Technical training.
Product information.

F11 Drive.

BMW Service

General notes

Symbols used

The following symbol/pictograph is used in this document for better understanding or to emphasize particularly important information:

Contains important safety tips and information required for proper system function, which must be observed under all circumstances.

Topicality and national versions

BMW Group vehicles are designed to meet the highest safety and quality requirements. Changing requirements in areas such as environmental protection, customer benefit, design and construction lead to continuous advancement of systems and components. This can result in deviations between the information contained in this document and the vehicles available for training.

This document describes European version vehicles with left-hand drive as a matter of principle. In vehicles with right-hand drive some controls and components may be arranged differently than shown in the illustrations in this document. Other deviations may result from equipment versions for specific markets or countries.

Additional information sources

Further information on the individual subjects is given:

- in the operating instructions
- in the Integrated Service Technical Application:

Contact: conceptinfo@bmw.de

The information contained in this document is a part of the BMW Group Technical Training Program and is intended for trainers and participants in this program. Changes/supplements to the technical data are given in the current BMW Group information system.

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F11 Drive.

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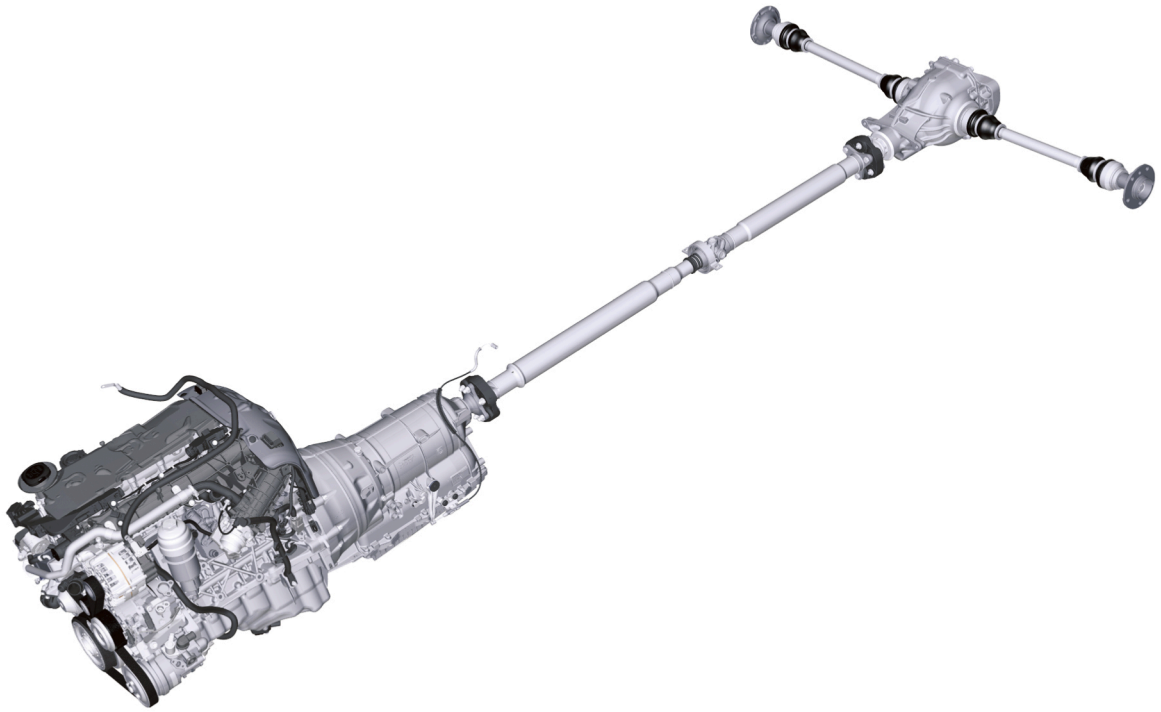
F11 Drive.

1. Drive versions.



TA09-1401

F11 Drive

1.1. Models

1.1.1. Gasoline engines

	523i	535i
Engine	N53B30U0	N55B30M0
Performance [KW]	150	225
Torque [Nm]	270	400
European emissions standard	EURO 5	EURO 5
US emissions standard	-	ULEVII
Manual transmission	GS6-17BG	GS6-45BZ
Automatic transmission	GA8HP45Z	GA8HP45Z
Differential	HAG 205AL	HAG 205AL

F11 Drive.

1. Drive versions.

1.1.2. Diesel engines

	520d	530d
Engine	N47D20O1	N57D30O0
Performance [KW]	135	180
Torque [Nm]	380	540
Emissions standard	EURO 5 (EURO 3 for SA 169)	EURO 5 (EURO 3 for SA 169) (EURO 6 for SA 163)
Manual transmission	GS6-45DZ	GS6-53DZ
Automatic transmission	GA8HP45Z	GA8HP70Z
Differential (with manual transmission)	HAG 205AL	HAG 225AL
Differential (with automatic transmission)	HAG 205AL	HAG 225AL

1.2. Further Information

The engines as well as the eight speed automatic transmission are described in the following information bulletins

- Information bulletin N53 Engine
- Information bulletin N55 Engine
- Information bulletin N47 Engine
- Information bulletin N57 Engine
- Information bulletin Automatic transmission GA8HP.

F11 Drive.
2. Engines.

2.1. N53 Engine

TA09-2174

N53 Engine

2.1.1. Technical Data

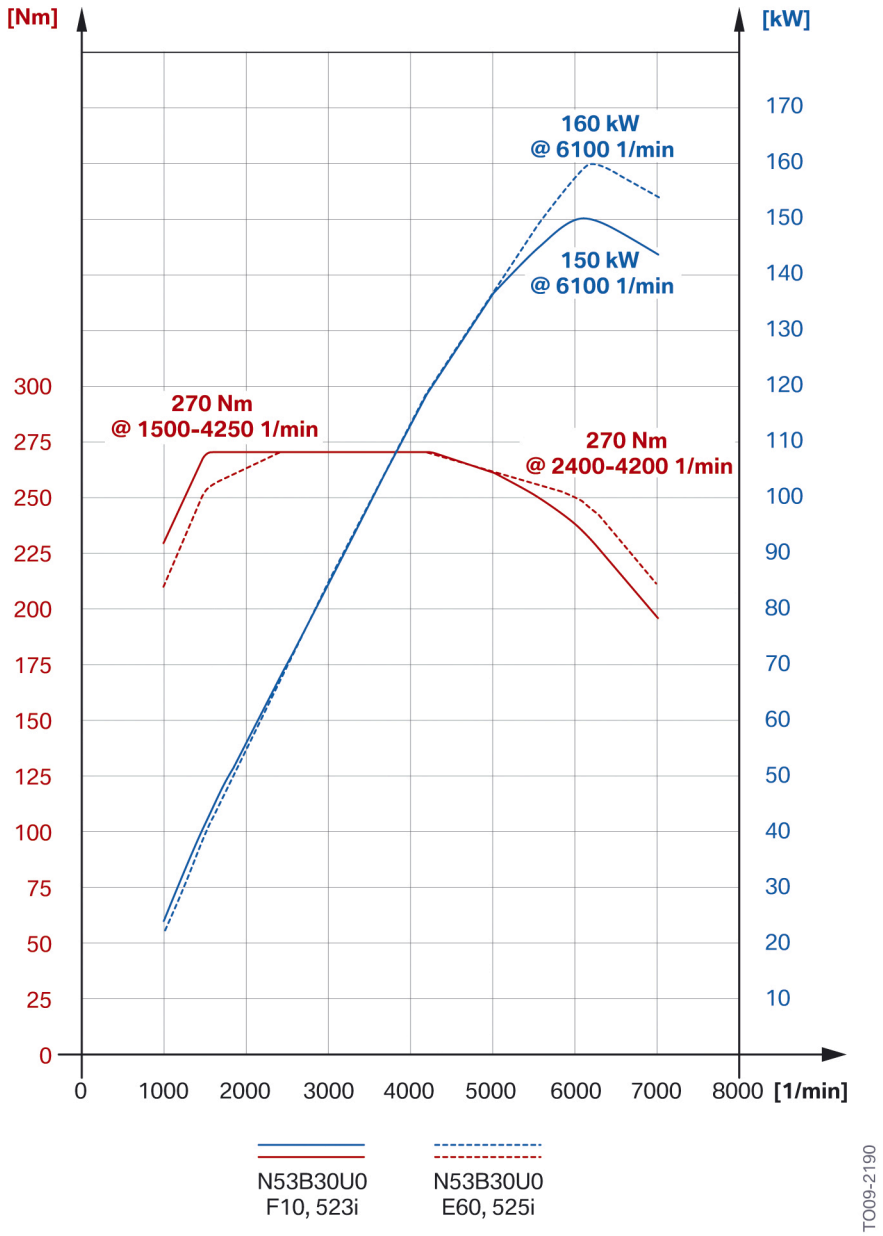
		N53B30U0 E61, 525i	N53B30U0 F11, 523i
Version		R6	R6
Valves per cylinder		4	4
Engine control		MSD81	MSD87
Displacement	[cm^3]	2996	2996
Stroke/bore	[mm]	88.0/85,0	88.0/85,0
Output at rpm	[kW] [rpm]	160 6100	150 6100
Torque at rpm	[Nm] [rpm]	270 2400 – 4200	270 1500 – 4250
Compression ratio	[ε]	12.0 : 1	12.0 : 1
Fuel grade		ROZ 91 – 98	ROZ 91 – 98

F11 Drive.
2. Engines.

		N53B30U0 E61, 525i	N53B30U0 F11, 523i
Emissions standard		EURO 4	EURO 5
Fuel consumption in compliance with EU combined (manual/automatic transmission)	[l/100 km]	7.4/7,9	7.9/7,8
Acceleration 0 – 100 km/h (manual/automatic transmission)	[s]	7.7/7,7	8.2/8,4

F11 Drive.
2. Engines.

2.1.2. Full load diagram



Full load diagram E61 525i with N53B30U0 engine in comparison to F11 523i with N53B30U0 engine.

F11 Drive.
2. Engines.

2.2. N55 Engine

N55 Engine

The N55 engine is the successor to the N54 engine. Technical revisions and modifications have made it possible to use only one exhaust turbocharger. The technical data has remained virtually unchanged in spite of reduced costs and improved quality.

Highlights

- Mono exhaust turbocharger (TwinScroll)
- Six-in-two, air-gap insulated exhaust manifold; catalytic converter near engine
- Direct fuel injection with central injection system, solenoid injectors
- 3rd generation Valvetronic system generation
- DME control unit (MEVD17.2 Bosch) close to engine, integrated into intake system, FlexRay compatible
- Light weight crankshaft
- Map-controlled electric oil pump
- Uniform single-belt drive for all models
- First introduced in F07, then extended to all models.

F11 Drive.
2. Engines.

2.2.1. Technical Data

		N53B30O0 E61, 530i	N55B30M0 F11, 535i
Version		R6	R6
Valves per cylinder		4	4
Engine control		MSD81	MEVD17.2
Displacement	[cm^3]	2996	2979
Stroke/bore	[mm]	88.0/85,0	89.6/84,0
Output at rpm	[kW] [rpm]	200 6700	225 5800
Torque at rpm	[Nm] [rpm]	320 2750 – 3000	400 1200 – 5000
Compression ratio	[ε]	12.0 : 1	10.2 : 1
Fuel grade		ROZ 95 – 98	ROZ 91 – 98
Emissions standard		EURO 4	EURO 5
Fuel consumption in compliance with EU combined (manual/automatic transmission)	[l/100 km]	7.9/7,7	8.6/8,5
Acceleration 0 – 100 km/h (manual/automatic transmission)	[s]	6.5/6,8	6.0/6,1

F11 Drive.
2. Engines.

2.3. N47 Engine

N47 Engine

Highlights

- Available in all models (E90/E91/E92/E93/F10)
- Secure and extend BMW top position in terms of fuel consumption (CO_2) and dynamics
- More torque, more power and wider rpm range for better dynamics
- Optimized combustion chamber
- Supercharging technology and gas exchange optimized
- Reduced friction (focal points: belt drive, valve gear, drive train, oil circuit and low viscosity oil)
- Automatic Start/Stop function on vehicles with manual transmission
- New assembly arrangement and air routing system

2.3.1. Technical Data

		N47D20O0 E61, 520d	N47D20O1 F11, 520d
Version		R4	R4
Valves per cylinder		4	4
Engine control		DDE7.1	DDE7.2.1
Displacement	[cm^3]	1995	1995

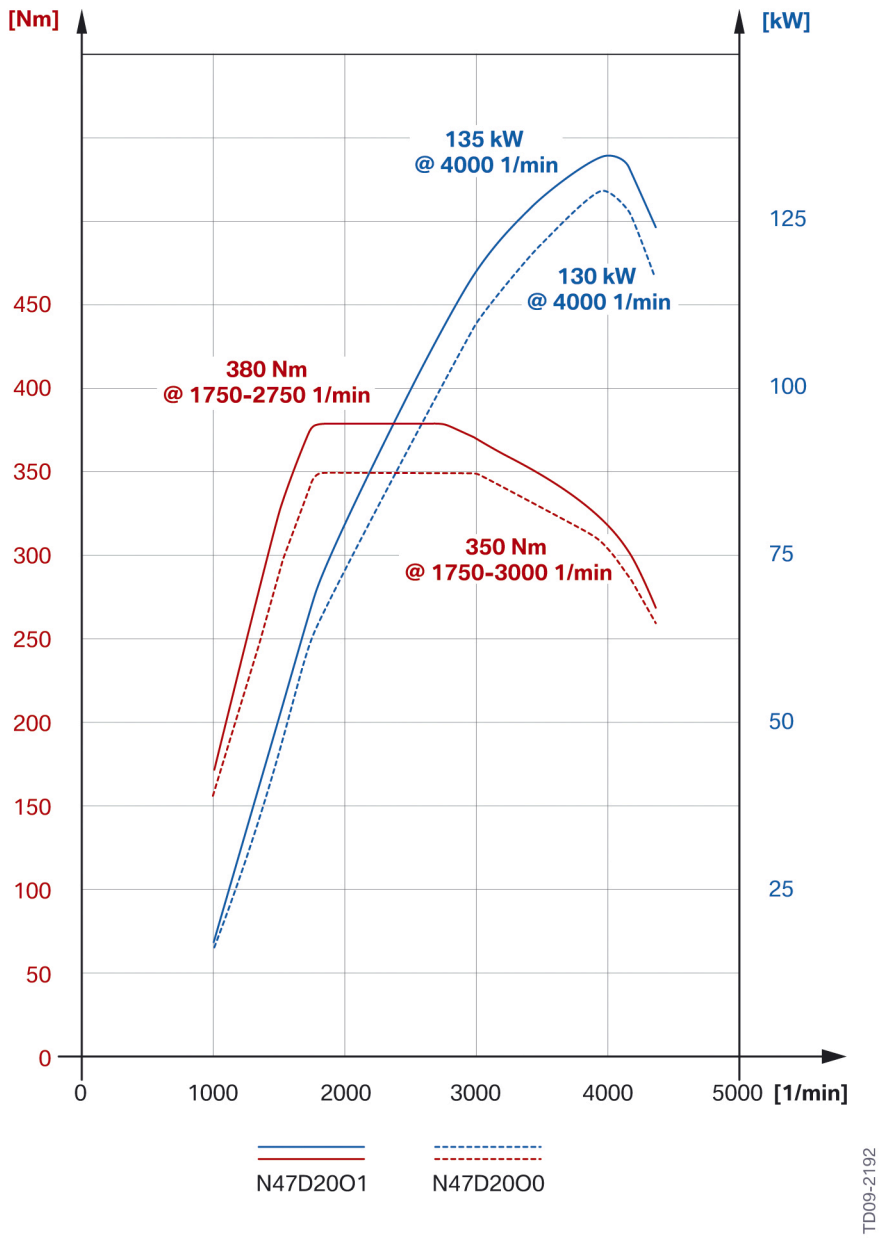
F11 Drive.
2. Engines.

		N47D20O0 E61, 520d	N47D20O1 F11, 520d
Stroke/bore	[mm]	90.0/84,0	90.0/84,0
Output at rpm	[kW] [rpm]	130 4000	135 4000
Torque at rpm	[Nm] [rpm]	350 1750 – 3000	380 1750 – 2750
Compression ratio	[ε]	16.0 : 1	16.5 : 1
Fuel grade		Diesel	Diesel
Emissions standard		EURO 4 (NX32*) EURO 5 (NX31*)	EURO 5 (EURO 3 for SA 169)
Fuel consumption in compliance with EU combined (manual/automatic transmission)	[l/100 km]	5.3/5,8	5.1/5,3
Acceleration 0 – 100 km/h (manual/automatic transmission)	[s]	8.5/8,6	8.3/8,3

* Code number

F11 Drive.
2. Engines.

2.3.2. Full load diagram



Full load diagram E61 520d with N47D20O0 engine in comparison to F11 520d with N47D20O1 engine.

F11 Drive.
2. Engines.

2.4. N57 Engine

TA09-2178

N57 Engine

Highlights

- Available in all models (E90/E91/E92/E93/F01/F02/F07/F10)
- Chain drive on power output side
- Oil and vacuum pump in oil sump
- All assemblies on intake side
- Engine mounted, deformable intake silencer
- Compact air intake manifold with electrical swirl-flap actuator
- 1800 bar Common rail injection system
- DDE7.3 Engine control with FlexRay link
- Uniform size diesel particle filter for all models

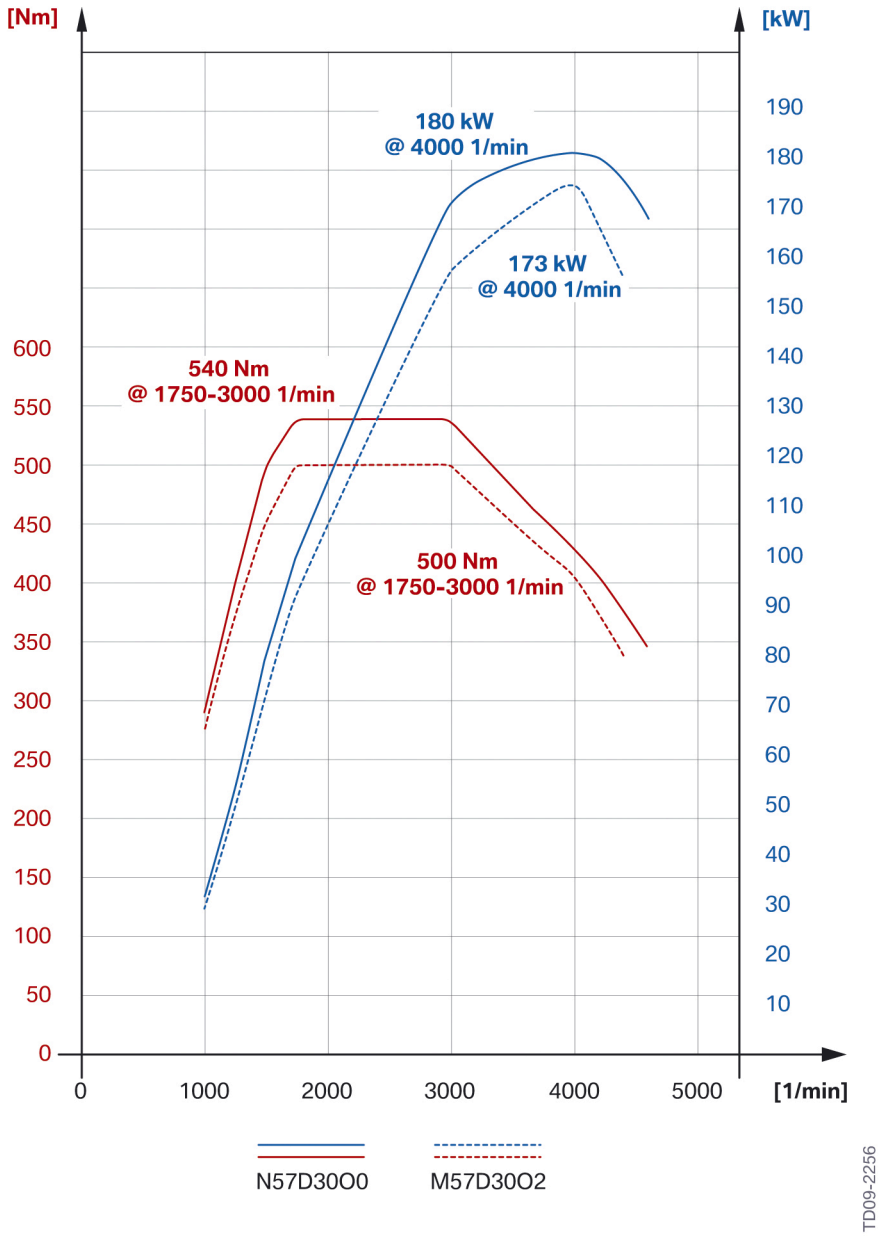
2.4.1. Technical Data

	M57D30O2 E61, 530d	N57D30O0 F11, 530d
Version	R6	R6
Valves per cylinder	4	4
Engine control	DDE6.2.6	DDE7.3.1

		M57D30O2 E61, 530d	N57D30O0 F11, 530d
Displacement	[cm^3]	2993	2993
Stroke/bore	[mm]	90.0/84,0	90.0/84,0
Output at rpm	[kW] [rpm]	173 4000	180 4000
Torque at rpm	[Nm] [rpm]	500 1750 – 3000	540 1750 – 3000
Compression ratio	[ε]	17.0 : 1	16.5 : 1
Fuel grade		Diesel	Diesel
Emissions standard		EURO 4	EURO 5 (EURO 3 for SA 169) (EURO 6 for SA 163)
Fuel consumption in compliance with EU combined (manual/automatic transmission)	[l/100 km]	6.6/6,8	6.4/6,3
Acceleration 0 – 100 km/h (manual/automatic transmission)	[s]	6.9/7,0	6.4/6,4

2.4.2. Full load diagram

In comparison to its predecessor the N57 engine is distinguished by higher overall power and broader torque curve.



Full load diagram E61 530d with M57D30O2 engine in comparison to F11 530d with N57D30O0 engine.

2.5. Engine designation and engine identification

2.5.1. Engine designation

The engine designation is used in the technical documentation for clear identification of the engine. However an abbreviated designation is frequently used as well. This abbreviated form is used to associate an engine with an engine family. For example, we frequently speak of the N53 engine family, consisting of a number of engines such as the N53B25U0, N53B30U0 and N53B30O0

Position	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW Motorsport BMW M GmbH Engines from other manufacturers
2	Type of engine	1 4 5 6 7 8	4-cylinder in-line engine (e.g. N12) 4-cylinder in-line engine (e.g. N43) 6-cylinder in-line engine (e.g. N55) V8 engine (e.lg. N63) V12 engine (e.g. N74) V10 engine (e.g. S85)
3	Change in basic engine concept	0 1 – 9	Basic engine Modifications, e.g. combustion process
4	Operating process or fuel and, where applicable, installation position	B D H	Gasoline, installed longitudinally Diesel, installed longitudinally Hydrogen
5 + 6	Displacement in 1/10th liters	30	3.0 Liters
7	Performance class	K U M O T S	Smallest Lower Medium Upper (standard) Top Super
8	Approved revision	0 1 – 9	New development Revision

2.5.2. Engine identification

The engines have a marking on the crankcase for clear identification and association

This engine identification is also required for approval by the authorities. With the N55 engine this identification was revised reducing the previous eight digits to seven. The engine number is located on the engine below the engine identification. This serial number provides for clear identification of each individual engine in combination with the engine identification.

Position	Meaning	Index	Explanation
1	Engine developer	M, N P S W	BMW Group BMW Motorsport BMW M GmbH Engines from other manufacturers
2	Type of engine	1 4 5 6 7 8	4-cylinder in-line engine (e.g. N12) 4-cylinder in-line engine (e.g. N43) 6-cylinder in-line engine (e.g. N55) V8 engine (e.lg. N63) V12 engine (e.g. N74) V10 engine (e.g. S85)
3	Change in basic engine concept	0 1 – 9	Basic engine Modifications, e.g. combustion process
4	Operating process or fuel and, where applicable, installation position	B D H	Gasoline, installed longitudinally Diesel, installed longitudinally Hydrogen
5 + 6	Displacement in 1/10th liters	30	3.0 Liters
7	Type test requirements (modifications require new type test)	A B – Z	Standard As required, e.g. ROZ87

2.6. Automatic Start/Stop Function

2.6.1. Overview

The F11 520d with manual transmission is equipped with an advanced automatic engine start-stop function (MSA).

The automatic engine start-stop function switches off the engine when the vehicle is standing still, the transmission is in neutral and the driver releases the clutch. The engine starts automatically as soon as the driver depresses the clutch.

Highlights

- Air conditioning function and availability with chill reservoir type evaporator
- Driver presence recognition with driver's seat belt and additional with driver's door.

Under certain circumstances it is necessary to suppress the automatic engine start/stop function (switch-off inhibitor and switch-on request).

- Vehicle rolls
- Steering wheel moved (switch-off inhibitor only)
- Insufficient power-assisted steering (switch-off inhibitor only)

- Brake pressure too low
- Vehicle not driven at speed > 5 km/h following last engine shutdown (switch-off inhibitor only).
- Vehicle not driven at speed > 5 km/h following last time ignition was switched off and back on (switch-off inhibitor only).
- Engine not running at idle speed (switch-off inhibitor only).
- Engine coolant temperature too low
- Activated charcoal canister being purged (switch-off inhibitor only)
- Battery charge state too low
- Electrical system power requirement too high
- Interior temperature too high (when air conditioning switched on)
- Automatic heating/air conditioning fogging sensor recognizes fog on windshield
- Air conditioning and defrost function switched on
- Automatic air conditioning (IHKA) switched to maximum cooling.
- Evaporator temperature too low to ensure sufficient cooling (switch-on request only).

Automatic engine start-up prevention when working in engine compartment

When the engine hood is open, the automatic engine start-stop function is deactivated. This prevents the engine from starting up automatically when working in the engine compartment

The engine can be started again with the START/STOP button.

The engine start/stop function is reactivated when:

- The engine hood is closed and the engine started
- The engine hood is closed and the vehicle is driven at a speed > 5 km/h.

Safeguard after exiting vehicle

When the driver gets out of the vehicle, the automatic engine start-stop function is deactivated to prevent the engine starting up automatically.

The driver presence recognition with the belt buckle switch and additionally with the door contact is new on the F11.

The engine start/stop function is always reactivated when:

- The driver's seatbelt is fastened and the vehicle is driven at a speed > 5 km/h.
- The driver's door is closed and the vehicle is driven at a speed > 5 km/h.

Various conditions lead to deactivation of the automatic engine start-stop function depending on the switching status of the driver's seatbelt switch and the driver's door contact.

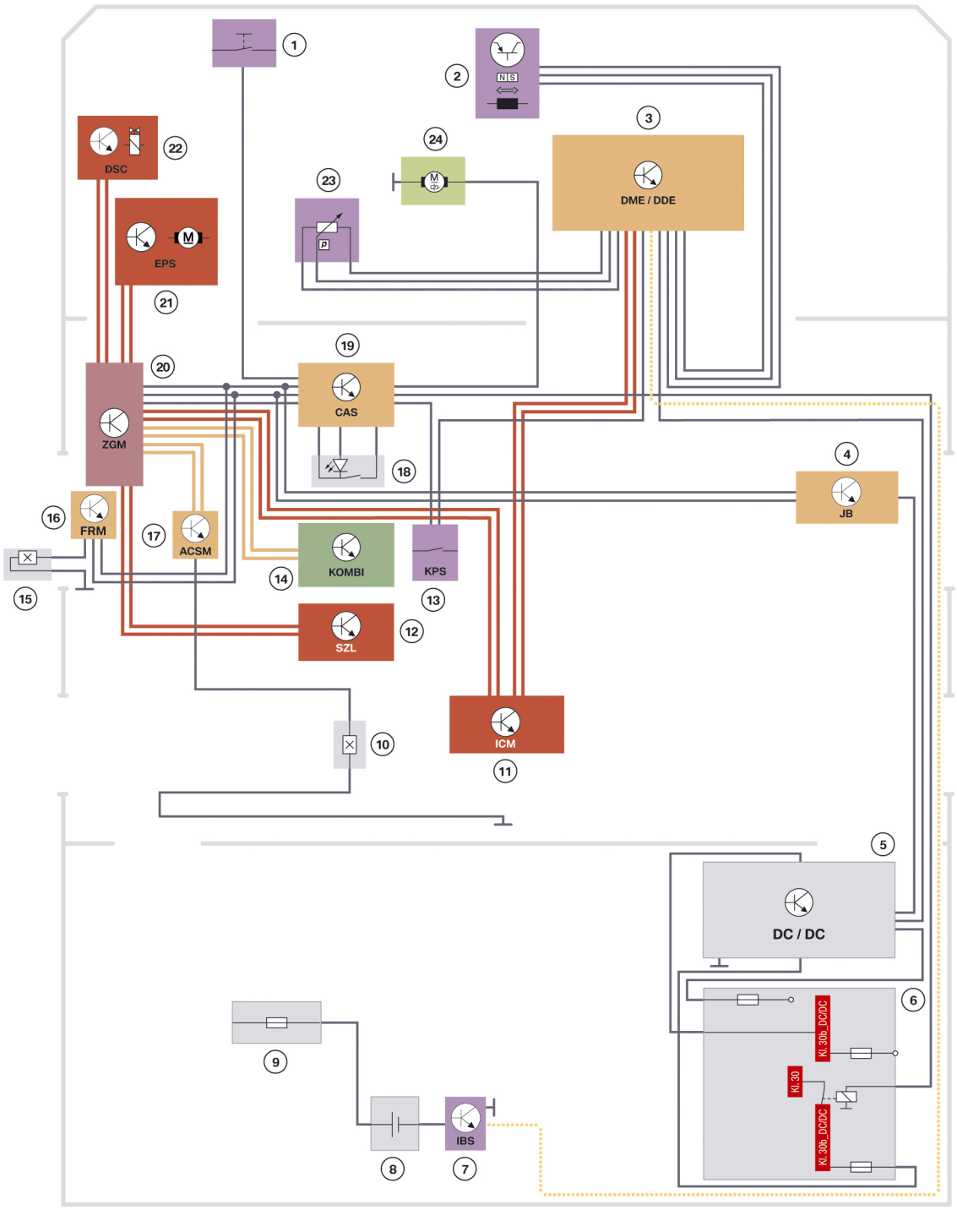
Automatic Start/Stop activation status.	Prerequisites for deactivation of automatic engine start-stop function.
• Driver's seatbelt fastened • Driver's door closed	Driver's seatbelt no longer fastened and driver's door open
• Driver's seatbelt not fastened • Driver's door closed	Driver's door open
• Driver's seatbelt fastened • Driver's seatbelt not fastened	Driver's seatbelt no longer fastened

The automatic engine start/stop function is reactivated when:

- The driver's seatbelt is fastened and/or driver's door closed and the engine started
- The driver's seatbelt is fastened and/or driver's door closed and the vehicle is driven at a speed > 5 km/h.

F11 Drive.
2. Engines.

2.6.2. System Components



F11 Automatic Start/Stop II Circuit Diagram

F11 Drive.
2. Engines.

Index	Explanation
1	Engine hood contact switch
2	Neutral safety switch
3	DME electronic digital engine control or DDE electronic digital diesel control
4	Electronic junction box with front electrical distribution box
5	DC/DC converter
6	Right rear electrical distribution box
7	Intelligent battery sensor IBS
8	Battery
9	Battery distribution box
10	Driver's seatbelt contact
11	Integrated Chassis Management ICM
12	Steering column switching center SZL
13	Clutch switch
14	Instrument cluster KOMBI
15	Driver's door contact
16	Footwell module FRM
17	Crash Safety Module ACSM
18	START-STOP button
19	Car Access System CAS
20	Central Gateway Module
21	Electronic Power Steering EPS (electromechanical power steering)
22	Dynamic Stability Control DSC
23	Brake vacuum-pressure sensor
24	Starter

The car's electrical system has been supplemented with components already familiar from the information bulletin "MSA Automatic Start/Stop Function" These components have been adapted to the large series vehicle electrical system. The automatic engine start-stop button, which allows deactivation of the automatic engine start-stop function, is installed below the START-STOP button on the F11.

F11 START-STOP button

Index	Explanation
1	Button for activation/deactivation of the automatic engine start-stop function

2.6.3. Chill reservoir type evaporator

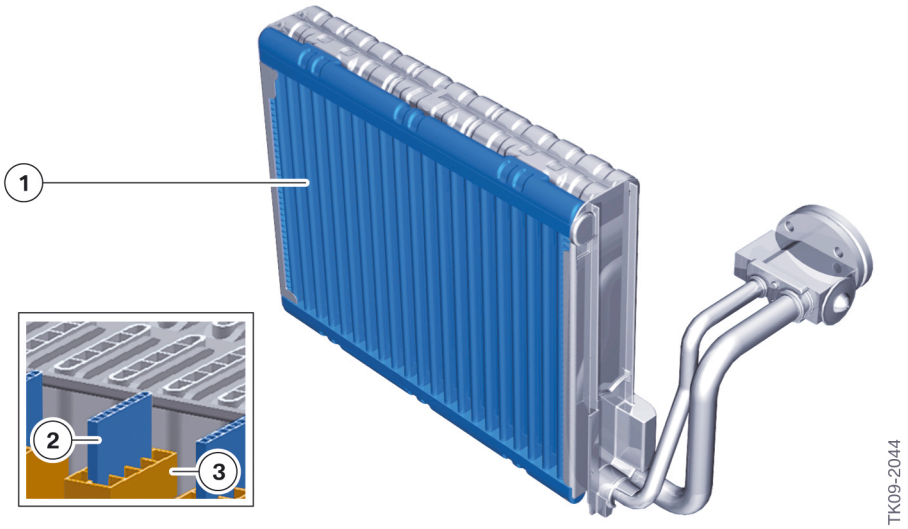
A so-called chill reservoir type evaporator is used on vehicles with automatic engine start-stop function to ensure that the vehicle passenger compartment remains air conditioned when the engine is shut off.

AC Evaporator Function

The air to be cooled flows through the AC evaporator wöhic is cooled by evaporating refrigerant. The evaporation process extracts heat from the air as it flows through, cooling it significantly.

Function of chill reservoir type evaporator

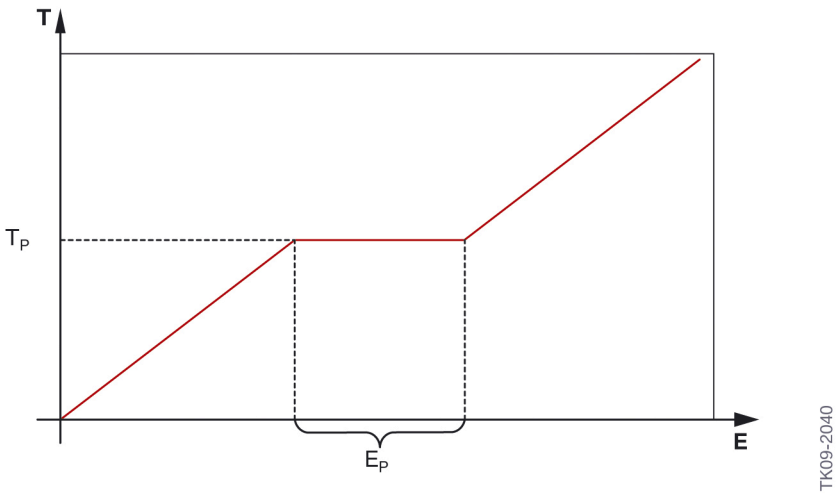
The chill reservoir type evaporator consists of a reservoir behind the AC evaporator for storing a chilled medium.



F11 Chill reservoir type evaporator

Index	Explanation
1	Chill reservoir type evaporator
2	Refrigerant line
3	Storage medium line

As in the AC evaporator, the refrigerant is evaporated in the chill reservoir type evaporator. In addition the refrigerant lines are surrounded by a storage medium. The process of evaporation also extracts heat from the storage medium, which solidifies (change of state from liquid to solid).



F11 Latent heat storage by storage medium

Index	Explanation
T	Temperature
T_P	Temperature at change of state
E	Quantity of heat energy stored
E_P	Quantity of heat resulting from change of state

When the engine stopped, e.g. at a red light, the AC compressor is also stopped. The refrigerant can no longer evaporate and the storage medium is no longer cooled. Upon reaching the temperature at which the medium changes state, the storage medium begins to melt, extracting heat from the air flowing through.

F11 Drive.
3. Manual transmission

3.1. Designation

The transmission designation is used in the technical documentation for clear identification of the transmission. However an abbreviated designation is frequently used by itself Frequently reference is made only to the I-transmission, K-transmission or G-transmission The correct designation is given in the following table.

Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	S	Manual transmission
3	Number of gears	1 – 9	Number of forward gears
4	Type of transmission	- X S W D Y	Manual transmission All-wheel-drive with manual transmission Sequential manual transmission All-wheel-drive with sequential manual transmission Twin-clutch transmission All-wheel-drive with twin-clutch transmission
5 + 6	Type of transmission	17 26 37 45 53	I-transmission D-transmission H-transmission K-transmission G-transmission
7	Gear train	B D S P	Gear ratio for gasoline engine Gear ratio for diesel engine (w)* Sport gear ratio Revised gear ratio for gasoline engine
8	Manufacturer	G J R Z H	Getrag Jatco GMPT ZF Company part

3.2. Versions

Model	Engine	Manual transmission	
523i	N53B30U0	I	GS6-17BG
535i	N55B30M0	K	GS6-45BZ
520d	N47D20O1	Kw	GS6-45DZ
530d	N57D30O0	Gw	GS6-53DZ

3.3. I Manual transmission

Highlights

F11 Drive.
3. Manual transmission

- Optimized gear train concept
- Weight reduction (-8 kg in comparison to H manual transmission)
- Improvement in fuel economy in comparison to H manual transmission.
- New transmission housing ribbing concept reduces noise and improves cooling-
- Improved shifting convenience resulting from
  - synchronization with carbon friction linings
  - Shifting force optimization for internal shifting
- Life-time oil filling.

Use of carbon friction linings improves shifting convenience and quality of synchronization. These are already in use on the lw transmission.

To further improve the shifting and provide a harmonious shifting force curve, 3rd gear is also designed with double taper synchomesh.

The shifting precision has been further optimized by revising the selector rod, also improving the friction characteristics by use of ball sleeves and sliding bushings.

An optimized tooth geometry reduces noise and increases the load capacity of the gear teeth. As a final step the gear teeth are machined in the hardened state for maximum performance.

In combination with low viscosity oil, the measures mentioned result in improved overall transmission efficiency.

3.3.1. Technical Data

		I-transmission GS6-17BG
Engine applications in F11		N53B30U0
Maximum drive torque	[Nm]	270
Center distance between shafts	[mm]	72
Weight with oil	[kg]	---
Clutch diameter	[mm]	---
Maximum input speed	[rpm]	---
Gear ratio in 1st gear		4.323
Gear ratio in 2nd gear		2.456
Gear ratio in 3rd gear		1.659
Gear ratio in 4th gear		1.230
Gear ratio in 5th gear		1.000
Gear ratio in 6th gear		0.848
Gear ratio in reverse gear		3.938
Axle ratio		3.231

F11 Drive.
3. Manual transmission

3.4. K-transmission

The K-transmission is a six-speed in-line, countershaft type manual transmission

Highlights

- Six gears with optimized ratios
- Intermediate bearings
- Dry sump lubrication
- Improvement in fuel economy (2 % in comparison to G-transmission.
- Weight reduction (-11 kg in comparison to H manual transmission)
- Synchronization with carbon friction linings
- Life-time oil filling.
- Neutral safety switch for automatic engine start-stop function.

The smaller, lighter and more economical K-transmission can be installed in place of the G-transmission in combination with the N55, N47Top and N57uL engines. The weight advantage is up to 11 kg, depending on the engine version. The transmission capacity of the transmission with simultaneous small size and weight is achieved primarily by use of intermediate bearings on the main shaft and a modified gear train design.

Two transmission versions are available to ensure the optimum overall gear ratio for maximum fuel economy and performance. GS6-45BZ K-transmission is designed for gasoline engines and the GS6-45DZ Kw-transmission for diesel engines.

A further advantage is the significantly improved shifting and high fuel economy, resulting from low drag and high efficiency.

The shifting had been improved considerably by

- use of newly developed carbon friction linings on the synchromesh units.
- Newly developed and extremely low friction gearshift mechanism.
- Low drag losses in the gear train
- Short shifting paths.

A dry sump lubrication system was used for the first time to keep drag losses low. In comparison to conventional immersion type lubrication, this prevents splashing in the oil sump, resulting in losses. The losses are further reduced by friction-optimized radial shaft seals.

3.4.1. Intermediate bearings

In countershaft type manual transmissions the meshing forces press the main shaft away from the countershaft. This leads to a deviation from the ideal tooth contact pattern, resulting in a significant reduct in the tooth strength and increase in the noise.

The K-transmission is therefore equipped with an intermediate bearing which significantly limits shaft deflection. This allows higher torques to be transferred in comparison to conventional transmissions while simultaneously reducing the tooth noise.

F11 Drive.
3. Manual transmission

3.4.2. Gear train concept

The torque has been increased on the Kw-transmission by changing the direct gear (transmission ratio = 1) from 5th to 4th gear. This decreases the gear ratio in the gears where strength is critical, thus reducing the load on the transmission components.

3.4.3. Dry sump lubrication

In conventional transmissions the gears are normally lubricated by immersing them in oil. During this process the gears on the countershaft dip into the transmission oil distributing it through out the entire transmission in a random fashion as the gear train rotates. Frequently auxiliary devices such as oil baffle plates or oil channels are required to ensure that the oil reaches the gear teeth, bearings and synchromesh.

The K-transmission is the first to be equipped with a dry sump lubrication system consisting of:

- An oil filter
- An oil pump
- A distribution pipe.

This allows the lubricating oil to be supplied systematically to the gear teeth, bearings and synchromesh while expending less energy than with an immersion type lubrication system. Moreover this systematic oil distribution improves the thermal balance, because the cool air at the bottom of the transmission case is routed to the area of the intake opening for the filter. This provides continuous cooling for the transmission oil.

The oil filter also improves the quality of the oil and thereby the load transfer capacity of the teeth.

3.4.4. Synchromesh

1st and 2nd gears are equipped with triple cone synchromesh. The remaining gears have single cone synchromesh. These are equipped with newly developed carbon friction linings to improve the shifting quality.

3.4.5. Connection dimensions

The connection dimensions for the transmission mounts were taken over from the familiar standard applications. This significantly simplifies integration into the vehicle environment, because the existing peripheral equipment can be used.

3.4.6. Technical Data

		K-transmission GS6-45BZ	**Kw-transmission GS6-45DZ**
Engine applications in F11		N55B30M0	N47D20O1
Maximum drive torque	[Nm]	470	450
Center distance between shafts	[mm]	80	80

F11 Drive.
3. Manual transmission

		K-transmission GS6-45BZ	Kw-transmission GS6-45DZ
Weight with oil	[kg]	43.3	43.7
Transmission length	[mm]	646	629
Gear ratio in 1st gear		4.110	4.110
Gear ratio in 2nd gear		2.315	2.248
Gear ratio in 3rd gear		1.542	1.403
Gear ratio in 4th gear		1.179	1.000
Gear ratio in 5th gear		1.000	0.802
Gear ratio in 6th gear		0.846	0.659
Gear ratio in reverse gear		3.727	3.727
Axle ratio		3.231	3.385

3.5. G-transmission

Customers will appreciate the extremely high precision, operational smoothness and shifting comfort. This transmission with its wide spread ensures optimum utilization of the engine power. The short shift paths of 55 mm provide a significant contribution to the high shifting comfort.

Highlights

- Slip suppression to prevent clutch slippage.
- Life-time oil filling.

A slip suppression feature is installed to prevent any possible clutch slip. This allows full load acceleration, without the clutch slipping. A speed sensor on the transmission countershaft and engine speed sensor allow calculation of the clutch slip and reduction of the engine torque as required.

3.5.1. Technical Data

		Gw-transmission GS6-53DZ
Engine applications in F11		N57D30O0
Maximum drive torque	[Nm]	540
Center distance between shafts	[mm]	95
Weight with oil	[kg]	55.2
Oil quantity	[l]	1.6
Transmission length	[mm]	644
Gear ratio in 1st gear		5.080
Gear ratio in 2nd gear		2.804
Gear ratio in 3rd gear		1.783

	Gw-transmission GS6-53DZ
Gear ratio in 4th gear	1.260
Gear ratio in 5th gear	1.000
Gear ratio in 6th gear	0.835
Gear ratio in reverse gear	4.607
Axle ratio	2.563

3.6. Gearshift Mechanism

F11 Gear selector switch

Highlights

- Advancement of shifting mechanism typical for BMW
- Improved shifting force curve and shifting precision
- New shifting arm concept to match innovative center console design.
- New, sporty, single-piece shift lever knob design with leather cover (improved feel and appearance).
- New "Dakota" leather material (improved service life and appearance).

F11 Drive.

3. Manual transmission

- Ergonomically optimized coordination of center console and shift lever knob.
- Different versions for vehicles with left and right hand drive for optimum human engineering.
- Gearshift rod wobble-riveted instead of welded.

The stick shift and proven concept of direct connection to the transmission have not been changed.

F11 Drive.

4. Automatic transmission

4.1. Designation

The transmission designation is used in the technical documentation for clear identification of the transmission. However an abbreviated designation is frequently used by itself This abbreviated form is used to associate a transmission with a transmission family. For example, we frequently speak of the GA8HP transmission family, consisting of a number of transmissions such as the GA8HP45Z, GA8HP70Z and GA8HP90Z

Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	A	Automatic transmission
3	Number of gears	6 8	Six forward gears Eight forward gears
4	Type of transmission	HP L R	Hydraulic planetary gear train GMPT designation GMPT designation
5 + 6	Transferable torque	19 26 32 45 (ZF) 45 (GMPT) 70 90 390	300 Nm Gasoline engine 600 Nm Gasoline engine 720 Nm Gasoline engine 450 Nm Gasoline engine, 500 Nm diesel engine 350 Nm Gasoline engine 700 Nm Gasoline engine and diesel engine 900 Nm Gasoline engine 390 Nm, 4th gear, 410 Nm gasoline engine
7	Manufacturer	G J R Z H	Getrag Jatco GMPT ZF Company part

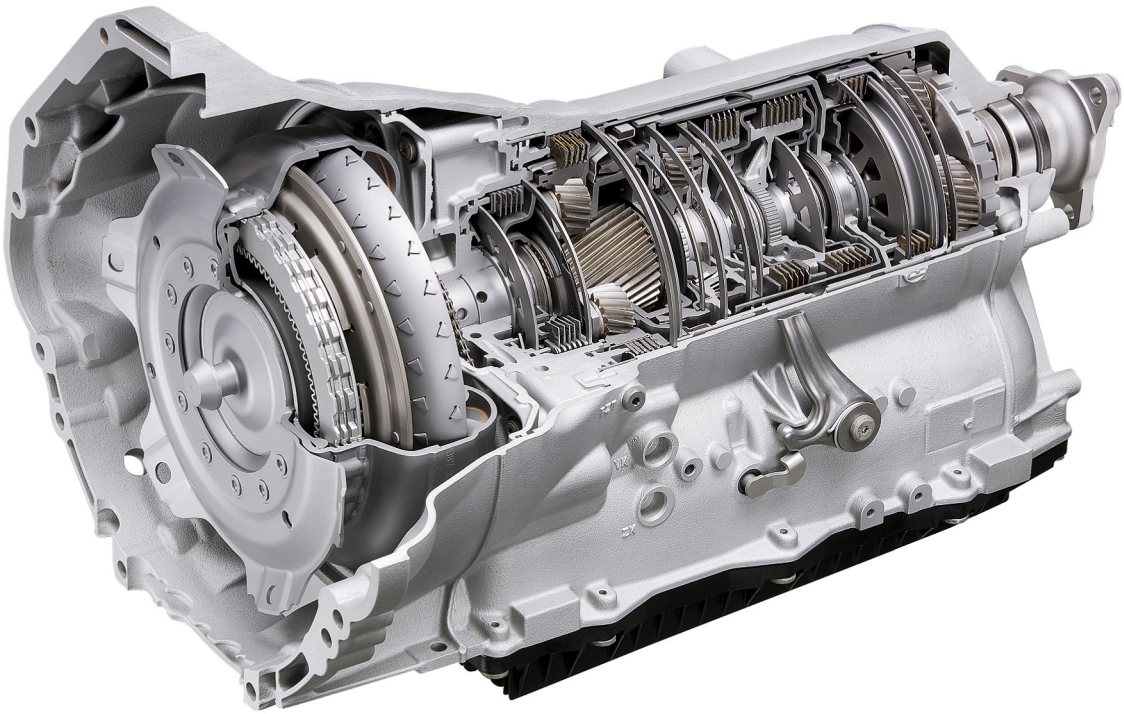
4.2. Versions

Model	Engine	Transmission	Torque converter
523i	N52B25O2	GA8HP45Z	NW235TTD
523i	N53B30U0	GA8HP45Z	NW235TTD
535i	N55B30M0	GA8HP45Z	NW235TTD
520d	N47D20O1	GA8HP45Z	NW235ZDW
530d	N57D30O0	GA8HP70Z	NW250ZDW

4.3. GA8HP Transmission

The new GA8HP45Z and GA8HP70Z automatic transmissions with eight forward gears and one reverse gear are used on the F11

F11 Drive.
4. Automatic transmission



TA09-1361

Highlights

- Much higher spontaneity for shifting operations.
- Small gear increments for greater driving and shifting comfort.
- Higher control accuracy for torque converter lockup clutch at low engine loads.
- Torque converter lockup clutch with higher transmission capacity.
- Better fuel economy (5 to 6% higher)

The GA8HP457Z and GA8HP70Z are new developments and will progressively replace the present 6-speed automatic transmissions GA6HP19Z TU and GA6HP26Z TU The spread was increased from 6.04 to 7.07, the gear increments have been decreased thus reducing the speed differences between gears. The transmission weight has been reduced considerably by measures such as use of a synthetic material for the oil pan.

The EGS electronic transmission control unit is integrated into the combination control unit for EWS electronic immobilizer control. This provides better protection against theft.

Control is possible with the gear selector switch or with the shift paddles (SA 2TB, Sports automatic transmission, over the SZL steering column control center).

Second generation mechanical torsion dampers are used in the torque converter.

- TTD Turbine torsion dampers
- ZDW Twin damper torque converter

F11 Drive.
4. Automatic transmission

The function and design of the torque converter is described in the information bulletin "E70 Automatic transmission".

The vibration decoupling feature reduces the percentage of slip at the torque converter lockup clutch and allows a greater operating range with closed torque converter lockup clutch. This increases the fuel economy by 5 to 6% in the KV01 fuel consumption cycle in comparison to the previous TU six-speed automatic transmissions.

4.3.1. Technical Data

		GA8HP45Z	GA8HP70Z
Maximum power (with gasoline engines)	[kW]	250	380
Maximum power (with diesel engines)	[kW]	180	240
Maximum torque (with gasoline engines)	[Nm]	450	700
Maximum torque (with diesel engines)	[Nm]	500	700
Maximum permissible rpm in 1st - 7th gear	[rpm]	7200	
Maximum permissible rpm in 8th gear	[rpm]	5700	
Maximum permissible rpm in reverse gear	[rpm]	3500	
Gear ratio in 1st gear		4.714	
Gear ratio in 2nd gear		3.143	
Gear ratio in 3rd gear		2.106	
Gear ratio in 4th gear		1.667	
Gear ratio in 5th gear		1.258	
Gear ratio in 6th gear		1.000	
Gear ratio in 7th gear		0.839	
Gear ratio in 8th gear		0.667	
Gear ratio in reverse gear		3.295	3.317

4.4. Gear selector switch

The F11 has the gear selector switch already familiar from the F10

F11 Drive.

4. Automatic transmission

F11 Gear selector switch

F11 Drive.
5. Differential.

5.1. Designation

Position	Meaning	Index	Explanation
1 – 3	Type of transmission	HAG	Differential
4 – 6	Size	205 225	Crown gear pitch circle dia. in mm
7	Type of housing	A	Aluminum
8	Type of transmission	L	Easy running

5.2. Versions

Model	Transmission	Differential	Gear ratio i
523i	GS6-17BG	HAG 205AL	3.231
523i	GA8HP45Z	HAG 205AL	3.385
535i	GS6-45BZ	HAG 205AL	3.231
535i	GA8HP45Z	HAG 205AL	3.077
520d	GS6-45DZ	HAG 205AL	3.385
520d	GA8HP45Z	HAG 205AL	2.929
530d	GS6-53DZ	HAG 225AL	2.563
530d	GA8HP70Z	HAG 225AL	2.471

5.3. Light weight differential

As on the F10 we have installed the new HAG 205AL and HAG 225AL differentials with aluminum housing on the F11.

F11 Light weight differential

Highlights:

F11 Drive.
5. Differential.

- Lower weight
  HAG 205AL: 23,6 kg (incl. oil)
  HAG 225AL: 29,7 kg (incl. oil)
- Higher transmission capability
- Better efficiency

F11 Drive.
6. Shafts

6.1. Propeller shaft

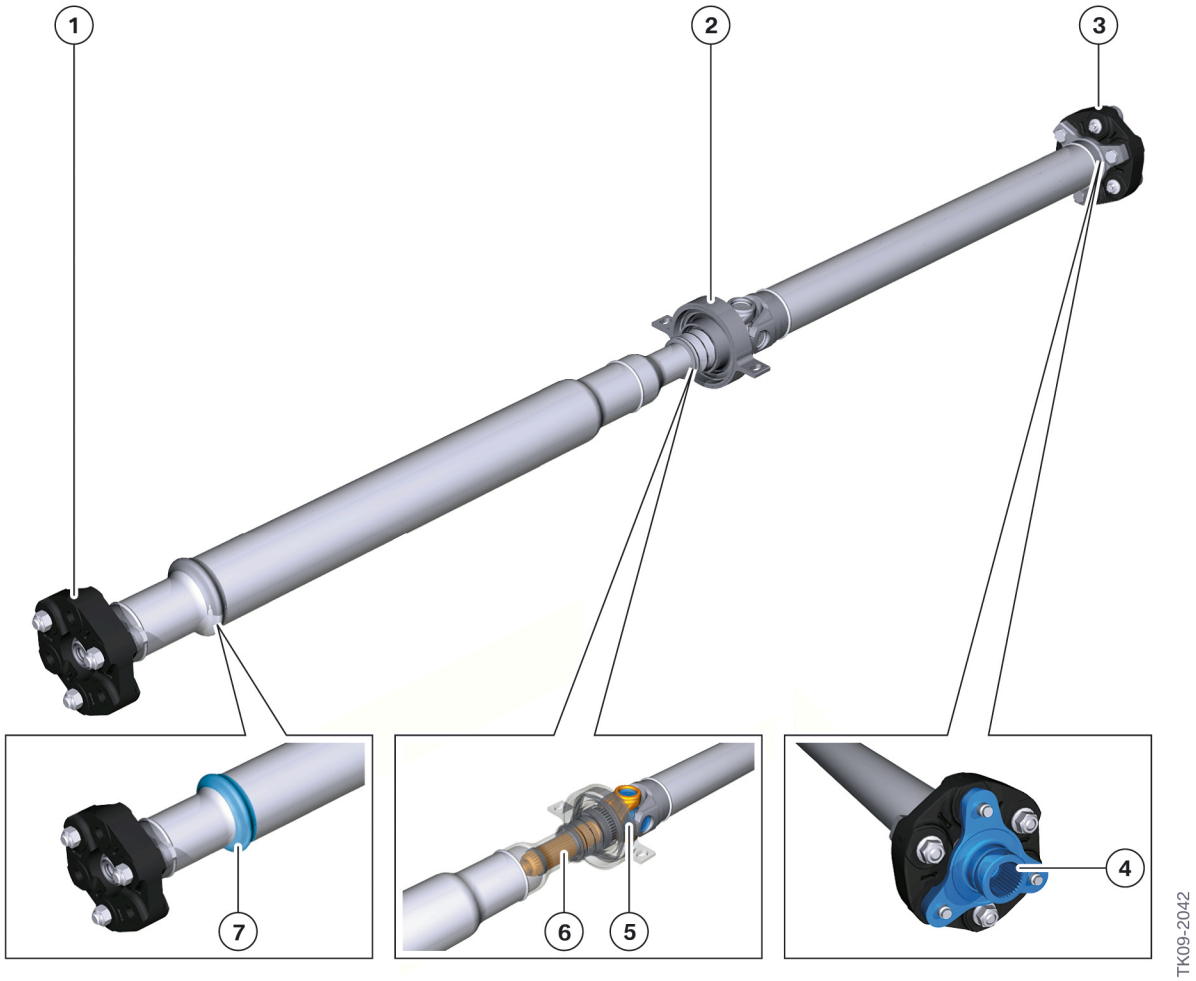
6.1.1. Overview

A steel propeller shaft version adapted to the torque requirements is available for every engine/ transmission combination.

Particular focal points in laying out the propeller shafts in the F11 were the comfort requirements in terms of noise and vibration in addition to transfer of the torque.

The U-joints, shaft sections and shaft diameter were laid out to prevent any annoying noises or vibrations being transferred at the connection points to the body.

On the F11 the propeller shafts are attached to the manual or automatic transmission and to the differential using exclusively flexible discs. This minimizes high frequency meshing noises in the differential.



F11 Propeller shaft

F11 Drive.
6. Shafts

Index	Explanation
1	Flexible discs (on automatic and manual transmission)
2	Center bearing
3	Flexible disc (on differential)
4	Plug connector
5	U-joint
6	Sliding element connection
7	Crash function

6.1.2. Crash function

The propeller shaft absorbs a portion of the crash energy during a head-on collision. The so-called crash function integrated into the front propeller shaft tube, has been optimized in terms of its properties. The sliding force which systematically deforms the front propeller shaft section, has been further reduced. The torque transfer capacity has remained unchanged.

6.2. Half shafts

6.2.1. Designation

Position	Meaning	Index	Explanation
1 + 2	Type of joints	VL	Löbro slip joints
3 – 7	Designation	2600i 3300i	Designation size/transmission capacity

6.2.2. Versions

Model	Transmission	Differential	Half shaft
523i	GS6-17BG	HAG 205AL	VL-2600i
523i	GA8HP45Z	HAG 205AL	VL-2600i
535i	GS6-45BZ	HAG 205AL	VL-3300i
535i	GA8HP45Z	HAG 205AL	VL-3300i
520d	GS6-45DZ	HAG 205AL	VL-2600i
520d	GA8HP45Z	HAG 205AL	VL-2600i
530d	GS6-53DZ	HAG 225AL	VL-3300i
530d	GA8HP70Z	HAG 225AL	VL-3300i

F11 Drive.
6. Shafts

6.2.3. Overview

F11 Half shaft

The F11 has half shafts inserted on the wheel and differential sides.

The type of stub shaft entering the differential depends on the size of the differential. The stub shafts on the wheel hub side are all the same size.

The overall length of the left and right half shafts differs due to the position of the differential.

The splined shaft between the two joints is laid out as a torsion resistant hollow shaft.

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