Contents

E85 Drive

Introduction

4 different gearboxes are offered for the E85:

2 manual gearboxes, the GA5HP19 automatic gearbox and the Sequential Manual Gearbox.

2 manual gearboxes:

- The GS5-20BG 5-speed manual gearbox is known from the E46. The brief designation of this gearbox is B-gearbox. (volume production launch USA 09/02)

- The GS6-37BZ 6-speed manual gearbox has been newly developed. The brief designation of this gearbox is H-gearbox.

Automatic gearbox:

- The GA5HP19Z automatic gearbox is available as an optional extra/special equipment (option 205). The automatic gearbox was offered in the E46 under the name A5S325Z. (volume production launch USA 09/02)

Sequential Manual Gearbox:

- The Sequential Manual Gearbox (SMG) is available as an optional extra/special equipment (option 206). The basis of the SMG is the H-gearbox. The SMG based on the H-gearbox is also known as H-SMG.
  The SMG used in the E46, which is based on the B-gearbox, is also known as B-SMG. The B-SMG is also known as the Sequential Shift Gearbox (SSG).

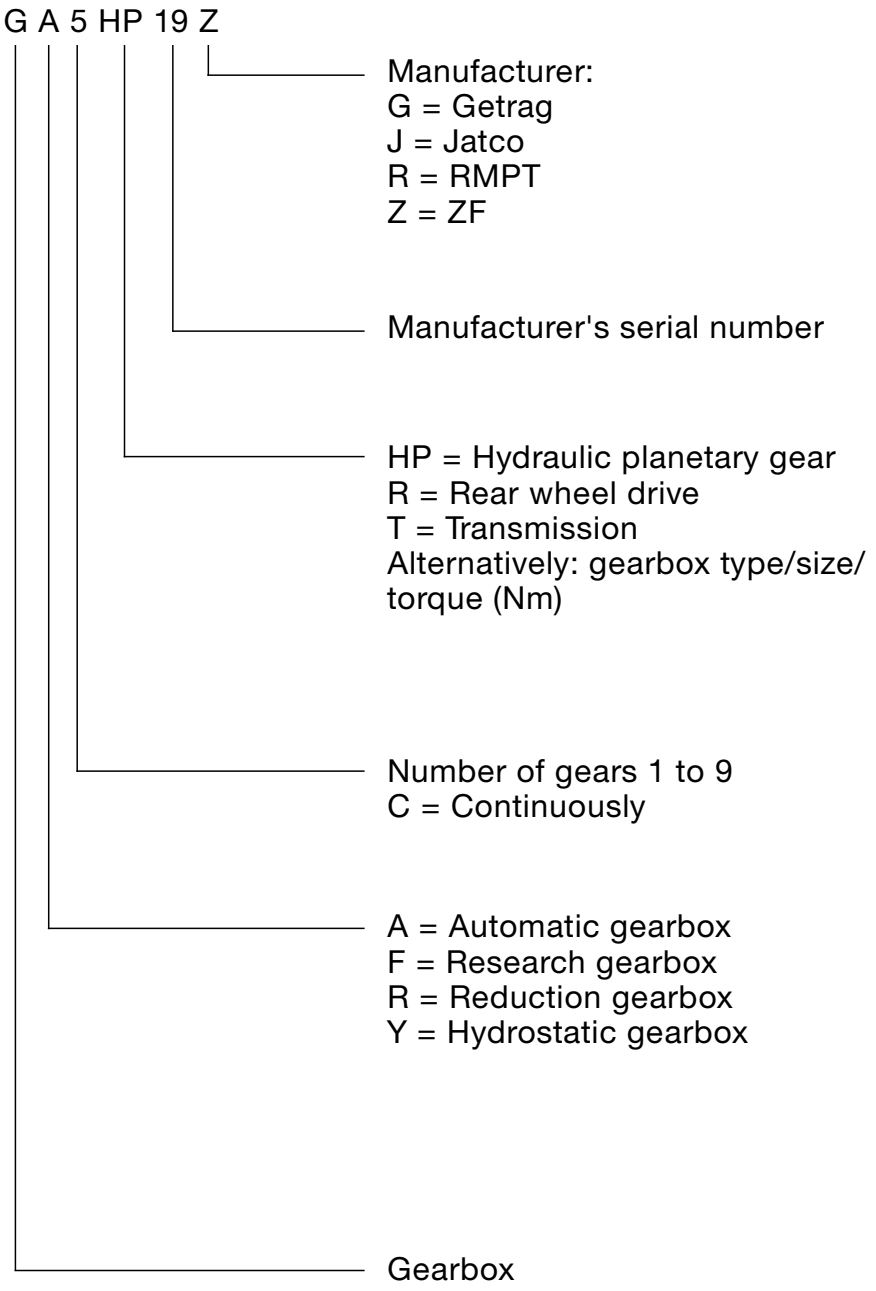
The following table shows the engine/gearbox combinations of the standard series and the options. The relevant data of volume production launch (VPL) are specified.

Engine	Series	Option SMG	Option automatic
M54B30	GS6-37BZ VPL 12/02	SMG-H VPL 04/03	GA5HP19Z VPL 09/02
M54B25	GS5-20BG VPL 09/02	SMG-H VPL 04/03	GA5HP19Z VPL 09/02
M54B22	GS5-20BG VPL 10/03	-	GA5HP19Z VPL 10/03

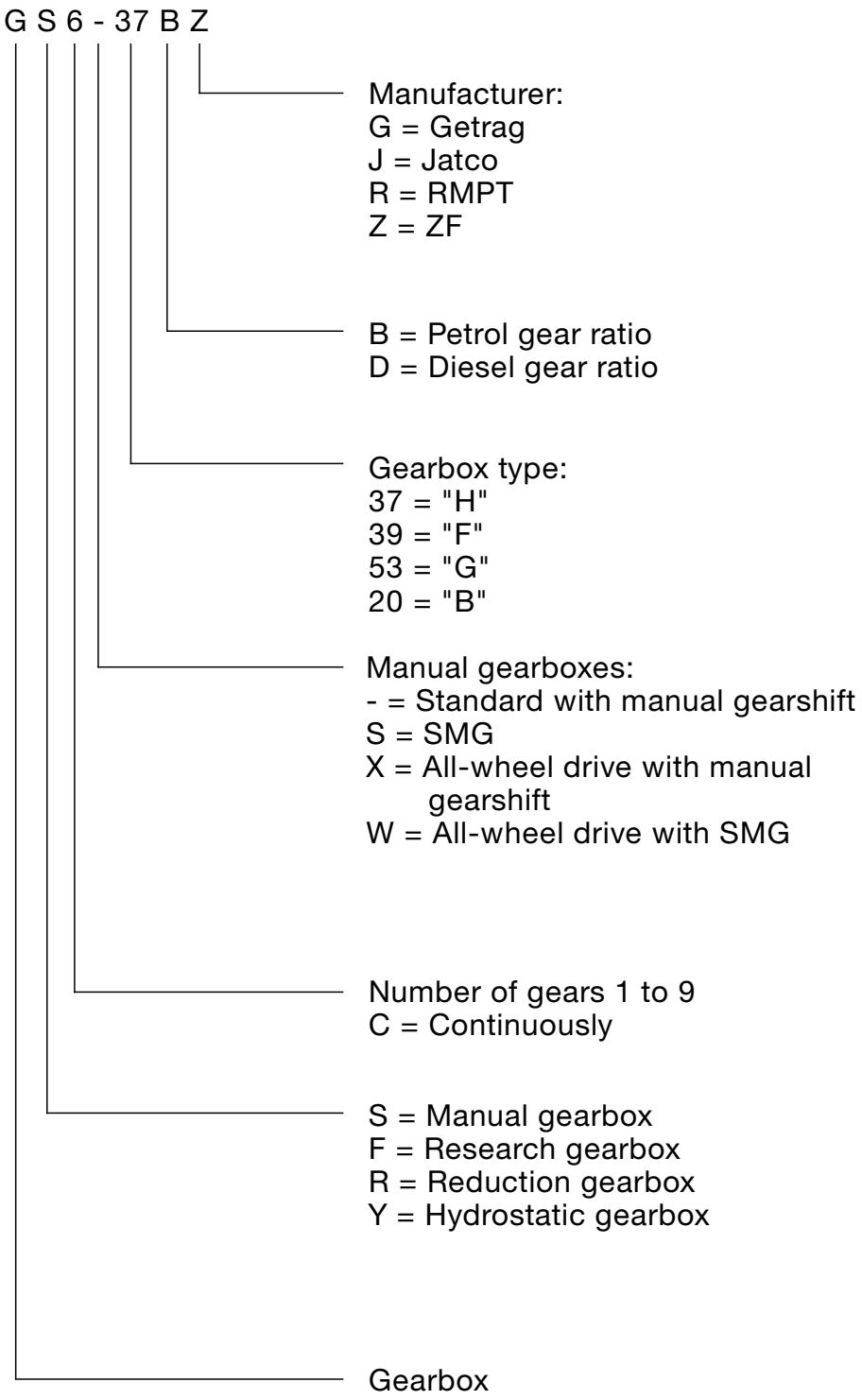
Gearbox designations

The gearboxes are designated according to the BMW Group Standard (GS) 90007.

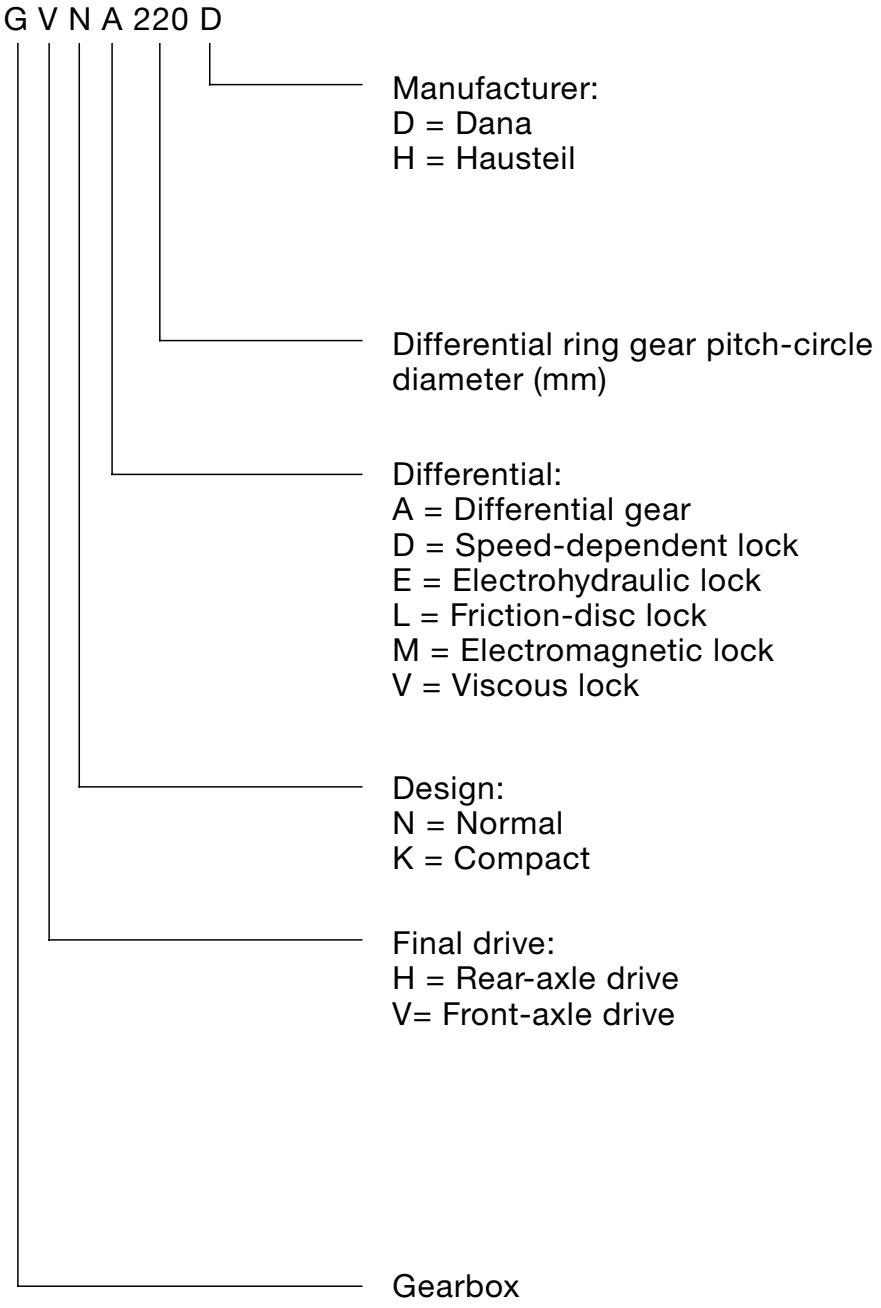
Example - automatic gearbox:



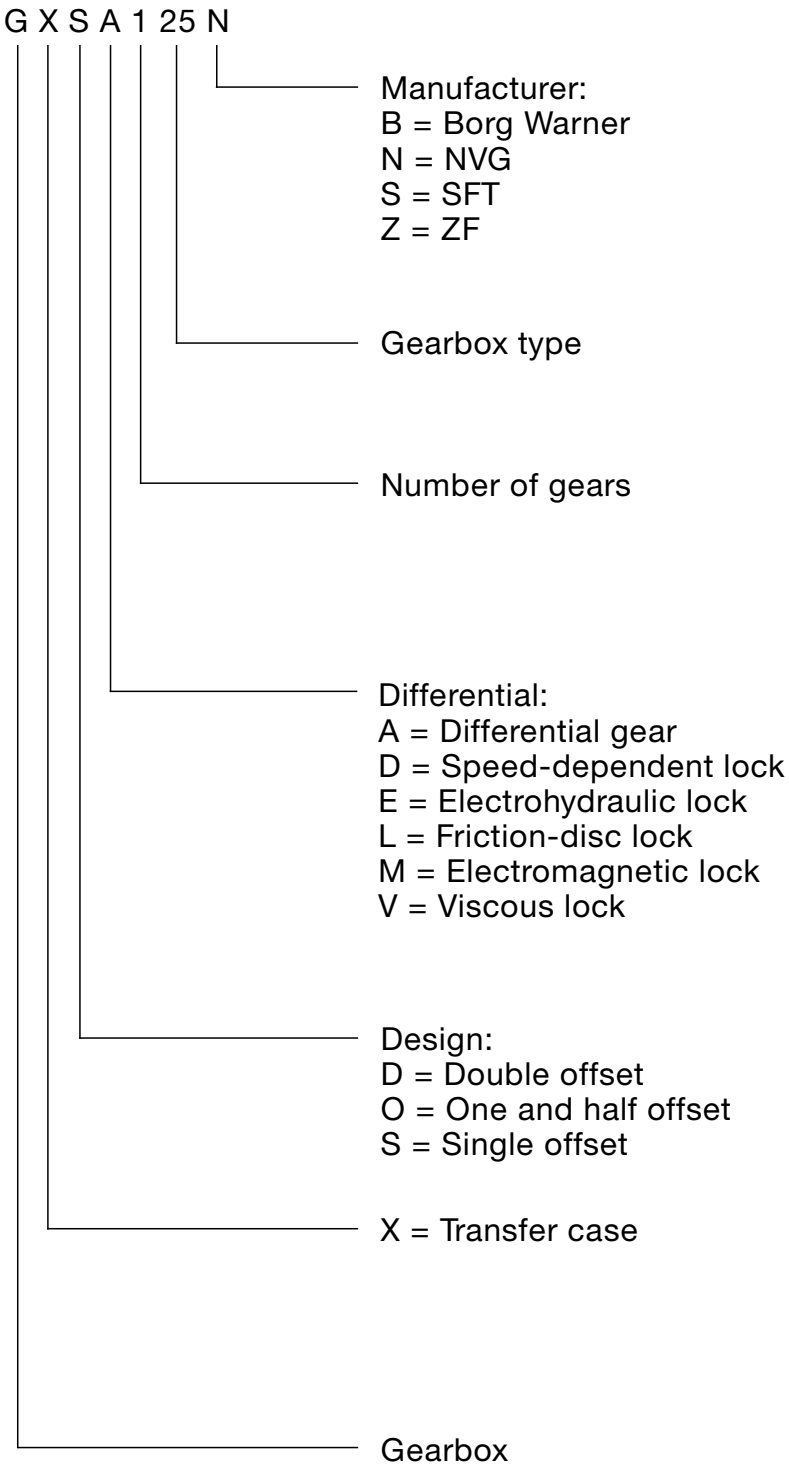
Example - manual gearbox:



Example - transfer case:



Example - final drive:



Driving-dynamics control

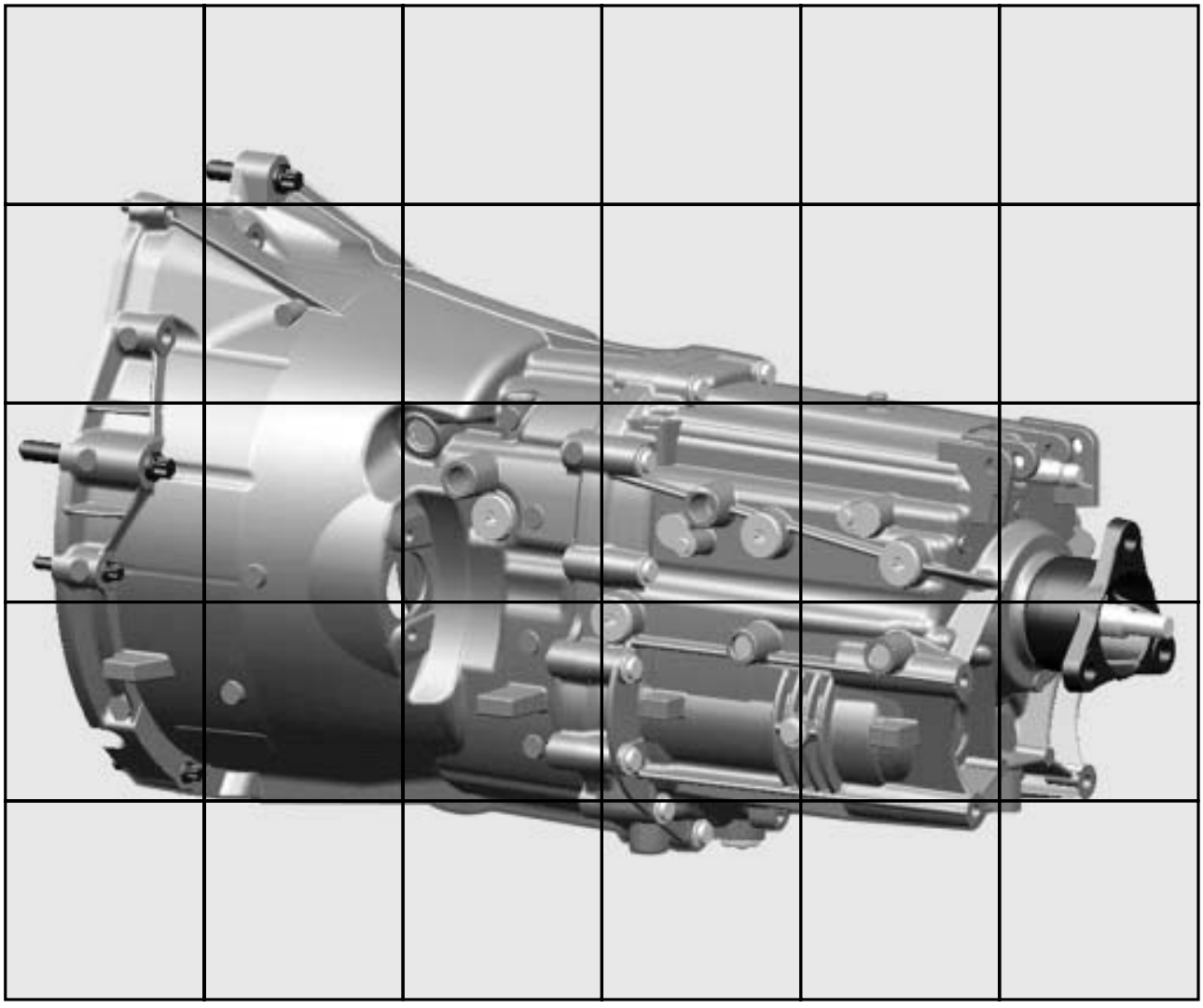
For a sporty style of driving, the driving-dynamics control (FDC) function is available as option 224. To activate this function, the FDC button is incorporated on the centre console next to the gearshift lever.

When the FDC function is activated, the following control units are influenced towards a sporty setting:

- SMG control unit (shorter gearshift times)
- MS45.0 engine control unit (engine progression)
- Electromechanical power steering (EPS) control unit (higher steering and holding forces)

BMW
Service Training

E85 GS6-37BZ Manual Gearbox
Seminar Working Material



NOTE
The information contained in this training course manual is intended solely for participants of th BMW Service Training course.
Refer to the relevant "Technical Service" information for any changes/supplements to the Technical Data.

VS-42 MFP-HGK-BRK-0350

Contents

E85 GS6-37BZ manual gearbox

Introduction

The GS6-37BZ 6-speed manual gearbox (H-gearbox) will be used for the first time at BMW as of 12/2002. It will be launched in the E85 with the M54B30 engine.

The gearbox is designed by Zahnradfabrik Friedrichshafen (ZF) and built and supplied by ZF and Getrag. This is why the gearbox designation bears the endings of both "Z" and "G."

The changes to the GS6-37BZ compared with the known manual gearboxes:

- Flanged gearbox bearing block
- Aluminium bolt connection to engine block
- Aluminium bolt connection of housing
- Mounting of drive shaft in dual-mass flywheel
- Involute drive-shaft toothing
- Introduction of a shift gate for guidance of selector shaft
- External shifting without play in neutral position
- New dual-mass flywheel

Summary

The GS6-37BZ is used with spark-ignition engines.

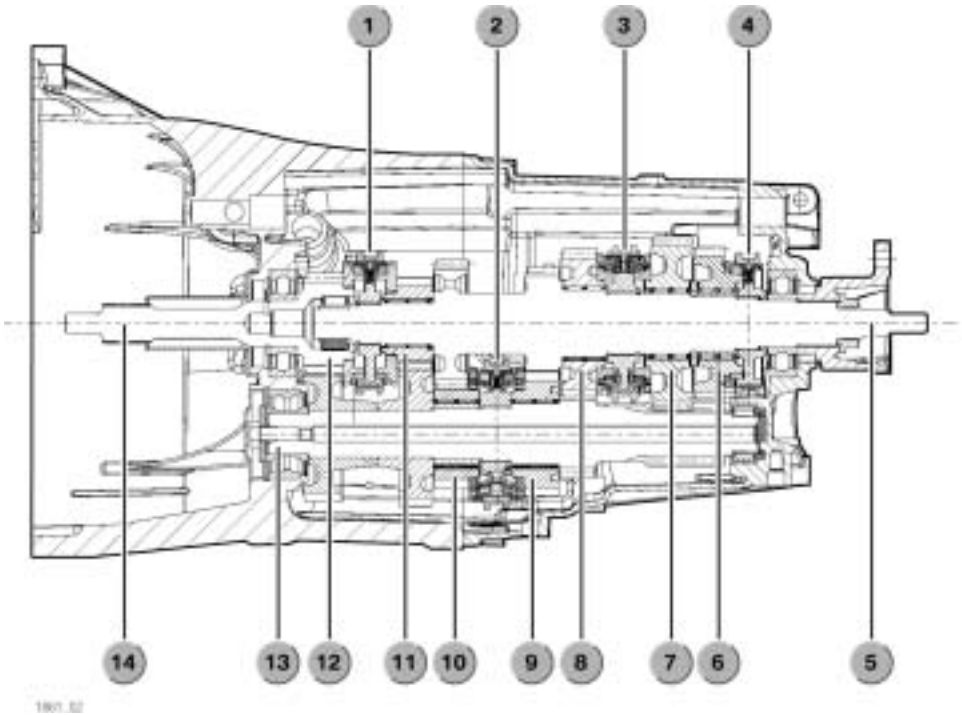
The GS6X37BZ is used in all-wheel drive vehicles and the GS6-37DZ is used for diesel engines.

The following table shows the vehicle models in which the respective gearboxes are used.

GS6-37BZ	GS6X37BZ	GS6-37DZ
E85 M54B30	E46 AWD 330Xi, 330XiTouring	E46 M47TU
E46 M54B30		E46 M47TU, 320d
E46/5 M54B25		

System overview

- Mechanism



KT-10411

Fig. 1: Cutaway view of GS6-37BZ manual gearbox

Index	Explanation	Index	Explanation
1	Selector sleeve, 5th/6th gear	8	2nd gear
2	Selector sleeve, 3rd/4th gear	9	4th gear
3	Selector sleeve, 1st/2nd gear	10	3rd gear
4	Selector sleeve, reverse gear	11	6th gear
5	Output shaft	12	5th gear (direct gear)
6	Reverse gear	13	Layshaft
7	1st gear	14	Drive shaft

Components

The gearbox consists of the following components:

- Gearbox casing
- Gearbox shafts
- Gearbox gear sets
- Gearbox synchronizers
- Gearbox shift mechanism

and the engine-side components:

- Dual-mass flywheel (ZMS)
- Clutch

- Gearbox casing

The casing is manufactured from diecast aluminium and flanged with aluminium bolts to the engine block.
The front section of the casing is similarly bolted to the rear end with aluminium bolts.
The casing is secured at the rear end with 4 bolts to a gearbox bearing block.

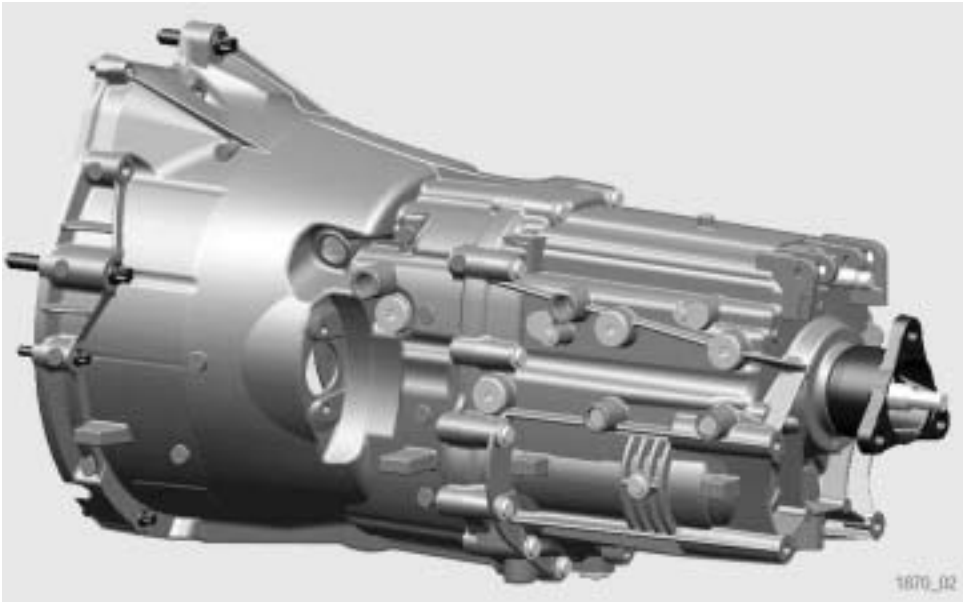


Fig. 2: View, left side, GS6-37BZ manual gearbox KT-10481

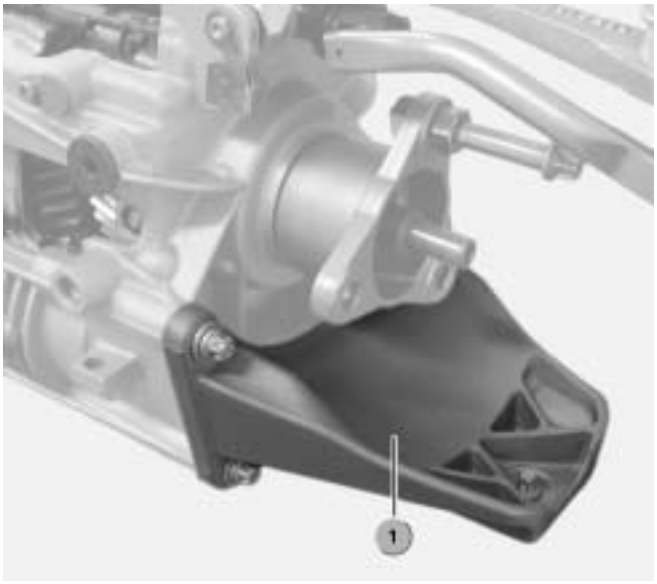


Fig. 3: Gearbox bearing block

KT-10308

Index	Explanation
1	Gearbox bearing block

The bolted gearbox bearing block increases the flexibility for acoustic adaptation of the relevant vehicle type. Adaptation of the acoustics to the relevant vehicle types can be achieved by changing the gearbox bearing block. It is no longer necessary to change the gearbox casing.

- Gearbox shafts

The drive shaft is supported in the flywheel in the pilot bearing and is approx. 25 mm shorter than that in the 5-speed manual gearbox. This configuration facilitates its removal. It is no longer necessary to pull the drive shaft in the axial direction towards the rear so far.
The longitudinal toothing of the gearbox drive shaft now takes involute form.
The hub of the clutch plate engages externally and internally via the guide tube of the drive shaft.

The clutch hub and guide tube form a labyrinth seal which prevents contamination of the drive shaft in comparison with G-gearboxes (used in 8-cylinder engines). The mounting of the drive shaft in the flywheel and the involute toothing make it easier to install and remove the gearbox.

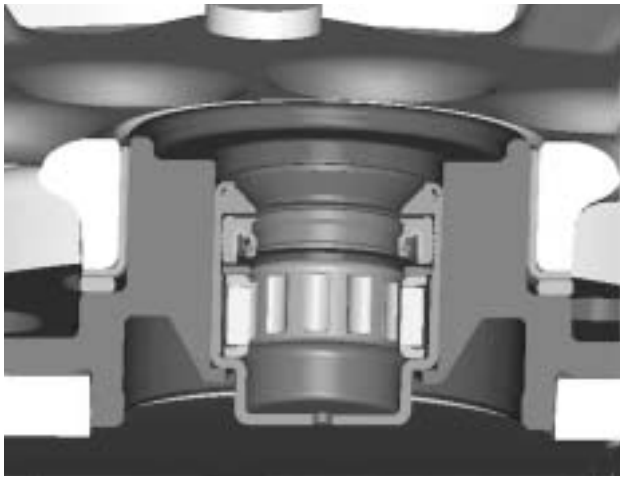


Fig. 4: Pilot bearing KT-10239

Involute toothing: Toothing denotes the special shape of the toothed segments. Involute denotes a mathematical curve shape.

The use of involute toothing on the drive shaft creates a linear contact (red dots) on the toothed segments at the contact with the clutch drive plate. A surface contact was created in previous drive shafts. The reduced friction of the line contact facilitates the declutching operation.

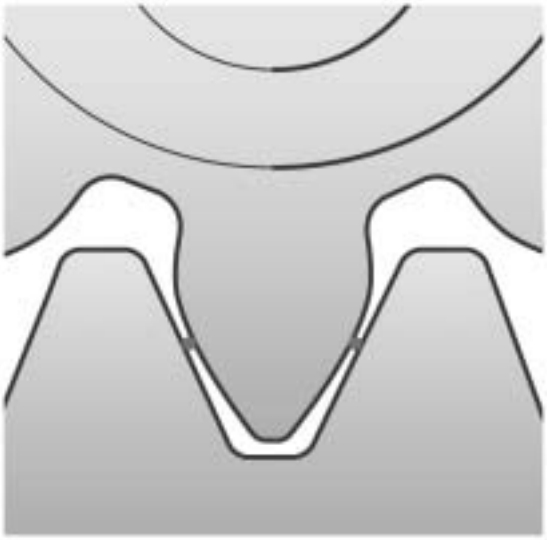


Fig. 5: Involute toothing KT-10155

The longitudinal toothing of the drive shaft has 22 teeth.

- Gearbox gear sets

The gearbox is designed in 5th gear as a direct gear and in 6th gear as an overdrive gear.

Gearbox ratios:

Gear ratios						
1	2	3	4	5	6	R
4.350	2.496	1.665	1.234	1.000	0.851	3.926

- Gearbox synchronizers

A triple-taper synchronizer is installed for the 1st and 2nd gears.
A double-taper synchronizer unit is installed for the 3rd and 4th gears.
A single-taper synchronizer unit is installed for the 5th and 6th gears and for the reverse gear.

- Gearbox shift mechanism

The biggest change to the internal gearshift mechanism is the introduction of a shift gate and a shift-gate finger. The shift-gate finger is permanently connected to the selector shaft and engages the shift gate.
The shift-gate finger and shift gate guide the selector shaft exactly.
The passive lock prevents 2 gears from being engaged simultaneously.
The short shift travels of the external gearshift mechanism in the E85 resulted in an adaptation of the selector forces of the internal gearshift mechanism.

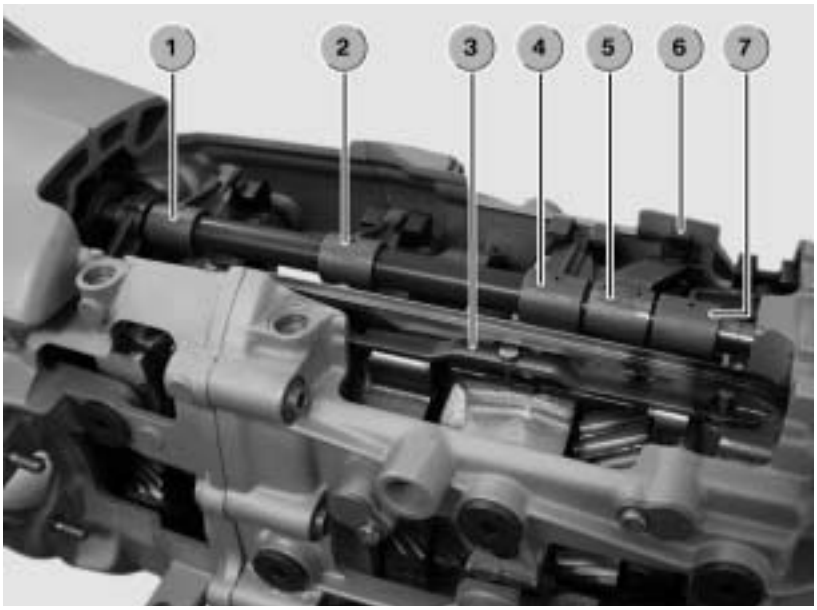


Fig. 6: Selector shaft KT-10309

Index	Explanation	Index	Explanation
1	Shift finger, gear 5/6	5	Shift-gate finger
2	Shift finger, gear 3/4	6	Shift gate
3	Passive lock	7	Shift finger, reverse gear
4	Shift finger, gear 1/2		

The gears are shifted by selector forks.

The design dictates that the selector fork for the 1st and 2nd gears is transmitted as follows: When the selector shaft is pushed forwards (engagement of 1st gear), the selector fork is forced 5 times backwards in order to engage 1st gear.

The corresponding chamfers on the shift gate facilitate precise guidance particularly in the case of diagonal gearshifts (2nd gear into 3rd gear, 4th gear into 5th gear, and vice versa).

The shift gate conveys to the driver a precise gearshift sensation.

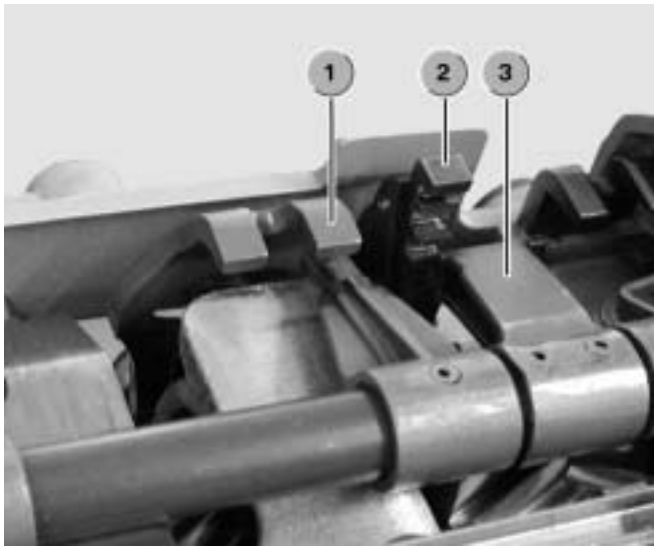


Fig. 7: Shift gate and shift-gate finger KT-10307

Index	Explanation	Index	Explanation
1	Selector sleeve, gear 1/2	3	Shift-gate finger
2	Shift gate		

A further function of the shift gate and the shift-gate finger is to absorb so-called "misuse forces" created by the driver at the gearshift lever. Previously these "misuse forces" were transmitted via the selector shaft to the selector forks.

A reduction of selector forces is achieved by the deployment of springs with low pretension at gutter 5/6, at the reverse gear and at the helical coiled spring (gutter 1/2).

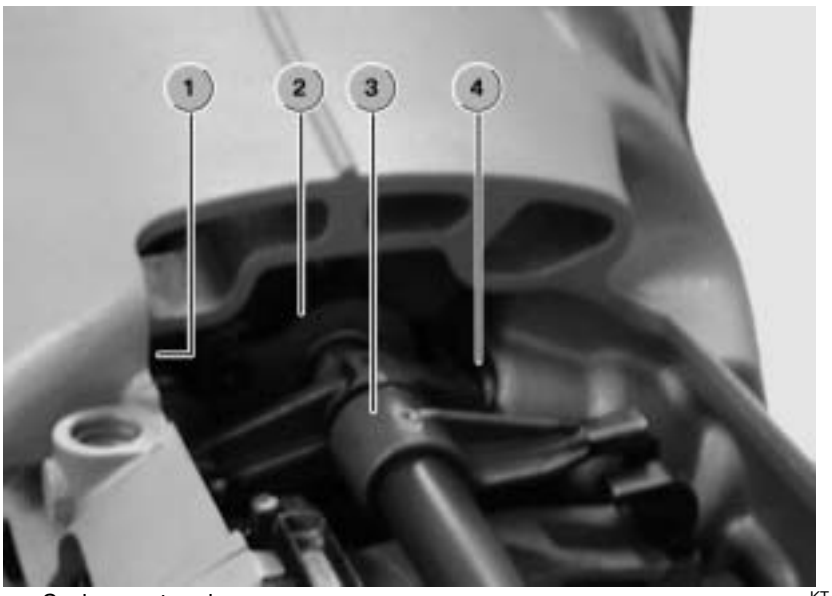


Fig. 8: Spring pretension KT-10310

Index	Explanation	Index	Explanation
1	Spring, gutter 5/6	3	Shift finger, gear 5/6
2	Helical coiled spring (gutter 1/2)	4	Spring, reverse gear

Correct adjustment of the selector-force mechanism when the gearbox is installed ensures that the gearshift lever is without play in neutral.

- Dual-mass flywheel (ZMS)

A newly developed dual-mass flywheel is used with the H-gearbox. The basis for this product family is the dual-mass flywheel used in the M54.

Design of dual-mass flywheel

In the flywheel, the 2 masses are connected via inner and outer dampers. The masses are now supported against each other in a plain bearing and no longer in a ball bearing.
The plain bearing requires less space and enables an additional inner damper to be used.
The gearbox drive shaft is supported in the flywheel in a needle bushing with roller bearing (pilot bearing).

KT-10236

Fig. 9: Cutaway view of dual-mass flywheel

Because the 6-speed manual gearbox has more gear wheels than its 5-speed counterpart, the gearbox itself is exposed to more vibrations. The flywheel has been modified as follows to compensate the vibrations and the noises thereby generated:

- Introduction of a plain bearing
- Additional inner damper

The thread-hole circle for connecting to the crankshaft flange is now located outside the plain bearing. In flywheels whose masses were supported with balls, the thread-hole circle was inside the ball-bearing ring.

Fig. 10: Plain bearing of dual-mass flywheel KT-10237

The space saved by introducing the plain bearing has been used for a second inner damper.

The flywheel is connected to the crankshaft flange with Torx socket bolts.

- Clutch

03/2003 will see the introduction of new heavy-metal-free friction linings which satisfy the requirements of used-car regulations with regard to freedom from heavy metals.

System functions

- Power flow through 6-speed gearbox

1st gear has an overall step-up ratio of 4.350.
2nd gear has an overall step-up ratio of 2.496.
3rd gear has an overall step-up ratio of 1.665.
4th gear has an overall step-up ratio of 1.230.
5th gear is designed as a direct gear.
6th gear is designed as an overdrive gear and has an overall step-down ratio of 0.851.
Reverse gear has an overall step-up ratio of 3.926.

The power flows of the individual gears for the M54B30 engine are illustrated. The power flows illustrated are applicable to an input torque of 300 Nm at a speed of 3500 rpm.

The step-up ratio from the drive shaft to the layshaft is 1.38. The input torque at the layshaft is 390 Nm.

Power flow in 1st gear

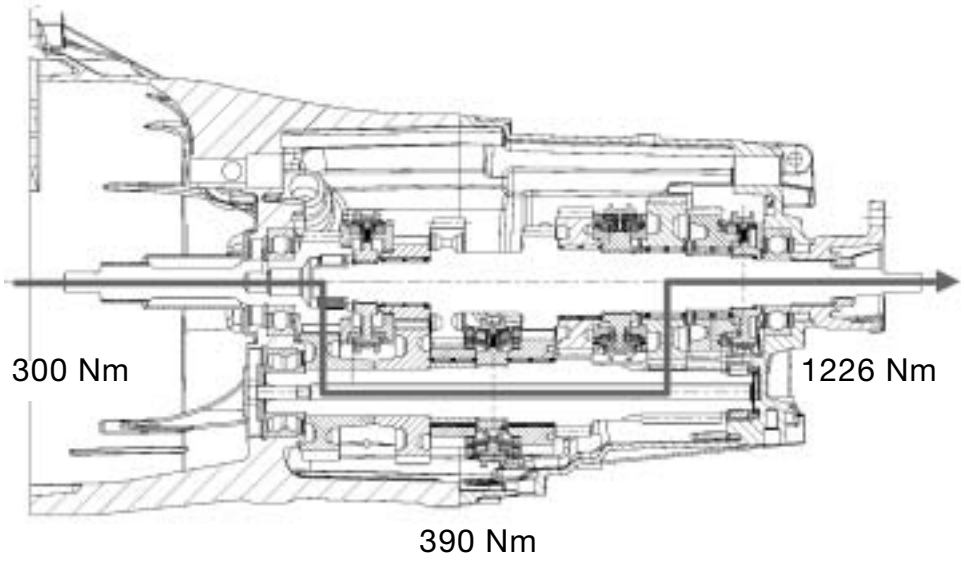
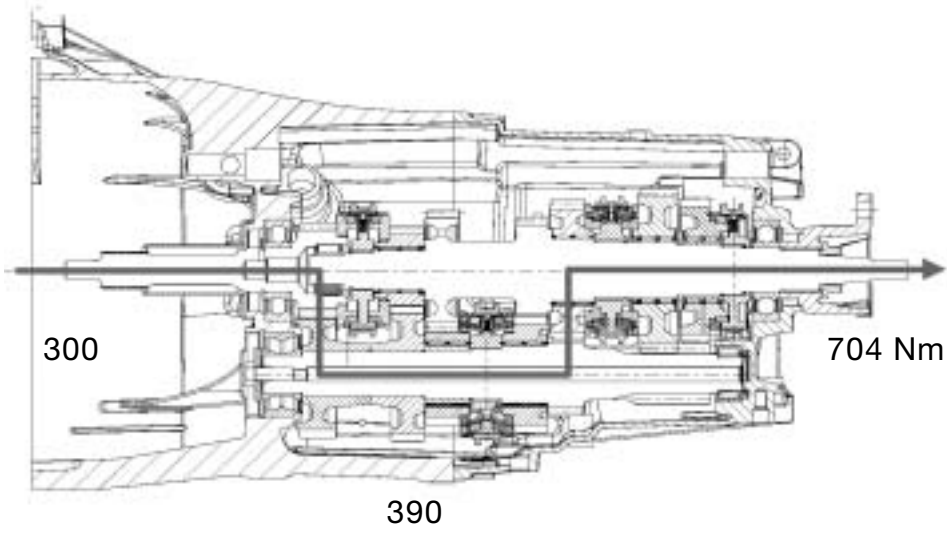


Fig. 11: Power flow in 1st gear

An input torque of 300 Nm produces a gearbox output torque of 1226 Nm.

Power flow in 2nd gear



KT-10435

Fig. 12: Power flow in 2nd gear

An input torque of 300 Nm produces a gearbox output torque of 704 Nm.

Power flow in 3rd gear

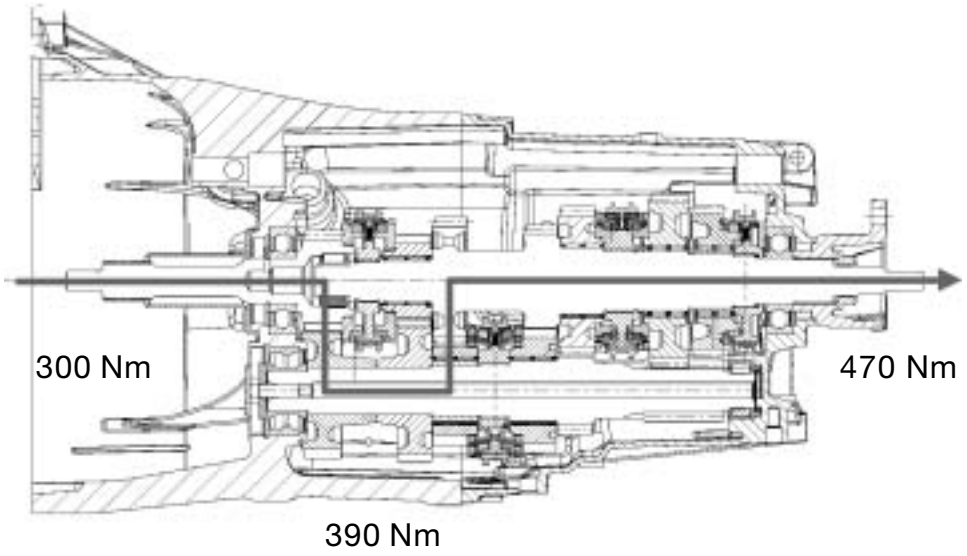


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Fig. 13: Power flow in 3rd gear

An input torque of 300 Nm produces a gearbox output torque of 470 Nm.

Power flow in 4th gear

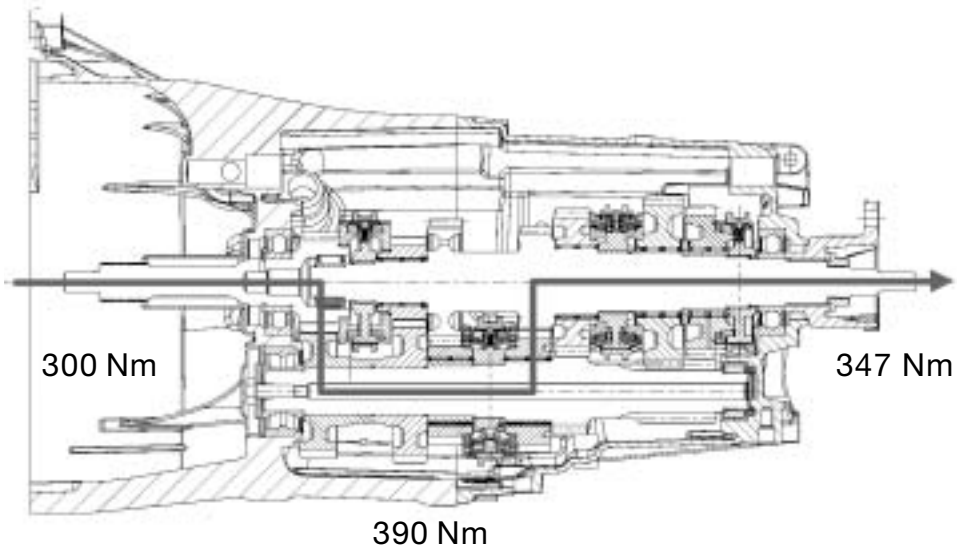

Fig. 14: Power flow in 4th gear KT-10439

An input torque of 300 Nm produces a gearbox output torque of 347 Nm.

Power flow in 5th gear

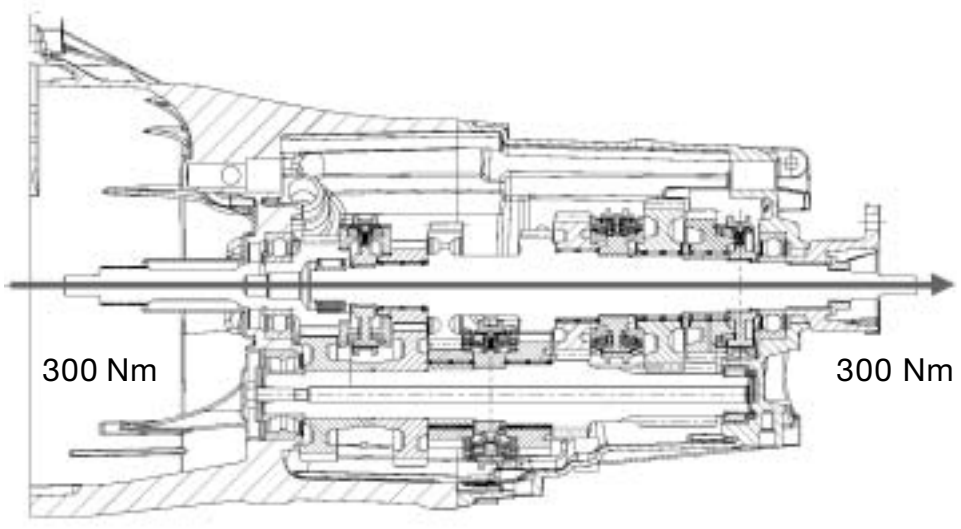

Fig. 15: Power flow in 5th gear KT-10441

The gearbox output torque is equal to the input torque.

Power flow in 6th gear

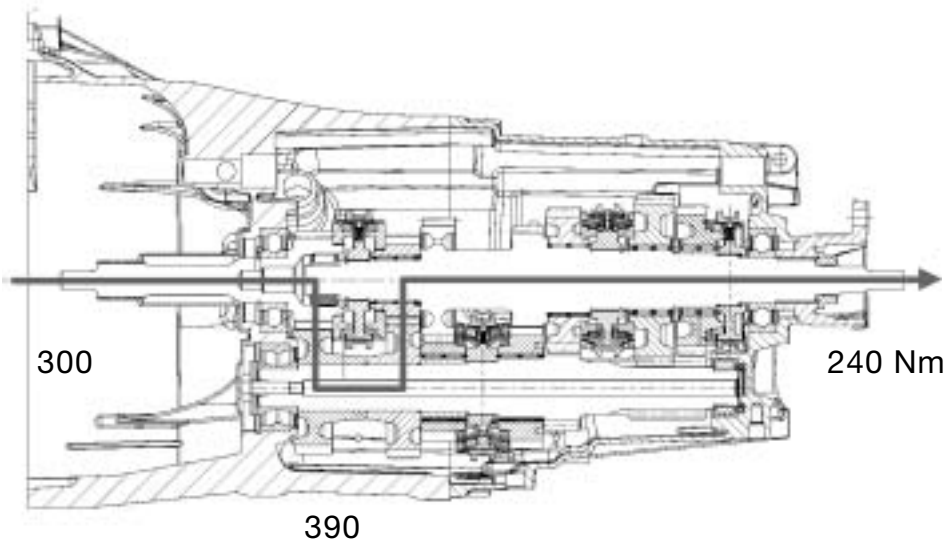

Fig. 16: Power flow in 6th gear KT-10443

An input torque of 300 Nm produces a gearbox output torque of 240 Nm.

Power flow in reverse gear

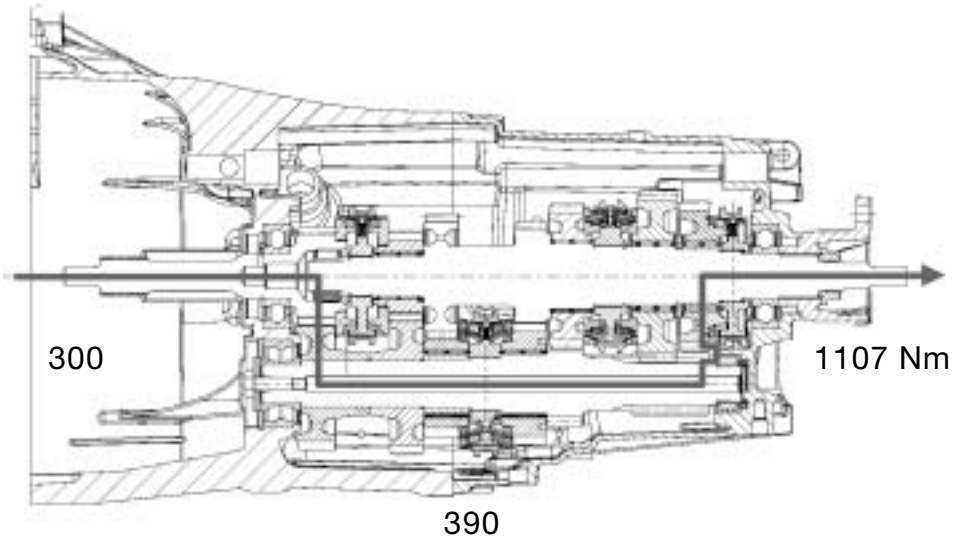

Fig. 17: Power flow in reverse gear KT-10444

An input torque of 300 Nm produces a gearbox output torque of 1107 Nm.

Notes for Service

- Removing gearbox

The aluminium bolts with which the gearbox casing is flanged to the engine block and the aluminium bolts which connect the casing halves may only be used 3 times!
Observe tightening torques.
The shortened drive shaft and the involute toothing make it easier to install and remove the gearbox.

- Installing gearbox

A new lubrication specification is introduced with the involute toothing on the drive shaft. Lubrication is carried out with a grease scraper ring.

- Carefully slide the grease scraper ring over the shaft up to the guide tube.
- Using a brush, spread the grease evenly on the toothing and the profile base up to the grease scraper ring.
- Carefully pull back the grease scraper ring over the shaft.
- Scrape off the excess grease retained on the grease scraper ring.

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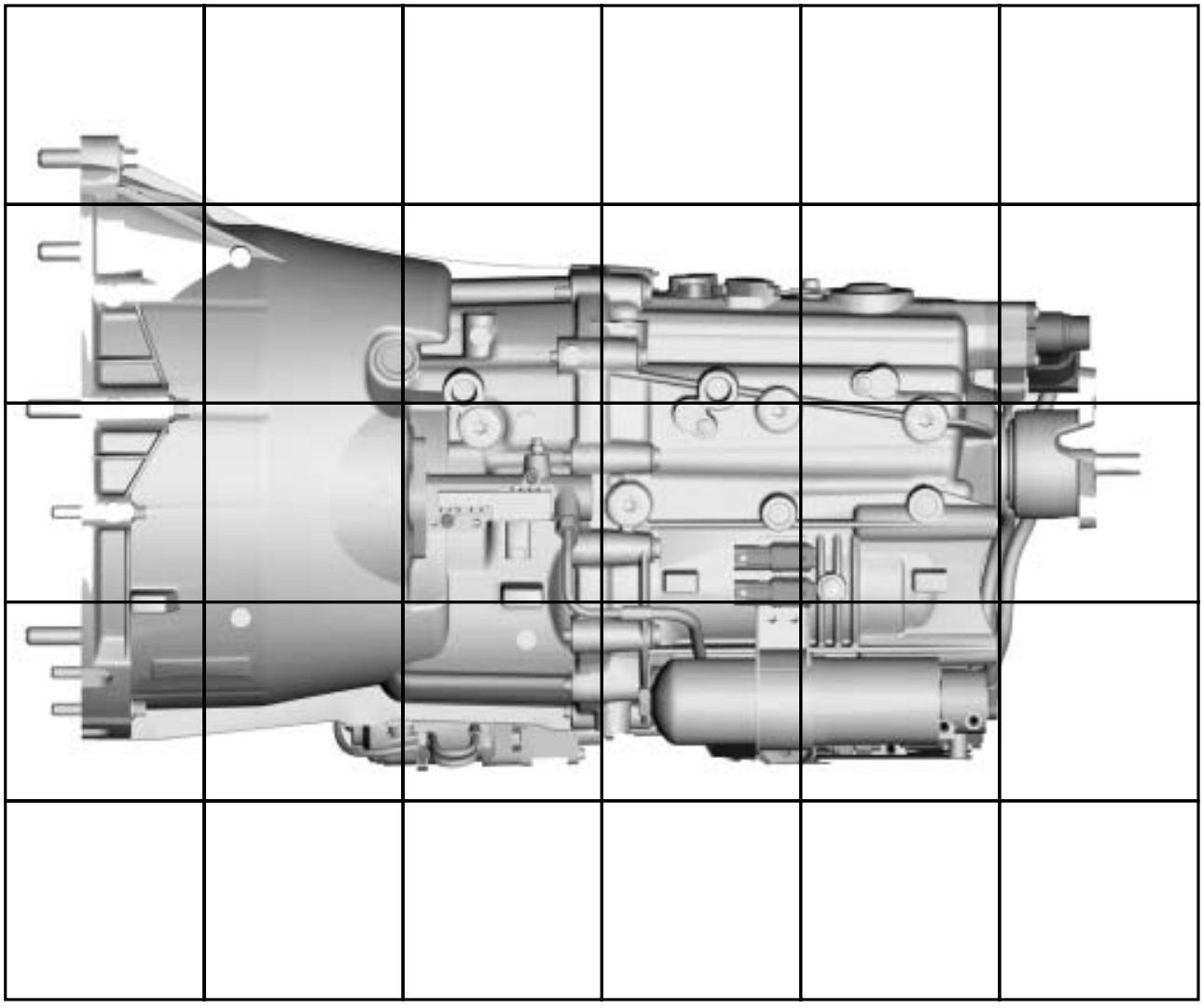
E85 SMG 6-Speed Sequential Manual Gearbox
Seminar Working Material



Contents

E85 6-speed SMG

Introduction

The Sequential Manual Gearbox (SMG) is the further development of the Sequential Shift Gearbox previously known by the abbreviation SSG.

The basis of the SMG in the E85 is the GS6-37BZ 6-speed manual gearbox.

Because the GS6-37BZ is also known as the H-gearbox, the SMG based on it is known as H-SMG.

The SMG is offered with the M54B30 and M54B25 engines for the E85 as an optional extra/special equipment (option 206).

The launch date for the E85 is 04/2003 and for the E46 03/2003.

Compared with the SSG (C-SMG) previously used in the E46, which was based on the 5-speed gearbox (C-gearbox), what have been changed in addition to a completely new gearbox are the mounting positions of the hydraulic components and the sensors on the gearbox casing.

In conjunction with the SMG option, the customer also obtains the driving-dynamics control function (FDC). The FDC function effects a sportier style of driving through intervention in the engine, gearbox and steering control systems. The FDC function is activated with the FDC button.

System overview

- SMG bus overview

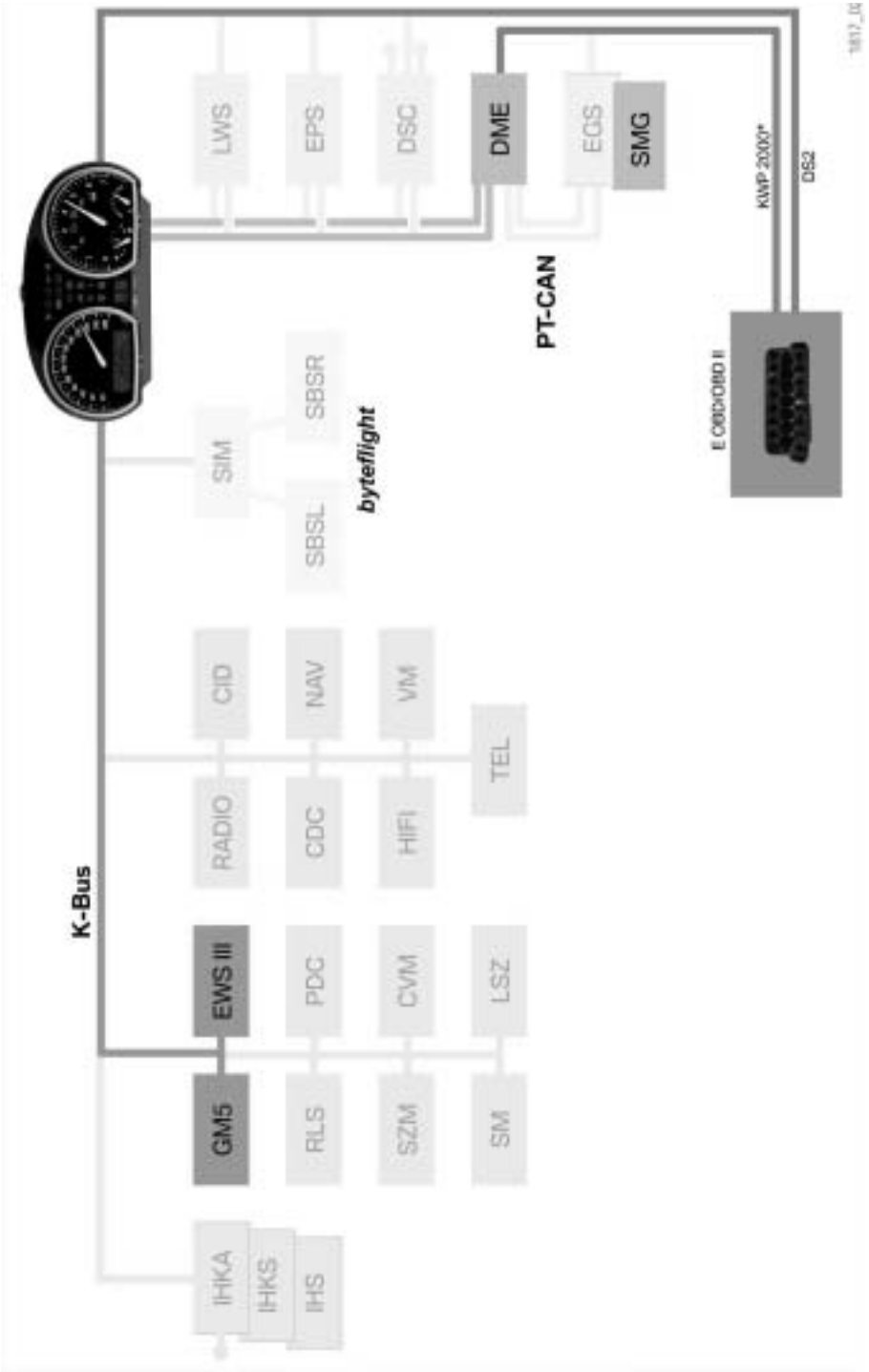


Fig. 1: SMG bus overview

KT-10365

Index	Explanation	Index	Explanation
CDC	CD changer	LWS	Steering-angle sensor
CID	Central Information Display	NAV	Navigation computer
CVM	Soft-top module	PDC	Park Distance Control
DME	Digital Motor Electronics	RADIO	Radio
DSC	Dynamic Stability Control	RLS	Rain/light sensor
EGS	Electronic gearbox control	SBSL	Satellite, B-pillar, left
EPS	Electric Power Steering	SBSR	Satellite, B-pillar, right
EWS III	Electronic immobilizer	SIM	Safety and Information Module
GM5	General module 5	SM	Seat module
HiFi	Top hi-fi amplifier (DSP)	SMG	Sequential Manual Gearbox
IHKA	Integrated heating and automatic air conditioning	SZM	Switch centre, centre console
IHKS	Integrated heating and A/C control	TEL	Telephone control unit
IHS	Integrated heating control	VM	Video module
LSZ	Light switch centre		

- SMG input/output signals

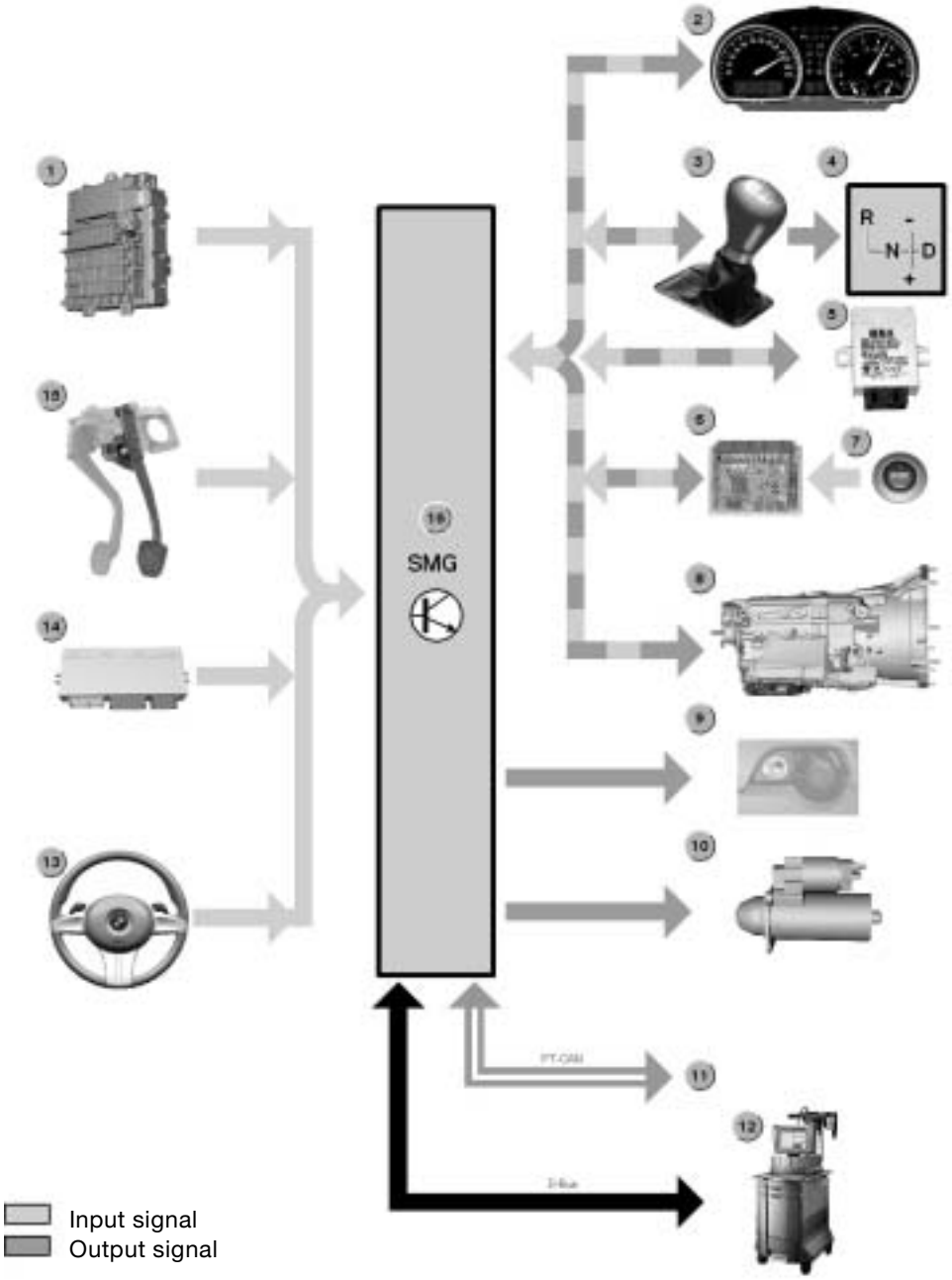
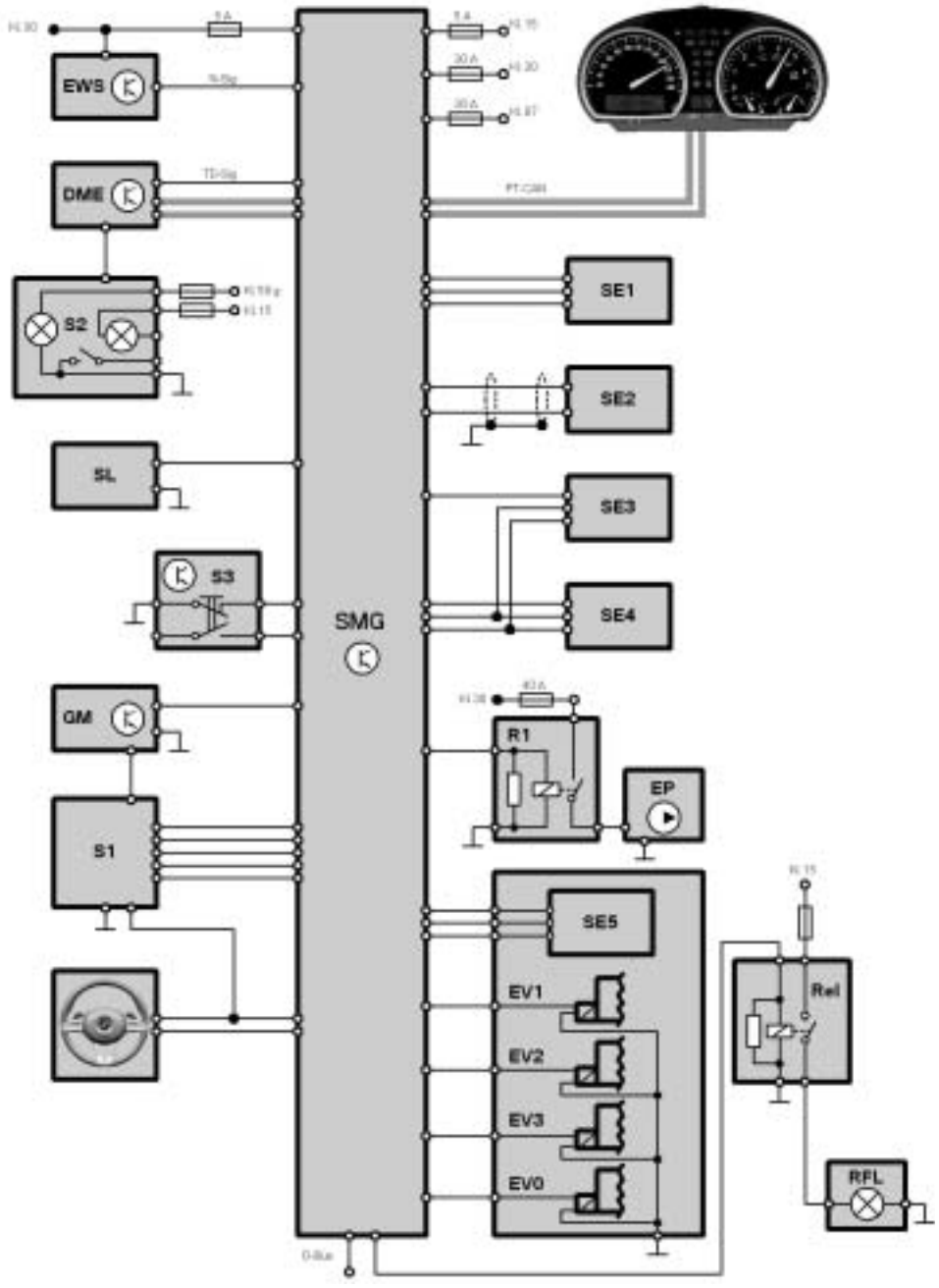


Fig. 2: System overview, input/output signals

KT-10208

Index	Explanation	Index	Explanation
1	Current distributor	9	Reversing-light relay
2	Instrument cluster	10	Starter motor
3	Gearshift lever	11	Powertrain CAN
4	Illuminated shift gate (US)	12	Diagnosis bus, DISplus, GT1
5	Electronic immobilizer	13	SMG steering wheel with shift paddles
6	MS45.0 engine management	14	General module 5
7	FDC button	15	Brake-light switch
8	Hydraulic unit on gearbox, shift-travel sensor, selection-angle sensor, sensor for gearbox input speed, clutch control travel sensor	16	SMG control unit

- SMG system schematic



KT-10209

Fig. 3: SMG system schematic

Index	Explanation	Index	Explanation
EWS	Electronic immobilizer	SE2	Sensor for gearbox input speed
DME	Digital Motor Electronics	SE3	Selection-angle sensor
S2	FDC button	SE4	Shift-travel sensor
SL	Shift lock	R1	Hydraulic-pump relay
S3	Brake-light switch	EP	Hydraulic pump
GM	General module	SE5	Accumulator pressure sensor
S1	Gearshift-lever switch	EV1	Solenoid valve, odd gears
Kl. 15	Terminal 15	EV2	Solenoid valve, even gears
Kl. 30	Terminal 30	EV3	Solenoid valve, S-CAM brake
Kl. 58g	Terminal 58g (locating light)	EV0	Solenoid valve, clutch
D-Bus	Diagnosis bus	Rel	Reversing-light relay
Kl. 50	Terminal 50	RFL	Reversing light
SE1	Clutch control travel sensor		

Central connector

To simplify access to awkwardly situated connectors on the gearbox, a small central connector is located on the left side of the gearbox below the clutch sensor.

The central connector incorporates the plug connections for the hydraulic-unit components:

- Control leads for hydraulic valves
- Signal line for pressure sensor
- Voltage supply of pressure sensor
- Ground connection of pressure sensor
- Ground connection of hydraulic valves

The gearshift lever accommodates a Micro-Quadlock system with a 12-pin pin tray. Two pins are additionally assigned in the US version. They are the outputs for the illuminated gearshift-lever position indicator, which is located on the driver's side next to the gearshift lever on the centre console.

Components

The system is made up of the following components:

- SMG gearshift lever
- SMG steering wheel with shift paddles
- FDC button (driving-dynamics control)
- SMG hydraulic system
- SMG control unit
- Reversing-light relay
- Gearbox
- Displays/indications in instrument cluster

- SMG gearshift lever

Design

The gearshift lever is 20 mm shorter than the E46 version.
The lever positions are recorded by 7 Hall sensors.
The design of the lever and the shift gate corresponds to that of the previously used shift lever. The shift gate depicted on the gearshift-lever knob features the D symbol instead of the C symbol for cruise mode.
The lever is connected to the gearbox by electric leads only.

Operation

The gearshift lever works in the same way as the previously used version.
A downshift is performed when the lever is pressed forward.
An upshift is performed when the lever is pulled backward.

- SMG steering wheel with shift paddles

Location of shift paddles

A gear change can also be performed using the shift paddles on the steering wheel.

Fig. 4: SMG steering wheel with shift paddles KT-10517

Operation

Pulling both shift paddles effects an upshift while pressing effects a downshift.

- FDC button

The FDC button replaces the sport button known from other model series.
The FDC button is provided as standard in the M54B30 and M54B25 EU versions.
The FDC button is not offered as an option for the M54B22.

Installation location

The FDC button is located in the instrument panel of the centre console and is denoted by the lettering "SPORT."

KT-10288

Fig. 5: Installation location of FDC button

Index	Explanation
1	FDC button

Design

The locating light (terminal 58g) and the function lighting have their own connections.
The FDC button has a 6-pin plug connection.

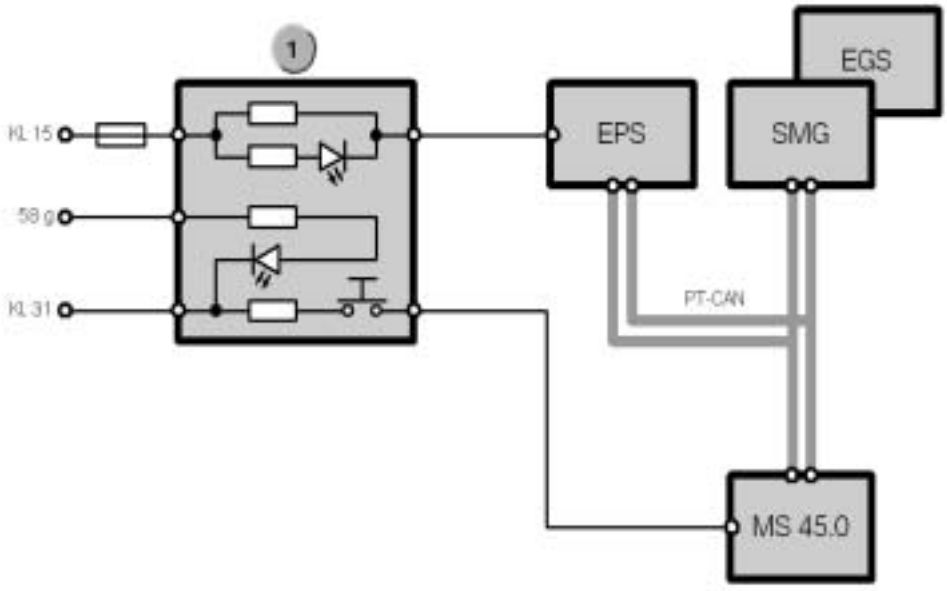


Fig. 6: Block diagram of FDC button

Index	Explanation	Index	Explanation
1	FDC button	PT-CAN	CAN bus, Powertrain
MS45.0	Engine control unit	Kl. 31	Terminal 31
SMG	SMG control unit	Kl. 15	Terminal 15
EPS	EPS control unit	58g	Locating light
EGS	Gearbox control unit		

- SMG hydraulic system

The clutching operation and the gear shift are performed automatically by the SMG hydraulic system.
The H-SMG hydraulic system has the same components and functions as the C-SMG hydraulic system.

Installation location

In comparison with the C-SMG, the mounting positions of the hydraulic-system components in the H-SMG have undergone significant changes, as can be seen in the following 5 illustrations:

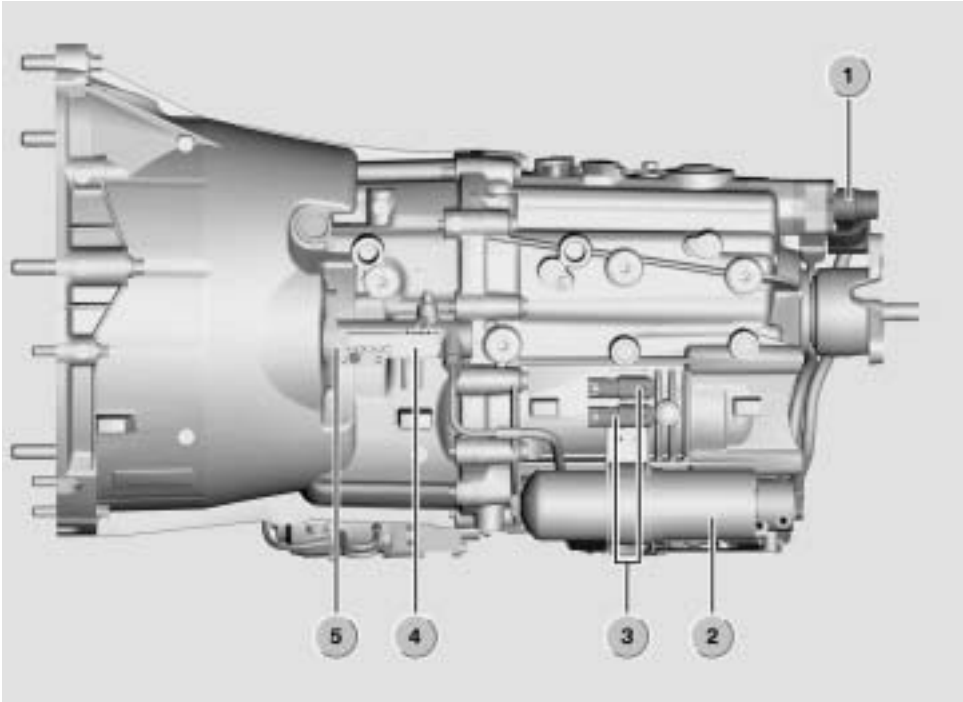


Fig. 7: SMG: view, left side

Index	Explanation	Index	Explanation
1	Shift/selection actuator	4	Clutch control travel sensor
2	Pressure accumulator	5	Clutch actuator
3	Connections of shift-travel sensor and selection-angle sensor		

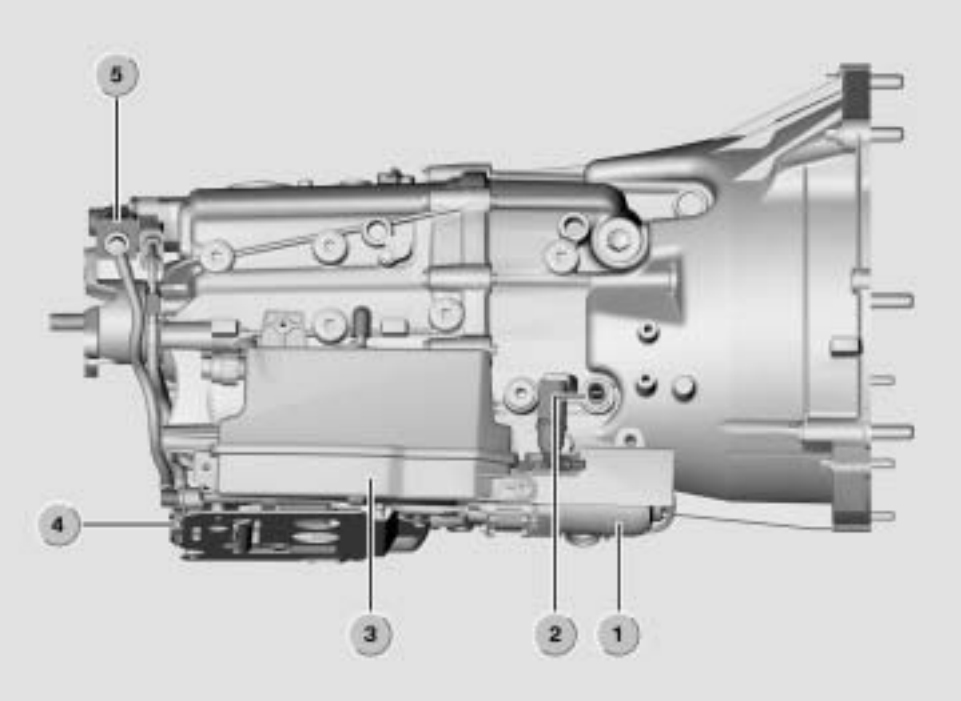


Fig. 8: SMG: view, right side KT-10302

Index	Explanation	Index	Explanation
1	Hydraulic pump	4	Valve block
2	Sensor for gearbox input speed	5	Shift/selection actuator
3	Expansion tank		

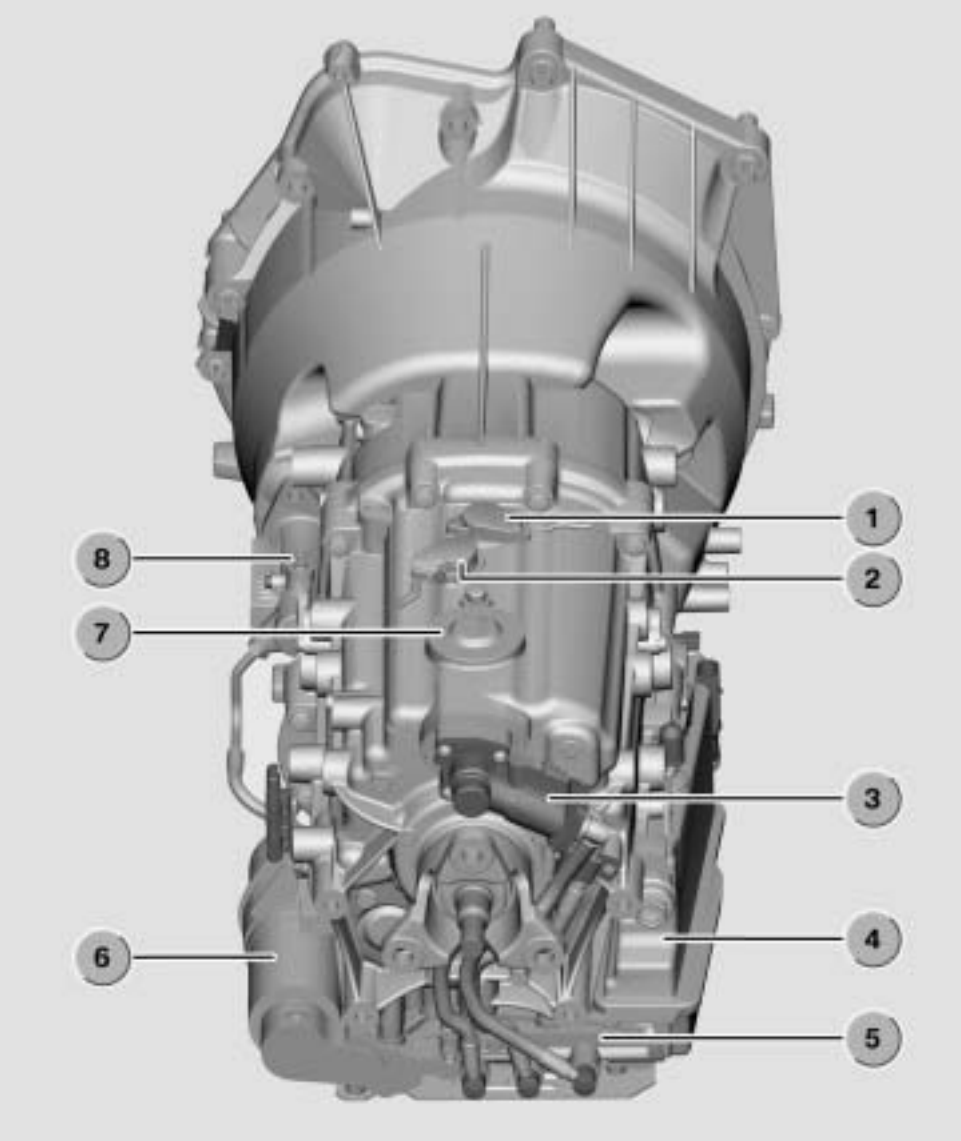
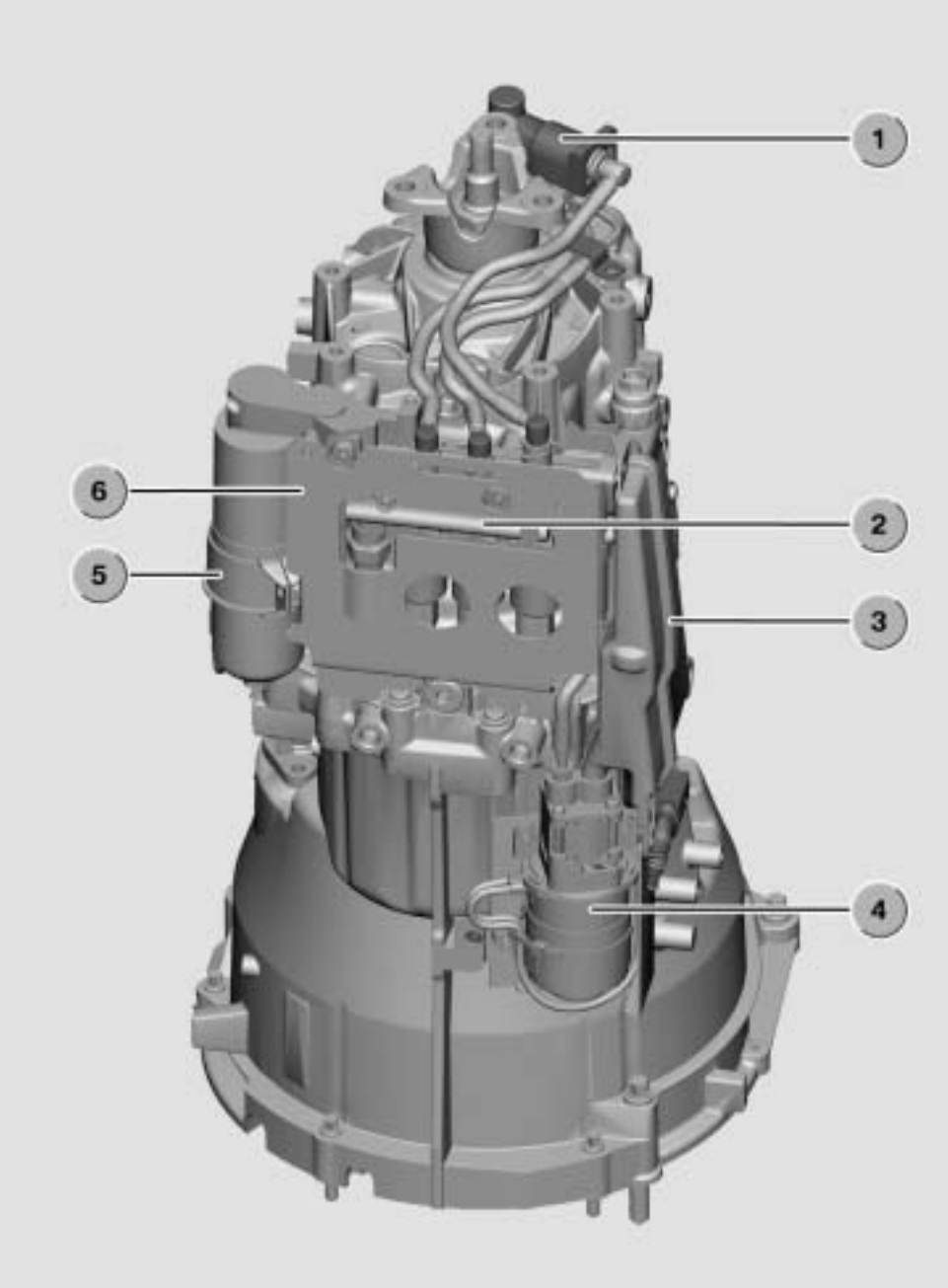


Fig. 9: SMG: view from above

Index	Explanation	Index	Explanation
1	Selection-angle sensor	5	Valve block
2	Shift-travel sensor	6	Pressure accumulator
3	Shift/selection actuator	7	Mounting hole for selector-shaft connection
4	Expansion tank	8	Clutch actuator with clutch control travel sensor



KT-10304

Fig. 10: SMG: view from below

Index	Explanation	Index	Explanation
1	Shift/selection actuator	4	Hydraulic pump
2	Valve block	5	Pressure accumulator
3	Expansion tank	6	Guard for valve block

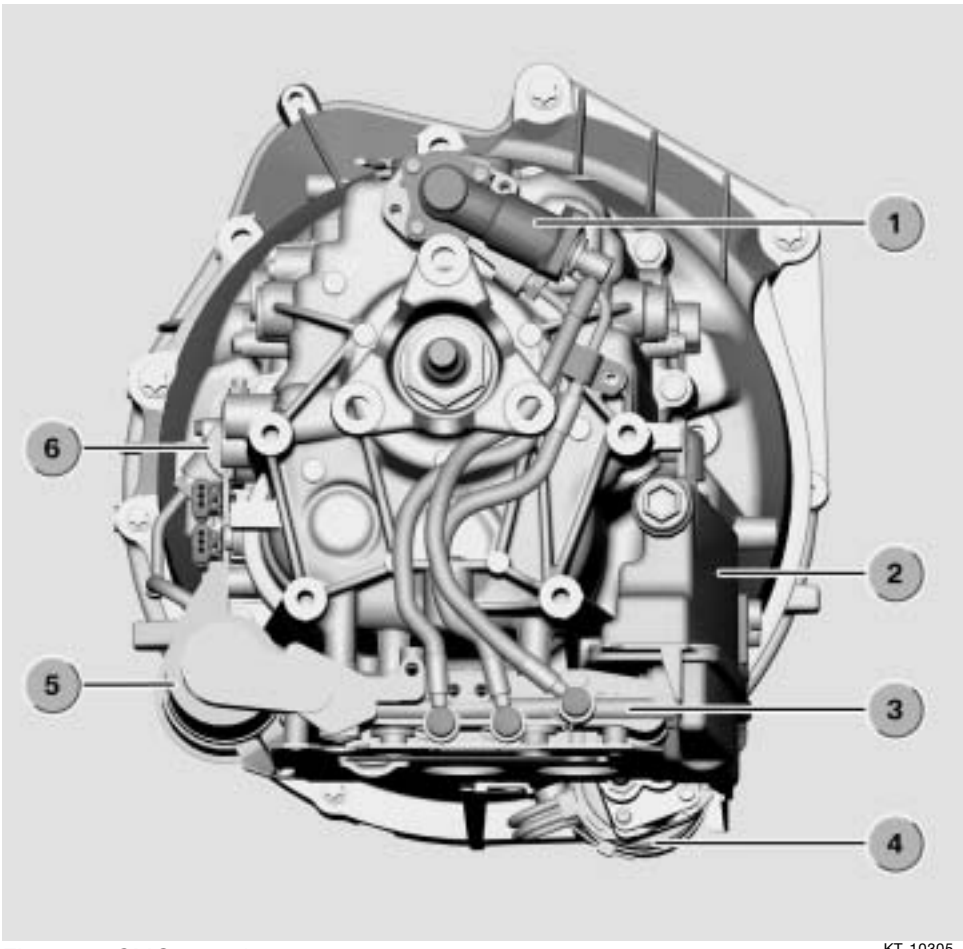


Fig. 11: SMG rear view

Index	Explanation	Index	Explanation
1	Shift/selection actuator	4	Hydraulic pump
2	Expansion tank	5	Pressure accumulator
3	Valve block	6	Clutch actuator with clutch control travel sensor

Design

Compared with the C-SMG hydraulic system, the H-SMG hydraulic system has been modified slightly in the following areas:

- The electromechanical reversing-light switch has been omitted.
- The valve block is situated underneath the gearbox.
- The expansion tank is located on the right side of the gearbox and has been assigned new maximum and minimum fill-level markings in line with the new geometry.
- The electrohydraulic pump is also located on the right side of the gearbox.
- On the left side of the gearbox, below the clutch actuator, there is a central connector for the valve block (solenoid valves EV0 to EV3, pressure sensor, voltage and ground supply to the valves).
- Flexible lines with quick-connect couplings are used for the high-pressure hydraulic lines.

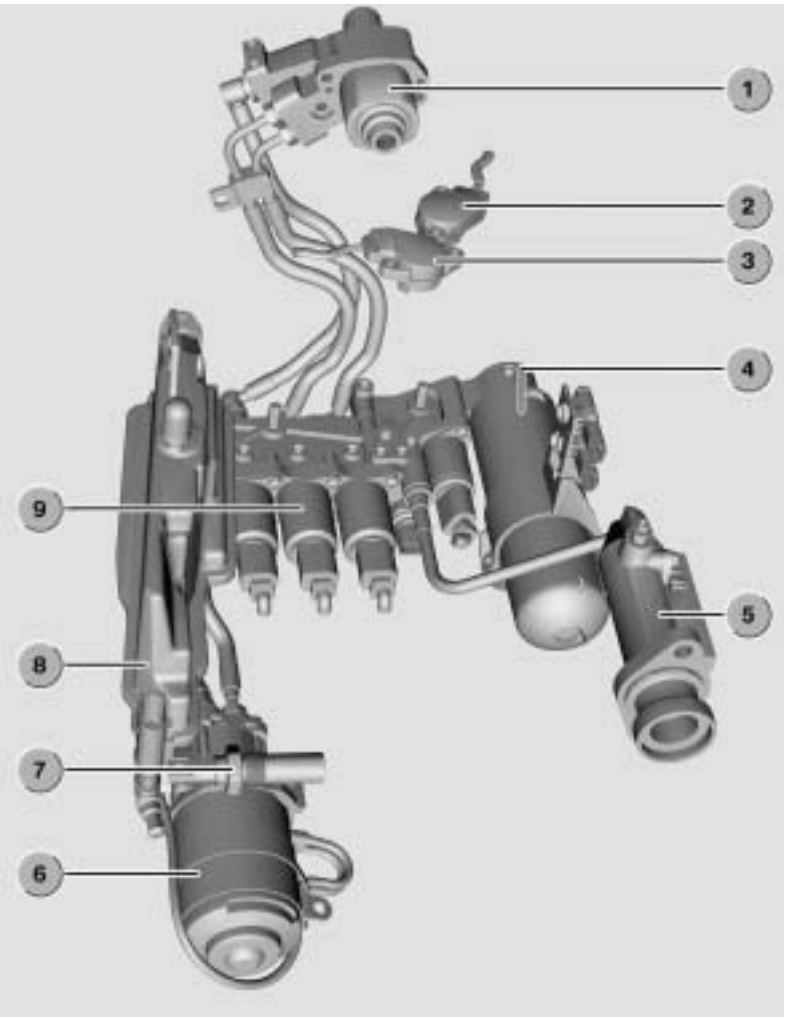


Fig. 12: SMG hydraulic system without gearbox KT-10306

Index	Explanation	Index	Explanation
1	Shift/selection actuator	6	Hydraulic pump
2	Shift-travel sensor	7	Sensor for gearbox input speed
3	Selection-angle sensor	8	Expansion tank
4	Pressure accumulator	9	Valve block
5	Clutch actuator with clutch control travel sensor		

Operation

The H-SMG hydraulic system operates in identical fashion to the C-SMG hydraulic system.

- SMG control unit

Installation location

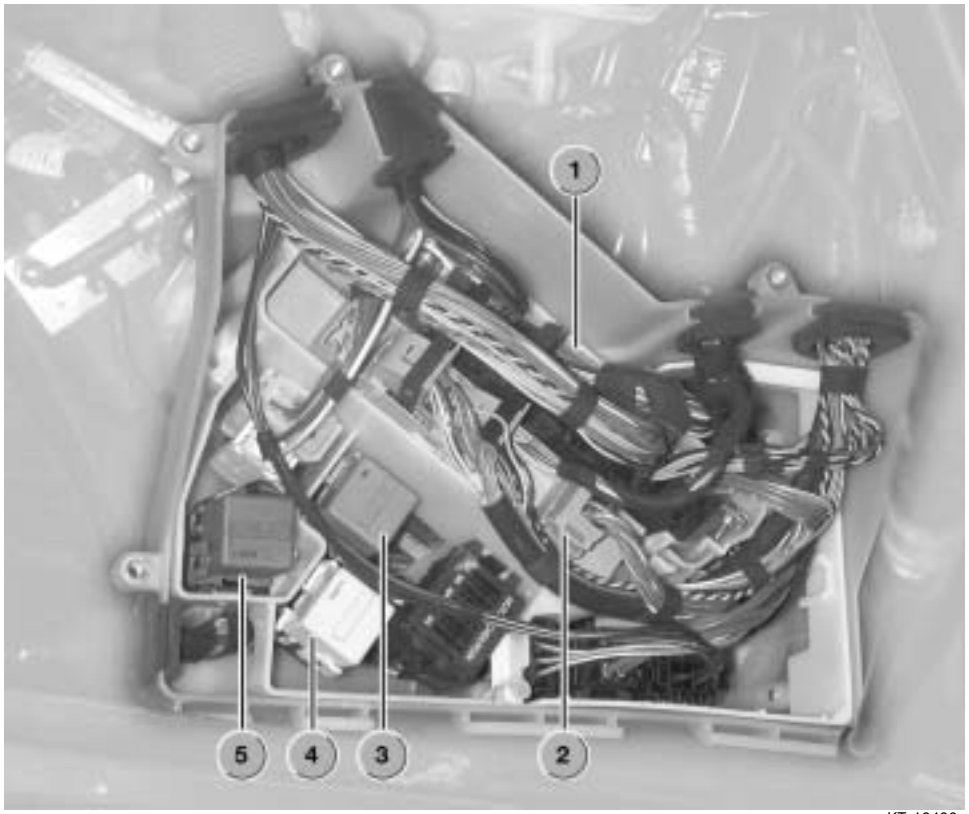


Fig. 13: Installation location of SMG control unit

Index	Explanation	Index	Explanation
1	Engine control unit	4	Fuel-injector relay
2	SMG control unit	5	Hydraulic-pump relay
3	Motor-electronics relay		

The SMG control unit is the GS30 known from the E46.
The SMG control unit is accommodated in the electronics box at front left in the engine compartment. It is positioned next to the engine control unit at the very point where the automatic-transmission control unit is located in cars with automatic transmissions.

Operation

The functions of the control unit correspond to those of the C-SMG. This is supplemented by activation of the reversing lights by way of the additional reversing-light relay.

- Reversing-light relay

Installation location

The reversing-light relay is located in the cover of the electronics box.

Operation

The signal of the gearbox position of the reverse gear is directed from the shift-travel sensor and selection-angle sensor to the SMG control unit.
The SMG control unit generates the signal for the reversing-light relay and directs it to the reversing-light relay.

- Gearbox

Design

The SMG gearbox has undergone slight modifications from the GS6-37BZ H-gearbox:
The sensors for shift travel and selection angle are located on the gearbox casing. They record the current position at the selector shaft.
The shift actuator is located at the rear of the casing at the top.
Shift and selection locking on the selector shaft has been modified.

- Displays/indications in instrument cluster

The selected drive positions are displayed in 2 segments in the instrument cluster.
The selected gearbox position (1-6) is displayed in the right segment.
The drive mode is displayed in the left segment ("D" for automatic mode). A fault can also be displayed in the left segment with "F."
A serious gearbox fault is indicated by an indicator lamp in the instrument cluster.

No symbol appears in the left segment when the manual drive program is selected. Only the selected gears are displayed in the right segment.

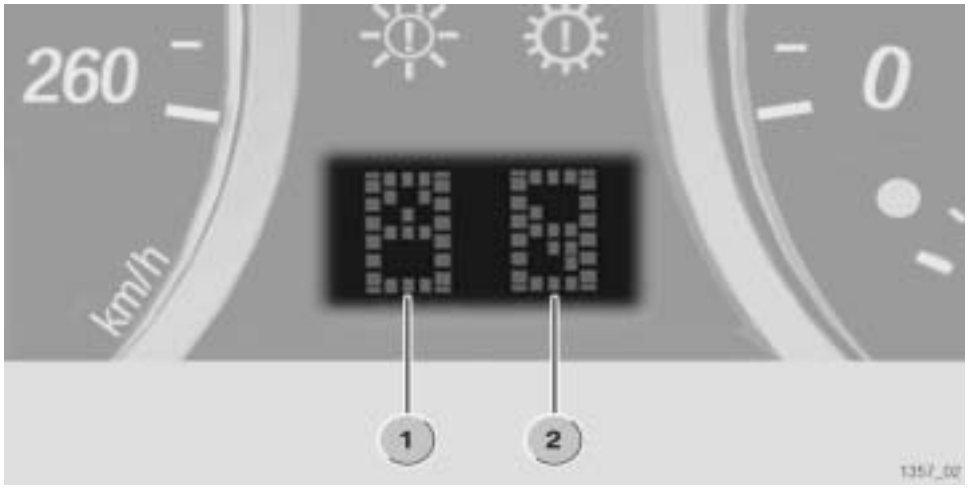


Fig. 14: Gear-display segments, instrument cluster KT-9964

Index	Explanation	Index	Explanation
1	Program display	2	Gearbox position

The indicator lamp is located above the 2 segments for displaying the drive position.

KT-9986

Fig. 15: Indicator lamp for a serious gearbox fault

System functions

- FDC

Pressing the FDC button activates the FDC function (sport mode) and selects a sportier style of driving.

The signals of the FDC button are read in by the MS45.0 control unit.

The MS45.0 control unit transmits the signals to the EGS/SMG control unit and to the EPS control unit.

If no fault message is transmitted by the control units, the EPS control unit connects to ground and the function lighting of the FDC button comes on. When illuminated, the FDC button indicates that the sport mode is activated.

The MS45.0 control unit alters the engine progression through a more sensitive response by the throttle.

The gearbox control unit (EGS) reduces the gearshift and clutching times.

The EPS control unit switches to a sportier characteristic curve. Greater holder and steering effort is now required from the driver.

With the SMG, the sport mode can also be selected in cruise mode.

The shifting characteristics are adapted to sports requirements when the FDC function is activated.

With the C-SMG, it was not possible to select the sport mode in cruise mode.

Country-specific version

- US version

For the US, Canadian and Australian markets, the gearshift-lever position display is integrated in the gearshift-lever trim in the centre console behind the gearshift lever.
The gearshift-lever position is indicated with LEDs.

The FCD button (option 224) is only available in the US versions with the options M sports suspension (option 704) and SMG (option 206).

Notes for Service

- Working on hydraulic system

Prior to all work on the hydraulic system, the system pressure must be reduced with the service function "Before working on hydraulic system" in the diagnostic tester.
The hydraulic-pump relay must be removed to prevent the hydraulic pump from starting.
The service function "After working on hydraulic system" must be implemented with the diagnostic tester.
The hydraulic system is vented.
The service function "Teach gearbox" must be implemented with the diagnostic tester.

The hydraulic pump must not run when dry! The relay must not be reconnected for the entire duration of the repair work.

Because the reversing-light relay is located in the cover of the electronics box, it must be released from the fixture in the cover.

After work is completed on the hydraulic system, the hydraulic-fluid level must be checked and topped up if necessary.

The hydraulic-pump relay can be reconnected.

The hydraulic-fluid level must be checked again.

- Teaching gearbox

The service function "Teaching gearbox" must be implemented with the diagnostic tester when the following components are replaced:

- SMG control unit
- Gearbox
- Clutch
- Clutch sensor

The gearbox control system learns the clutching characteristic during the drive-off operations. There may therefore be impaired comfort during the initial gearshift operations.

- Diagnosis

Diagnosis corresponds to diagnosis in the E46.
Diagnosis comprises the following:

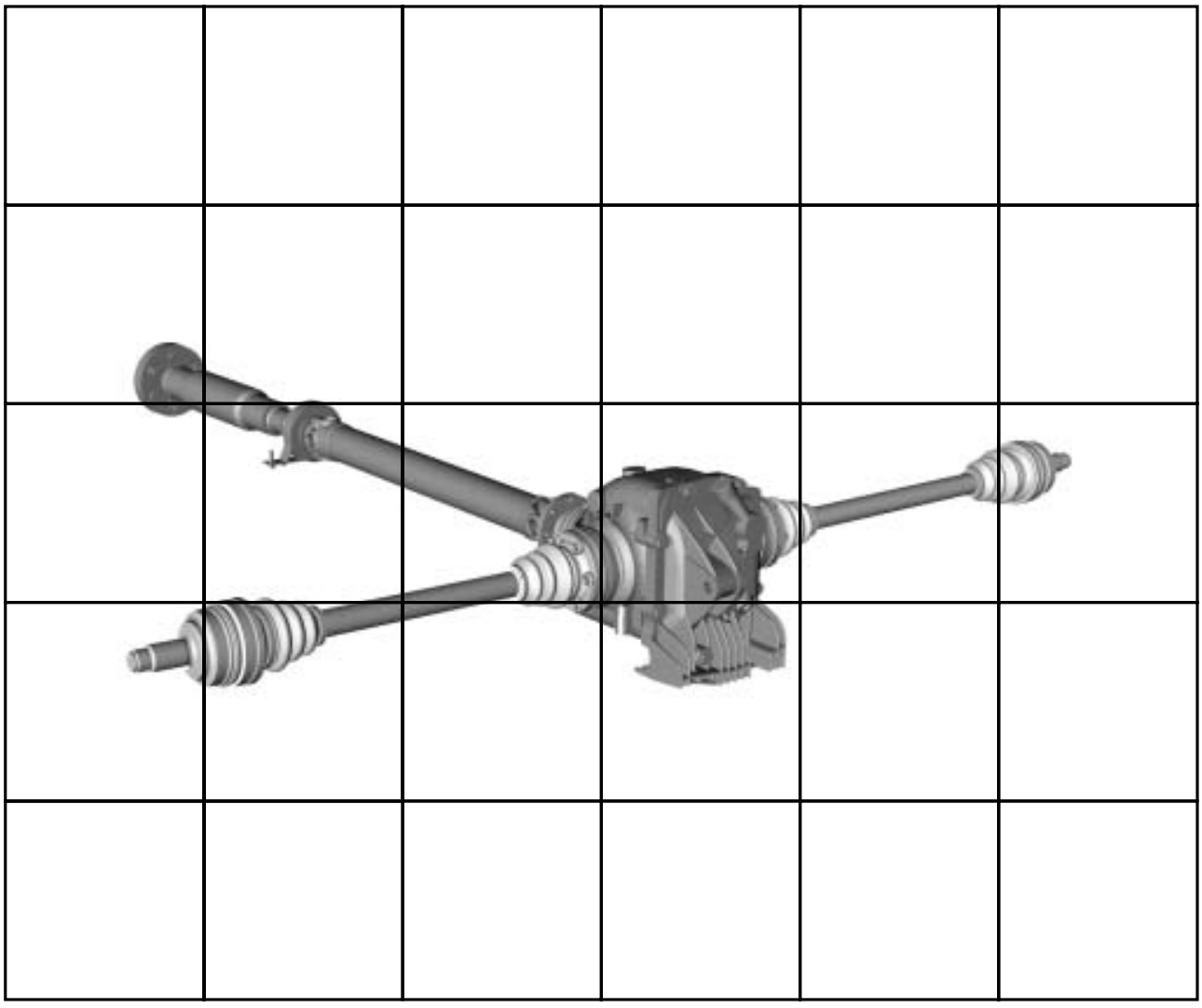
- Read identification
- Read fault memory
- Delete fault memory
- Diagnosis request

- Programming

The SMG control unit is programmable.

BMW
Service Training

E85 Drivetrain
Seminar Working Material



NOTE
The information contained in this training course manual is intended solely for participants of the BMW Service Training course.
Refer to the relevant "Technical Service" information for any changes/supplements to the Technical Data.

VS-42 MFP-HGK-BRK_0380

Contents

E85 Drivetrain

Introduction

3 different drivetrains are used in the E85.

3 different propeller shafts are used depending on the gearboxes. The propeller shafts are universal-joint shafts.

The 2 different output-shaft sets with constant-velocity joints for cars with M54B25 engines (manual and automatic gearboxes) and M54B30 engines (automatic gearbox) have been taken over from the E46. The output-shaft sets of standard rigidity have a diameter of 31.5 mm.

In cars with M54B30 engines with GS6-37BZ manual gearboxes, torsion-resistant output shafts with a diameter of 38 mm are used.

The gear ratio of the rear-axle differential has been adapted to the roadster.

The rear-axle drive of the E85 is essentially the same as that of the E46.

The changes with respect to the E46 rear-axle drive are:

On account of the modified aerodynamics for improving the drag coefficient, the lower aluminium cover has been designed with cooling fins to ensure sufficient cooling of the rear-axle drive.

- Cooling fins on the lower aluminium cover of the rear-axle drive
- The gear ratio adapted to the roadster

The propeller shaft is shorter than the propeller shaft in the E46.

The drive shafts have been taken over from the E46. For cars with M54B30 engines and manual gearboxes, the longitudinal toothing of the drive pins is hardened lower.

System overview

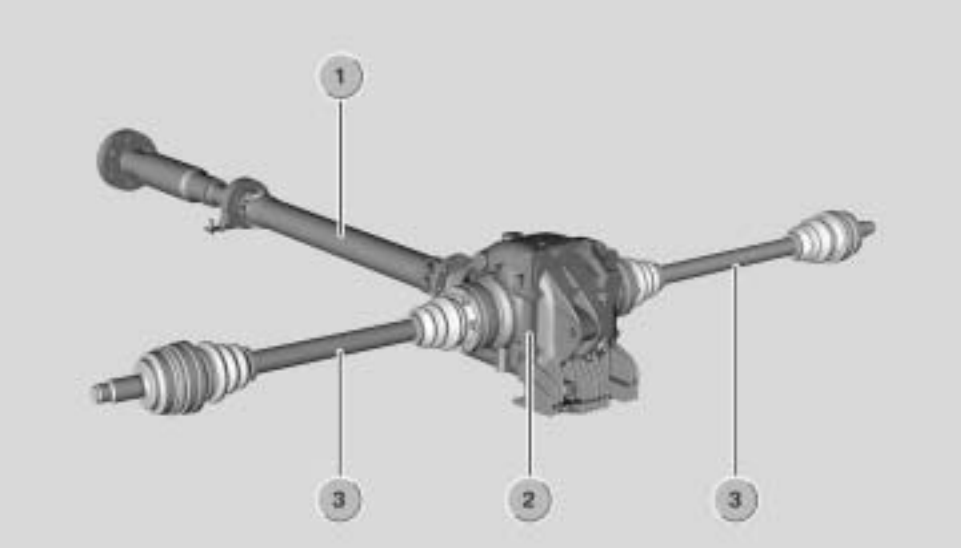


Fig. 1: Drivetrain KT-10061

Index	Explanation	Index	Explanation
1	Propeller shaft	3	Output shafts
2	Rear-axle drive		

Components

The system consists of the following components:

- Propeller shaft
- Rear-axle drive
- Output shafts

- Propeller shaft

Depending on the gearbox type, 3 types of propeller shaft are used which differ in length and weight.

Engine	Gearbox type	Length (mm)	Weight (kg)
M54	5HP-19	1188.7	7.59
M54B30, M54B25 with SMG	Type "H"	1229.9	7.72
M54B25	Type "B"	1355.3	7.76

Design

The propeller shafts are mounted to the gearbox with a flexible disc. Universal joints are located on the centre bearing and the rear-axle drive.

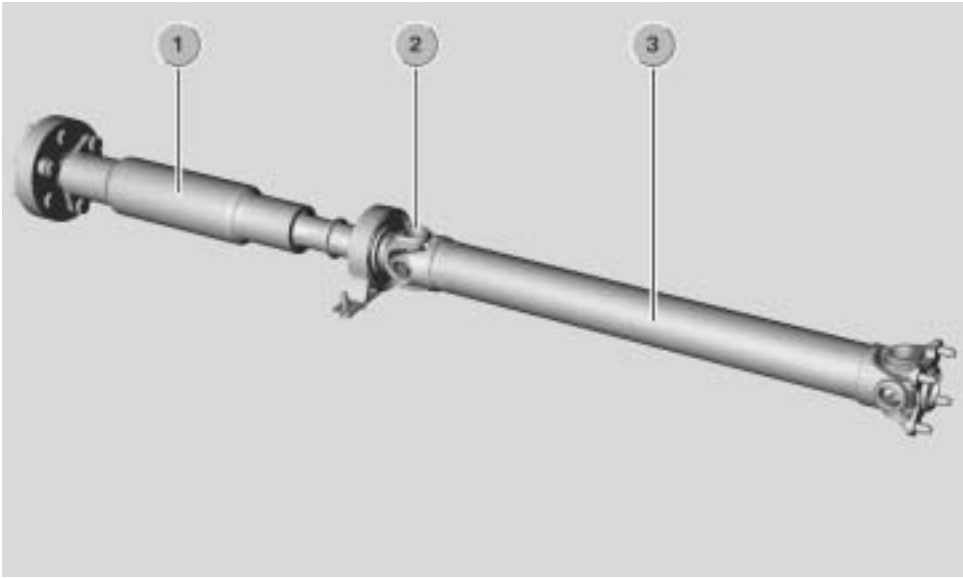


Fig. 2: Propeller shaft KT-10060

Index	Explanation	Index	Explanation
1	Front propeller-shaft section	3	Rear propeller-shaft section
2	Centre bearing and universal joint		

- Rear-axle drive

The rear-axle drive is the same as that of the E46. A 188K rear-axle drive is used in cars with M54B25 and M54B30 engines.

Design

The lower aluminium cover of the rear-axle drive has been fitted with cooling fins.
The rear-axle drive is filled with Lifetime fluid.

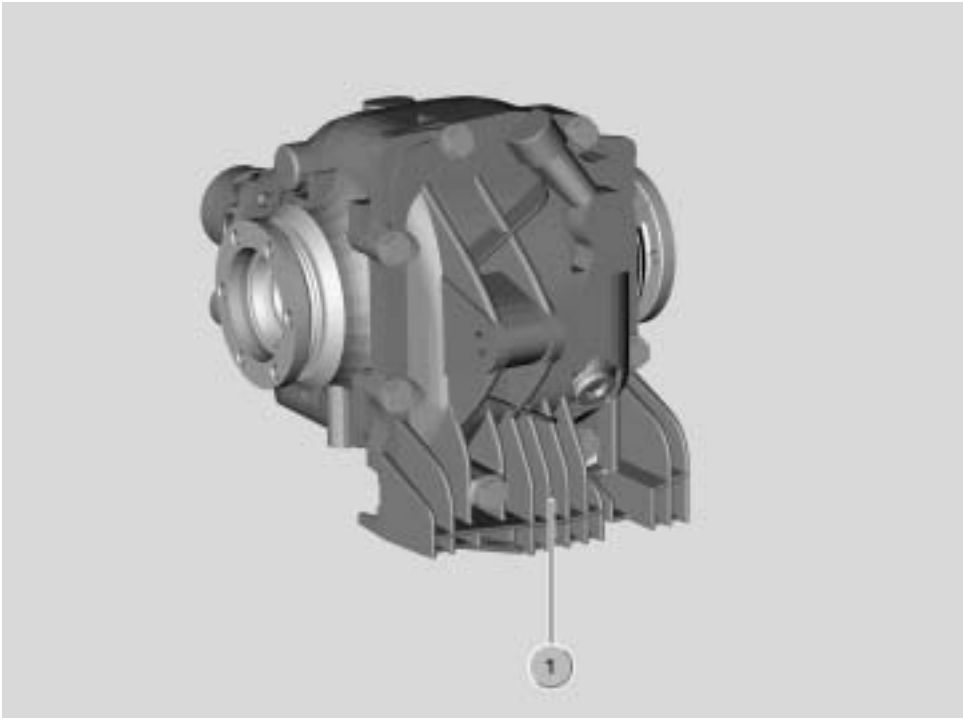


Fig. 3: Rear-axle drive KT-10059

Index	Explanation
1	Cooling fins

The aerodynamics of the car has been modified to improve the drag coefficient. It has therefore been necessary to implement measures for improved cooling of the rear-axle drive. The cooling fins on the rear-axle drive increase the surface area of the drive and therefore increase heat radiation. In addition, an aluminum plate on the rear reinforcement plate routes the driving air to the rear-axle drive.

- Output shafts

The different output shafts for M54B25 engines (manual and automatic gearboxes) and M54B30 engines (automatic gearbox) have been taken over from the E46 (similarly to the previous M52B28 engine).
In cars with M54B30 engines with GS6-37BZ manual gearboxes, torsion-resistant output shafts with lower-hardened longitudinal toothing of the drive pins are used.

The changeover has already been implemented in the E46.

For cars with M54B25 engines with manual gearboxes, the use of torsion-resistant output shafts is likewise under discussion.

Design

The output shafts are flanged to the rear-axle drive with dacromet-coated screwed components.

Dacromet is an aqueous dispersion containing metal oxides and metallic zinc and aluminium elements.

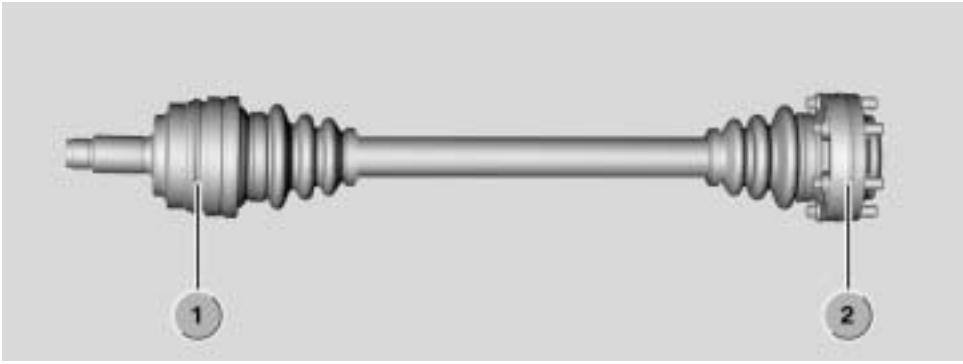


Fig. 4: Output shaft KT-10063

Index	Explanation
1	Wheel-side joint with rear-axle shaft
2	Screwed joint on rear-axle drive side with dacromet-coated screwed components

Notes for Service

- Securing propeller shaft

The threaded bush for connecting the rear and front propeller-shaft sections is tightened to a torque of only 6 Nm.
If the threaded bush is secured too tightly, this may result in drivetrain distortions and thus cause noises.

- Rear-axle drive

The drive flange and the shaft seal on the rear-axle drive have been approved as spare parts.