cycle to the lowest torque stage (e.g. 20-30Nm)

Fill time adaptation (Star Diagnosis guided):

This adaptation determines the time required to fill the torque converter lockup clutch and corrects it. This adaptation is important for engagement of the torque converter lockup clutch (e.g. after start-off).

Limit the transmission to the first gear, accelerate from a standstill with 150-200Nm until the torque converter lockup clutch is slipping, repeat as per Star Diagnosis

Deceleration mode adaptation:

Deceleration mode adaptation teaches in the actuation during the deceleration phase and is required for dynamic changes (e.g. change between acceleration/deceleration).

Coast from 3000rpm to approx. 1500rpm, repeat as per Star Diagnosis

Standstill adaptation

Standstill adaptation can be used to perform a shift adaptation at a standstill on certain model series with VGS4 control unit. This eliminates the need for a time-consuming adaptation test drive. If standstill adaptation is possible for the vehicle you are performing adaptation on, this option will be shown in Star Diagnosis.

Certain boundary conditions must be met to carry out standstill adaptation. Star Diagnosis guides you through the entire adaptation process.




Stillstandsadaption

Stillstandsadaption

Status der Adaption

- Die Voraussetzungen sind nicht erfüllt. Istwerte in die Sollwertbereiche bringen.
- Fahrpedal nicht betätigen.


Status der zugehörigen Istwerte

Name	Istwert	Sollwert
 Klimaanlage EIN	JA	NEIN
Unterschreitung der minimalen Motordrehzahl	NEIN	NEIN
Öltemperatur des Automatikgetriebes	IN ORDNUNG	IN ORDNUNG
 Wählhebel in Stellung 'D'	NEIN	JA
 Bremsmoment	NICHT IN ORDNUNG	IN ORDNUNG
Getriebe-Abtriebsdrehzahl	IN ORDNUNG	IN ORDNUNG
Alle Türen sind geschlossen.	JA	JA
Regeneration des Dieselpartikelfilters	NEIN	NEIN
CAN-Fehler aufgrund eines falschen Eingangssignals	NEIN	NEIN

Wichtige Hinweise

- Der Vorgang wird automatisch beendet.
- Mit der Taste 'Abbruch der Adaption' wird der Einlernvorgang abgebrochen.

Abbruch der Adaption

Weiter 

P27.00-2399-00

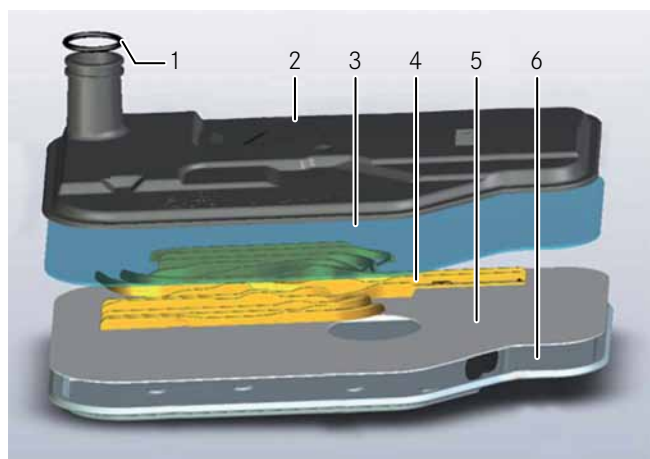
Standstill adaptation

Oil filter and oil pan

There were previously four different oil filters and oil pans for the automatic transmission. Two different oil filters and pans are currently installed.

The obsolete components are still in circulation but are replaced with their successors in the event of a complaint. The old components can no longer be ordered.

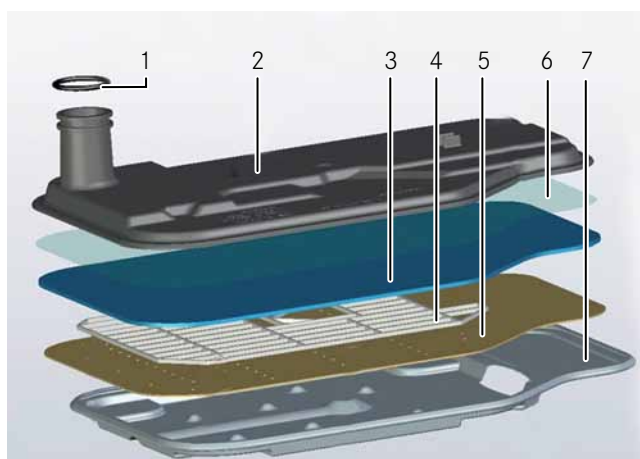
The current oil filters and oil pans with part numbers and identifying features are shown below.



P27.56-0003-00

Combination filter (A221 277 01 95)

- 1 O-ring
- 2 Plastic upper shell
- 3 Metal mesh 50 µm
- 4 Plastic support grille
- 5 Fine filter medium SPFM A35
- 6 Metal lower shell



P27.56-0004-00

SmartMediaTriple filter (A211 277 01 00)

- 1 O-ring
- 2 Plastic upper shell
- 3 Metal mesh 50 µm
- 4 Plastic support grille
- 5 Fine filter medium SPFM A35
- 6 Metal lower shell, deepened version
- 7 V-Pore ®97 filter medium

Oil

Identifying features of both oil filters



Flat combination filter **A221 277 01 95**

P27.56-0005-00



Smart Media Triple oil filter **A221 227 01 00**

P27.56-0007-00

Combination possibilities of oil filter/oil pan

	Flatter oil pan A222 270 12 12	Deeper oil pan A222 270 05 12
Flatter combination filter A221 277 01 95	●	Not permissible
Smart Media Triple oil filter A221 227 01 00	Not permissible	●



P27.10-2488-00

Oil pan 722.9 up to prod. 18.06.2010
 Part no.: A221 270 12 12
 Round depressions in oil pan



P27.10-2489-00

Oil pan 722.9 as of prod. 21.06.2010
 Part no.: A222 270 05 12
 Two oval and two round depressions in the oil pan and cable clamps



P27.10-2490-00

Overflow pipe in oil pan is white



P27.10-2491-00

Overflow pipe in oil pan is green

Oil

Red and blue fluid

There are currently two different types of transmission fluid, ATF 134 (red) and FE-ATF 134 (blue).

The following table shows which fluid is permitted for which transmission.

If the transmission has been inadvertently filled with the wrong fluid, it is permissible to drain out the fluid and refill the transmission with the correct fluid up to a distance of 10 km. Transmission replacement is not necessary in this case.

Note

No third-party fluids or additives may be used.

Note

For vehicles with 722.9 as of transmission serial number 2834527 which are currently filled with blue transmission fluid FE-ATF 134, an additional fluid will be approved as of 09/2013 (transmission fluid of the 725.0, 9G-TRONIC automatic transmission).

Excepted from this are all AMG and hybrid vehicles which must still be filled exclusively with the blue FE-ATF 134.

Please observe the Service Information bulletin: Specifications for Operating Fluids for automatic transmissions SI00.40-P-0014A

Color of fluid	ATF 134 BeVo 236.14	FE-ATF 134 BeVo 236.15
	Red	Blue
722.6	●	
722.9 with engine 629 (irrespective of oil pan installed)	●	
722.9 up to transmission serial number 2834526	●	
722.9 as of transmission serial number 2834527		●

Oil change interval

With the introduction of the NAT2FE+ transmission (7G-TRONIC PLUS), an extended oil change interval applies. This does not apply to the transmissions with EHS object number A220 270 00 60 or A220 270 01 60 i.e. it does not apply to all transmissions which use the blue fluid.

Due to the reduction of friction power and thus heat input into the FE+ converter (see chapter "FE torque converter"), the oil change interval of the transmission fluid in the NAG2FE+ changes from once at 50,000 km to regularly every 125,000 km.

Engines		Market launch
M276	All BR	Phased in as of 09/2010
M278	All BR	Phased in as of 09/2010
M271EVO	BR with A/T code 427	As of 03 and 06/2011
OM642	BR with A/T 722.966/.903	As of 09/2010
OM651	All BR 164, 166, 172, 218, 221 and subsequent BR	As of 12/2010 BR-dependent
	BR 204, 212 without 4Matic with A/T code 427	As of 03 and 06/2011
	BR 207 with A/T code 427	As of 06/2011

Oil

Measuring and adjusting the oil level

The oil level must always be checked when there are indications that the transmission may be underfilled. These include:

- Visible leaks
- After work is performed on the transmission cooling system
- If there are complaints which mainly occur when the transmission is very cold
- If there are complaints which occur on steep uphill/downhill slopes and/or during rapid cornering

It is not necessary to always check the oil level in the event of shift quality complaints.

The method used to add transmission oil depends on the vehicle variant. A distinction is made between vehicles with and without additional transmission cooler:

- Without additional transmission cooler as per AR27.00-P-0100W
- With additional transmission cooler as per AR27.00-P-0270W

If the oil drain screw is removed at 45 °C on transmissions with a sloped transmission oil pan, at least a small quantity of oil will flow out (oil that was in tube). If no further oil flows out after this small quantity, this only means that the oil level is below the top edge of the tube. If the oil level is only a few millimeters below the edge, the oil level is still OK because it is within the tolerance.

i Note

Unfortunately, there is no way of measuring the distance between the oil level and the upper edge of the tube. Experiments with bent dipsticks were not successful because they could not be read off accurately.

It is therefore not possible to evaluate the oil level by removing the drain screw. In case of suspicion that the oil level is too low, 0.5-1 l of transmission oil must be poured into the transmission and then the excess oil must be drained off until only a small quantity runs out (arrow b). It is only possible to determine the top-up quantity once this excess oil has been collected and measured. The transmission oil level is then adjusted to the center of the tolerance range. If the oil level was previously at the OK level on the drawing, it is possible that only 0.1-0.2 l of transmission oil was added. In this case, the transmission was not underfilled previously even though no oil ran out. If more than 0.3 l of oil is required to reach the state indicated by picture b, the oil level was outside the tolerance.

Transmission oil level is OK with this flow rate.



P27.10-2492-00

Transmission oil level is OK with this flow rate.



P27.10-2493-00

Transmission oil level must be corrected and rechecked with this flow rate.



P27.10-2494-00

Wear debris patterns

Wear debris in the form of metallic particles (shavings) can collect in the oil pan, even in a transmission that has only been in operation for few kilometers. This wear debris comes from metallic parts in the transmission which move into or against each other e.g. from disk carriers which are gently impacted by disks during operation.

This wear debris collects in the oil pan and does not represent any risk to the electrohydraulic control system because the oil filter filters the particles out.

If a complaint is received, it is necessary to differentiate between this type of shaving and elongated shavings and between a "normal" pattern of wear debris and excessive wear debris accumulation. These elongated shavings are also filtered out by the filter but they are caused by a damaged component and may therefore be related to the complaint. As a result, if elongated shavings are found (3-10 mm in length) it is important to determine their origin and replace any defective components. If the replacement of components is not cost-effective, it may be necessary to replace the transmission.

We currently recommend replacing the transmission if the following damage is present: Oil pump has corroded in housing Rear planetary gear set is defective Torque converter lockup clutch or other components in converter worn (very large amount of shavings in the transmission oil pan without visible defects in transmission) If there is a very large amount of contamination, it is also recommended to replace the cooler. Flushing the cooler is not possible because the thermostat only opens at an oil temperature of approx. 80°C. The following pictures give examples of transmissions where there is obvious mechanical damage and of transmissions whereby the pictures do not allow a conclusion to be drawn about damage. Naturally, the transmission can also be damaged even if no wear debris has been produced

Transmissions with obvious mechanical damage



P27.10-2495-00



P27.10-2496-00

Mechanical damage not identifiable based on pictures



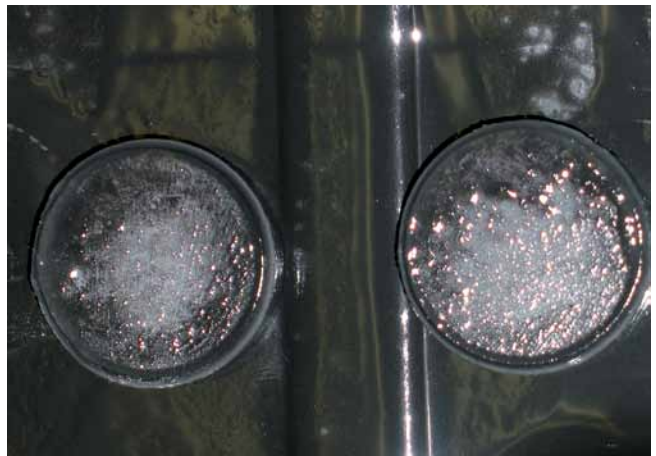
P27.10-2497-00



P27.10-2498-00



P27.10-2499-00



P27.10-2500-00

Transmission SmartRepair

With a transmission SmartRepair, the EHS is detached and the valves removed. These are then flushed with fresh fluid as per AR27.19-P-0212A. In addition, the oil pan and magnets are cleaned and the oil filter, the seal of the oil pan and the B3 oil guide pipe are replaced.

After assembly, the transmission is refilled with fresh fluid and the shift operation subject to complaint is readapted.

If the control solenoid valve looks like this after cleaning, it must be replaced.



P27.60-3687-00

Clean control solenoid valve, if it looks like this after cleaning, it can be reinstalled.



P27.60-3688-00

Control solenoid valve OK, can be reinstalled.

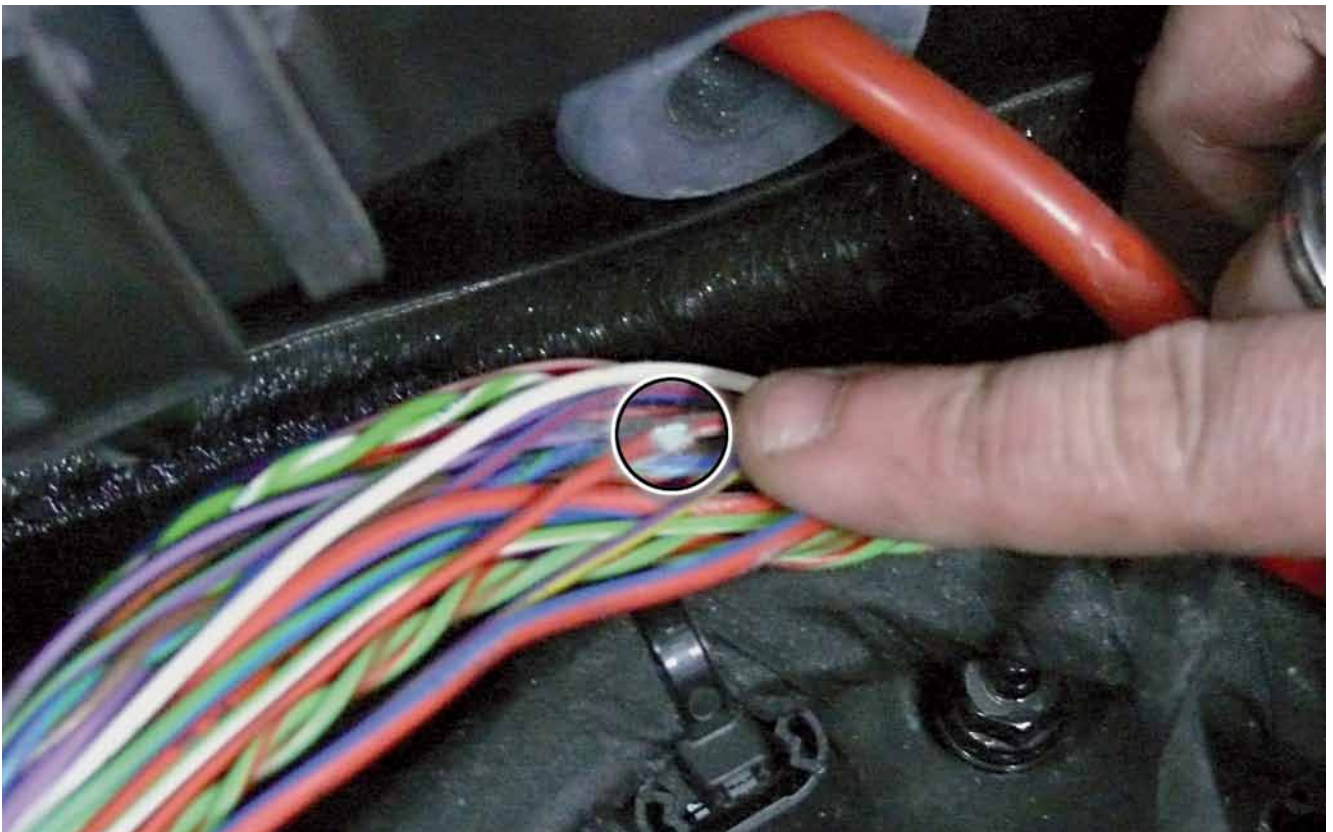


P27.60-3689-00

CAN faults

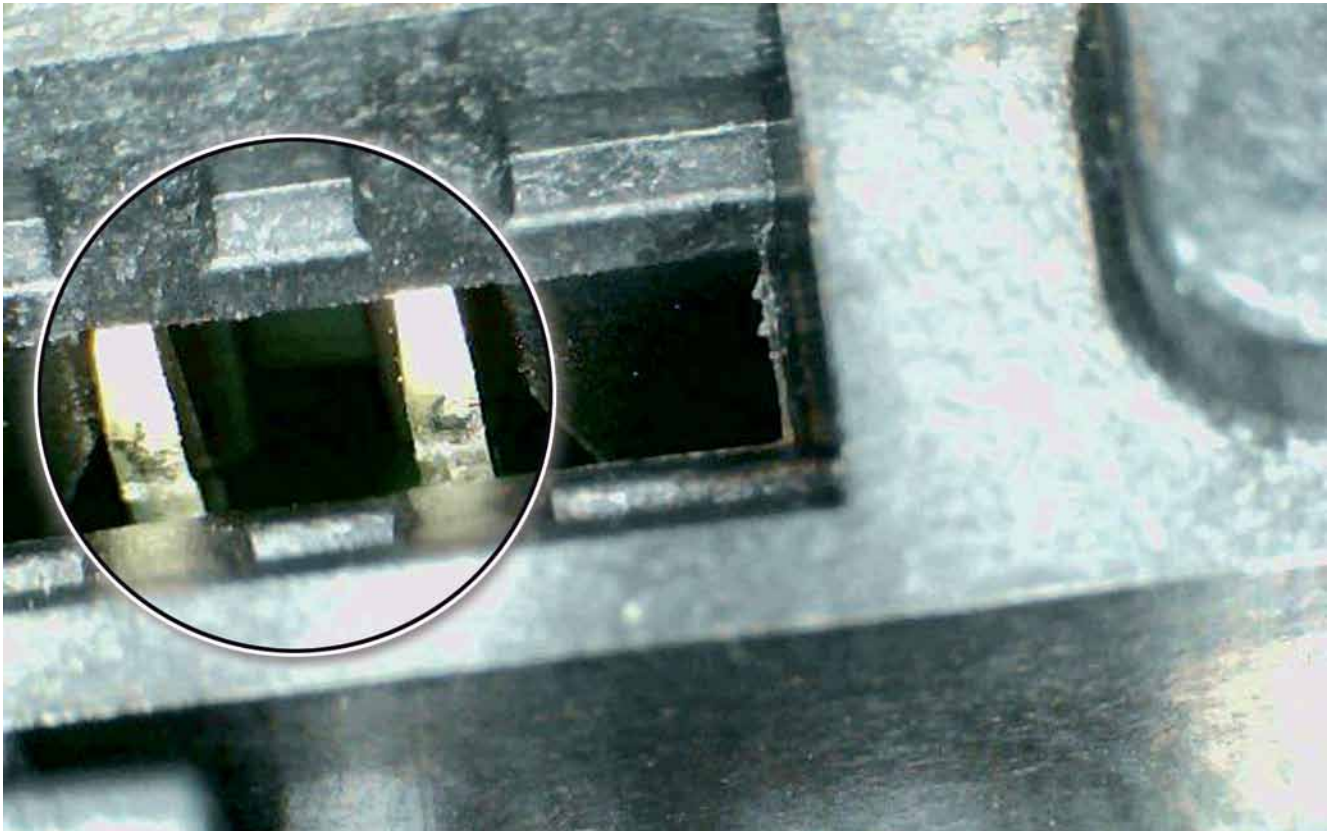
In the case of various CAN fault codes in control units which are connected to the powertrain, such as the transmission control unit, engine control unit, ESP control unit, ISM/DSM control unit, EZS control unit etc., the fault will generally be related to a damaged wiring harness or its contacts.

A typical indication of a damaged wiring harness is sporadic occurrence of the complaint e.g. caused by a loose contact or short circuit. The damage is often very difficult to detect, so it is recommended to expose the lines in question and carefully check them for chafe marks. In addition, all contacts and connectors should be carefully checked for water entry, corrosion and widened pins. The following pictures show a number of defective wiring harnesses.



Chafe mark

P27.19-2643-00



Burned contact

P27.19-2644-00



Pinched line

P27.19-2645-00

Tips on EHS repair

If a repair is interrupted for whatever reason after the adaptation data and characteristics have been read out from the old control unit e.g. EHS repair set is not available, the data which were read out (valve characteristics and adaptation data) remain stored on Star Diagnosis until it is reconnected to the vehicle being repaired and the data are automatically transferred OR a StarDiagnosis update is carried out with a new service DVD or add-on.

If one of the fault codes is accidentally erased, the repair can be carried out via the emergency access function:

Xentry: Access VGSNAT2 control unit ▶ Adaptations ▶ Teach-in processes ▶ Adaptation of transmission ▶ Display or reset

adaptation values ▶ Adaptation values of shift operations ▶ Development data (status of valves for gearshifting) DAS: Access electronic transmission control control unit (722.9 7G-Tronic) ▶ Diagnosis routines ▶ Save adaptation data (repair Y3/8n4 (fully integrated transmission control unit (VGS)))

When removing the EHS, make sure that the connector is not damaged. It is recommended to press on the connector from above during removal, otherwise it can be torn off easily.

When installing the EHS, make sure that the selection range valve is hooked back into the DIRECT SELECT module (DSM) otherwise fault code 2806 will be set.

Note about AMG vehicles

An EHS repair on AMG vehicles is only possible on transmissions with model designation 722.907 with torque converter.

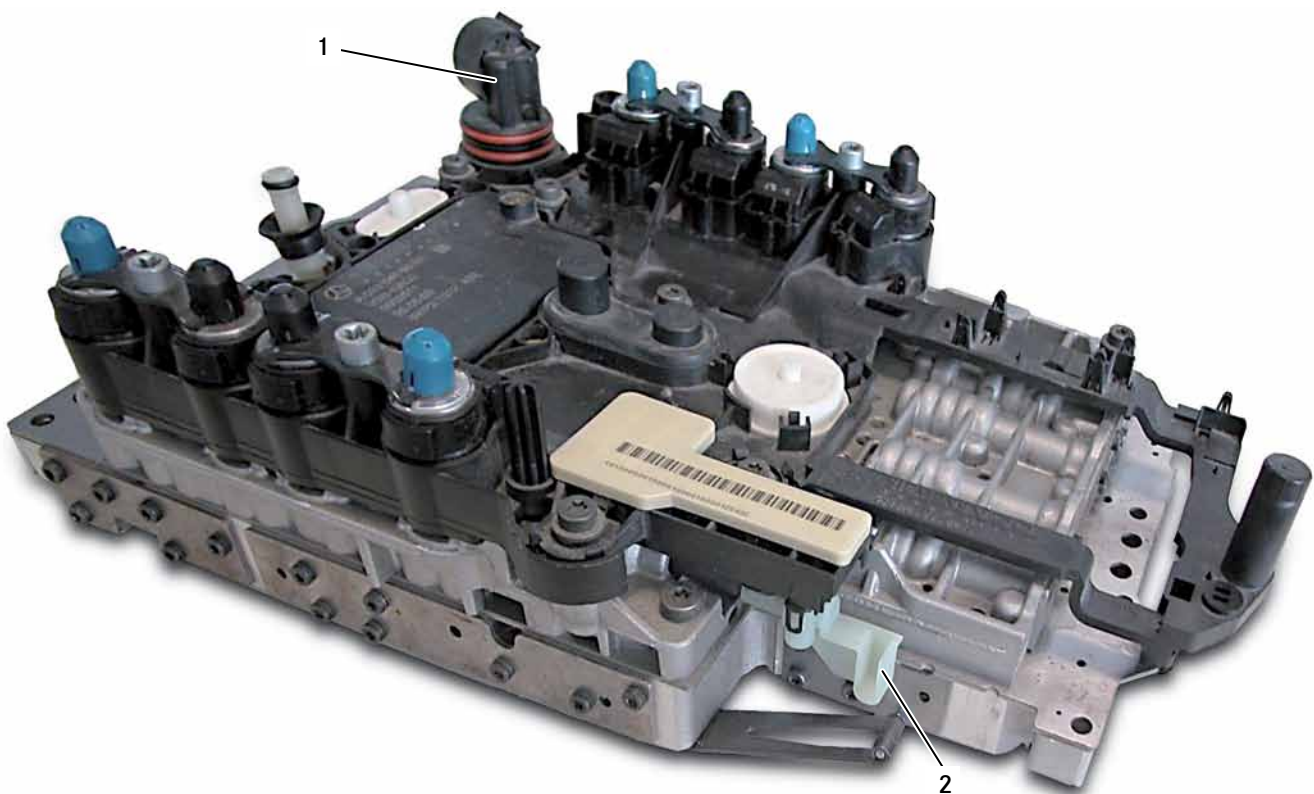
On all other AMG vehicles with wet clutch, a complete EHS replacement is required.

Note

For further information about EHS repair, please also see the SDmedia video: "Replacement of fully integrated transmission controller unit (VGS) on electrohydraulic controller unit (EHS) on automatic transmission 722.9"

Note about hybrid vehicles

EHS repair is possible for hybrid transmission 724.2. Further information can be found in WIS.



EHS selection range valve and connector

- 1 Connector
- 2 Selection range valve

P27.19-2646-00

NAT2i

Soaking multidisk clutch (load change element) in oil

When replacing the multidisk clutch, it is recommended to soak the new multidisk clutch in oil before installation. This ensures that the new multidisk clutch is adequately lubricated right from the beginning and thus prevents the possibility of a complaint about shuddering after the repair. Place the new multidisk clutch in oil before you start disassembling the transfer case, then the component will be adequately lubricated by the time you are ready to install the new multidisk clutch.

Towing vehicles with 4MATIC On vehicles with NAT2i, single-axle towing is not permissible and can result in serious damage to the transfer case. If the vehicle is damaged at the transmission, front axle or rear axle, have it transported on a car transporter or trailer.

Note

Balancing the vehicle wheels directly on the vehicle is also impermissible.

Leakage/sweating

As with all oil-filled systems, a transfer case may "sweat" due to its design. This is normal and there is no action required. The following pictures provide an example of the difference between sweating and leakage.



P28.00-2070-00

Transfer case sweating



P28.00-2071-00

Transfer case leaky

Are reconditioned transmissions now always filled with blue fluid?

No, if the old transmission was filled with red fluid, the reconditioned transmission must also again be filled with red fluid. A table of the permissible fluids can be found in the chapter "Red and blue fluid".

Is it permissible to mix the blue and the red fluid?

It is generally not permissible to mix the blue fluid with any other fluid. A separate filling unit must also be used for the new fluid (FE-ATF 134).

Exception: transmissions, electrohydraulic controller units and torque converters which are available via the replacement parts system are tested in the production plant exclusively with blue fluid (FE-ATF134). It is therefore possible that these parts may have residues of blue fluid. In this case, the transmission, controller unit and torque converter do not have to be cleaned. The transmission can be filled with the corresponding transmission fluid directly after installation.

Which transmissions have which oil change intervals and why are there differences?

The topic is dealt with extensively in the chapter "Oil change interval".

Why do the EEPROM data have to be stored and attached to a TIPS case as a log file?

The EEPROM data allow the technical workshop support team to obtain detailed information about the following transmission properties:

- Information about adaptation of the torque converter lockup clutch
- Information about the friction values of the torque converter lockup clutch
- Information about the diagnosis status of the torque converter lockup clutch
- Adaptation counter for upshifts and downshifts
- Adaptation data for switch-on process
- Information about the temperature statistics of the transmission
- Information about flushing and slip entries of the transmission

This information can be helpful for troubleshooting. This is why it is always necessary to attach the EEPROM data when creating a TIPS case. Selected content from the EEPROM is implemented for diagnostic purposes as the systems are developed further.

Important: The path of the EEPROM data can vary with every new DVD!

Why is there no beep during shift adaptation?

The topic is dealt with extensively in the chapter "Shift adaptation".

Why is it better to clean control solenoid valves than replace them?

Every valve has its own specific valve characteristic which is stored on the EHS. It is not possible to change these data. It is therefore often better to flush the old valve rather than replace it with a new valve with a different characteristic.

What happens when data are transferred after repair of the EHS?

This topic is covered in the chapter "Tips on EHS repair".

Why can't the torque converter lockup clutch be shut off for diagnostic purposes?

Shutting off the torque converter lockup clutch results in an immediate increase or decrease in the engine speed, which always changes the noise characteristics or driving characteristics. This makes it impossible to draw conclusions about the cause of the fault. On transmission 722.6 (NAT1), shutting off the torque converter lockup clutch resulted in incorrect diagnosis in most cases.

Instead of this, the torque converter lockup clutch can be fully closed for one ignition sequence (see chapter "Closing torque converter lockup clutch").

Web links

Workshop equipment

<http://gotis.aftersales.mercedes-benz.com/>

Global Training

<https://etraining.daimler.com/DCGT/docs/start/pages/index.htm>

Mercedes-Benz Star Diagnosis

<http://stardiagnosis.aftersales.daimler.com/>

Mercedes-Benz Specifications for Operating Fluids

<http://bevo.mercedes-benz.com/bevolistenmain.php>

ADA Application pressure adaptation	KID Unpowered in D
ATF Automatic Transmission Fluid	KÜB Torque converter lockup clutch
ART Adaptive cruise control	KZM Temporary M mode
CAN Controller Area Network	LSE Load change element
DSM DIRECT SELECT module	RBS Regenerative Braking System
EHS Electrohydraulic controller unit	SAM Signal acquisition and actuation module
EM Electric motor	SI Service Information
ESP Electronic Stability Program	VGS Fully integrated transmission control
FZA Fill time adaptation	WIS Workshop Information System
GI Global Information	ZÖP Auxiliary oil pump
ISM Intelligent Servo Module	

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