Technical training.
Product information.

G29 Powertrain/Chassis

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1834 2/1/2019

BMW Service

General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status: October 2018

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

The information contained in the training course materials is solely intended for participants in this training course conducted by BMW Group Technical Training Centers, or BMW Group Contract Training Facilities.

This training manual or any attached publication is not intended to be a complete and all inclusive source for repair and maintenance data. It is only part of a training information system designed to assure that uniform procedures and information are presented to all participants.

For changes/additions to the technical data, repair procedures, please refer to the current information issued by BMW of North America, LLC, Technical Service Department.

This information is available by accessing TIS at www.bmwcenternet.com.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application
- Aftersales Information Research (AIR)

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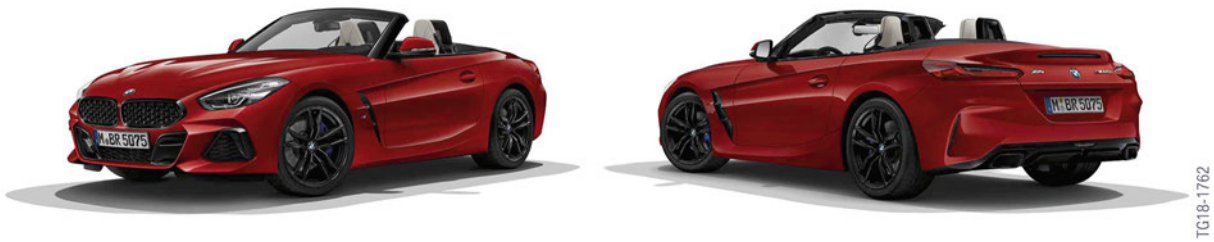
1. Introduction

1.1. Overview

The 3rd generation of the BMW Z4 has the development code G29. The market introduction takes place in March 2019.

G29 sDrive30i



G29 M40i

Both models are equipped with an 8-speed automatic transmission and the variable sport steering for the market introduction. Models with all-wheel drive are not offered for the G29.

1.2. Models

1.2.1. Overview

The following models are available for the market introduction in March 2019:

Model	Engine	Automatic transmission	Rear axle final drive
Z4 sDrive30i	B46B20O1	GA8L51CZ	190AL; optional 215LWS
Z4 M40i	B58B30M1	GA8L51CZ	215LWS

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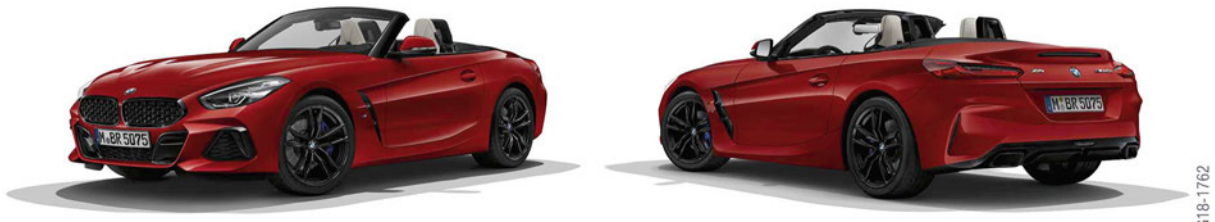
1. Introduction

1.2.2. BMW M Performance model

For the market introduction of the G29 the BMW M Performance model Z4 M40i is available.



G29 BMW M Performance model M40i

The M Performance model has specific design and equipment features. In addition to the specific internal and external standard equipment of the vehicles, the BMW Z4 M40i is also equipped with the following technical highlights as standard:

- M sports suspension
- M sport differential
- 17" M sport brake

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2. Engines

2.1. Overview

The following table provides an overview of the technical data of the engines used:

Parameters	Unit	sDrive30i	M40i
Engine designation	-	B46B20O1	B58B30O1
Power output	[kW (HP)]	190 (255)	285 (381)
Torque	[Nm] (lb-ft)	400 (295)	500 (368)
Displacement	[cm]	1950	2998

2.2. B46TU engine

2.2.1. Technical data

B46TU engine

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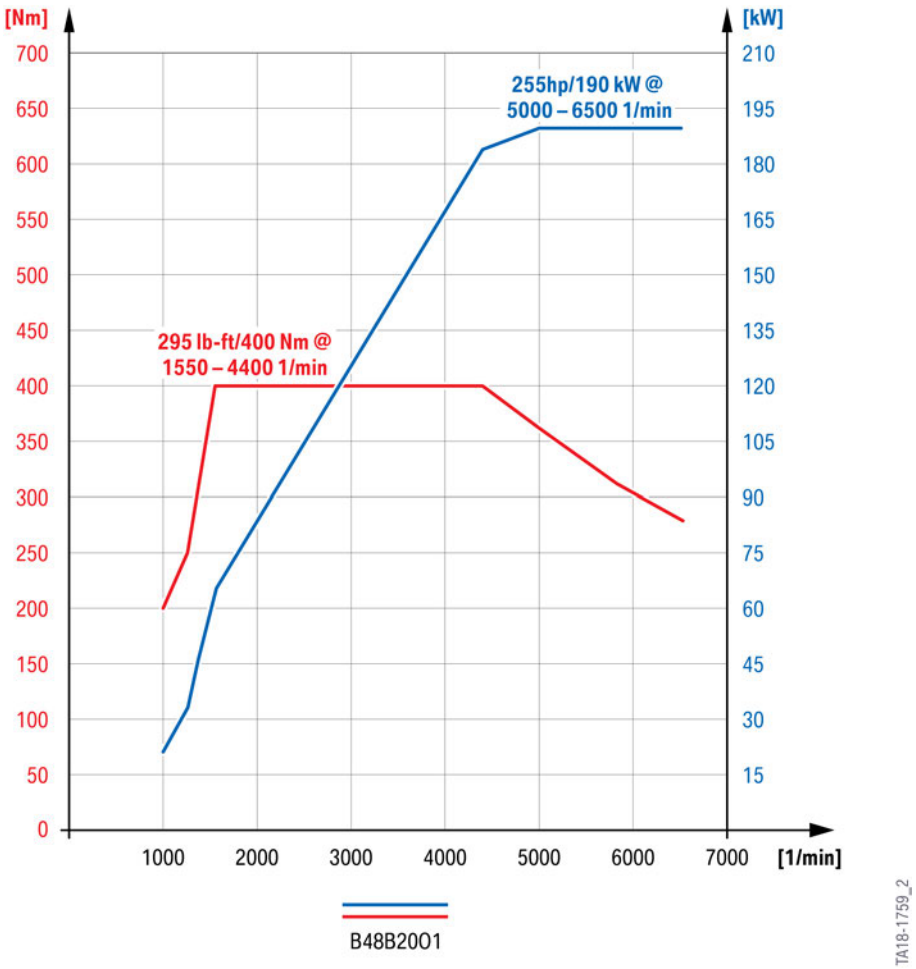
2. Engines

Parameters	Unit	B48B20O1
Displacement	cm^3	1950
Cylinder layout	-	In-line
number of cylinders	-	4
Firing order	-	1–3–4–2
Bore hole	mm	81
Stroke	mm	94.6
Compression ratio	ε	10.2 : 1
Combustion process	-	Turbo-Valvetronic direct injection
Max. output at rotational speed	kW (hp) rpm	190 (255) 5000–6500
Max. torque at rotational speed	Nm (lb-ft) rpm	400 (295) 1550–4400
Oil quantity	l	5.25

2.2.2. Full load diagram



Full-load diagram for B48B20O1

2.2.3. Highlights

- Fuel preparation with 350 bar injection pressure
- Cylinder head with **without** integrated exhaust manifold (exhaust turbocharger housing and exhaust manifold are a single component)
- Indirect charge air cooling
- Adapted exhaust turbocharger made from steel
- Split cooling
- Coolant pump with integrated pressure relief valve
- Heat management module with electric split cooling valve
- Single-part chain drive
- Digital Motor Electronics (DME) of the 8th generation (DME 8.4T.1)

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2. Engines

2.3. B58TU engine

2.3.1. Technical data

B58TU engine

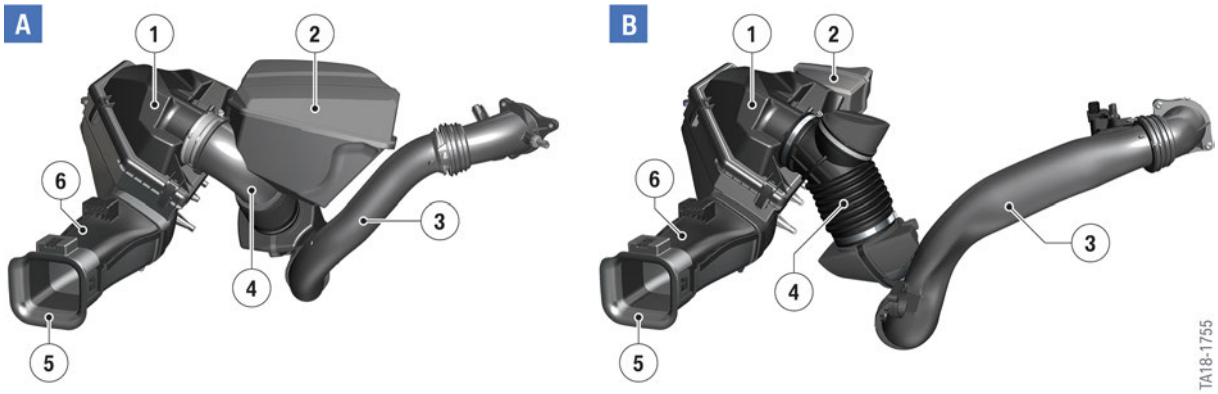
Parameters	Unit	B58B30O1
Displacement	cm^3	2998
Cylinder layout	-	In-line
number of cylinders	-	6
Firing order	-	1–5–3–6–2–4
Bore hole	mm	82
Stroke	mm	94.6
Compression ratio	ε	11.0 : 1
Combustion process	-	Turbo-Valvetronic direct injection

Parameters	Unit	B58B30O1
Max. output at rotational speed	kW (hp) rpm	285 (381) 5000–6500
Max. torque at rotational speed	Nm (lb-ft) rpm	500 (368) 1600–4500
Oil quantity	l	6.5

2.3.2. Highlights

- Fuel preparation with 350 bar injection pressure
- Cylinder head **without** integrated exhaust manifold (exhaust turbocharger housing and exhaust manifold are a single component)
- Adapted exhaust turbocharger made from steel
- Split cooling
- Coolant pump with integrated pressure relief valve
- Heat management module with electric split cooling valve
- Single-part chain drive
- Digital Motor Electronics (DME) of the 8th generation (DME 8.6T.1)

2.4. Air intake system



G29 intake air system

Index	Explanation
A	Air intake system B48B20O1
B	Air intake system B58B30O1
1	Intake silencer
2	Resonator

Index	Explanation
3	Charge air hose from compressor for indirect charge air cooling
4	Clean air pipe
5	Unfiltered air intake
6	Unfiltered-air duct

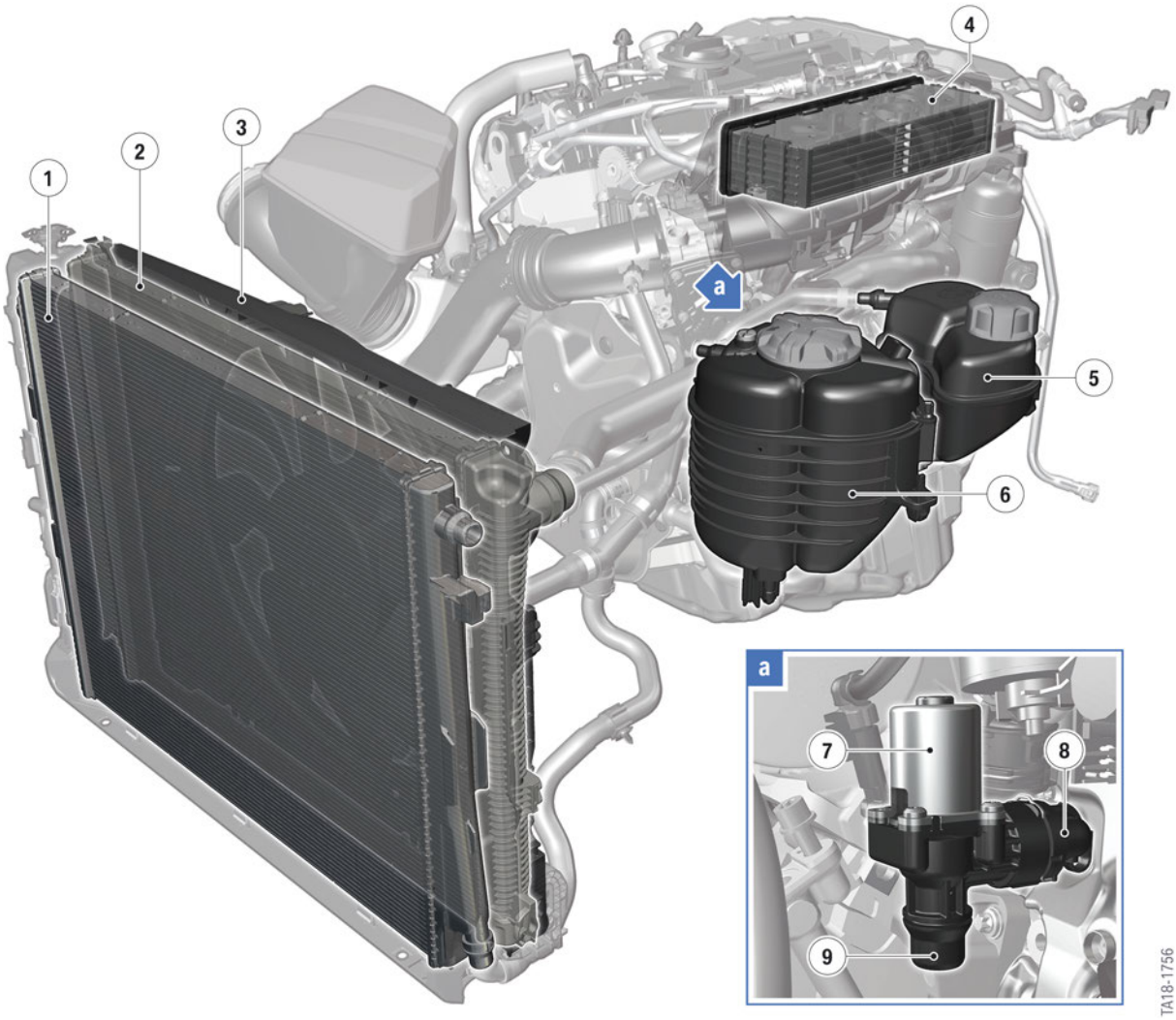
2.5. Cooling

The B46TU engine in the upper power level, as well as the B58TU engine, have 2 separate coolant circuits.

The low-temperature coolant circuit serves for cooling the charge air (indirect charge air cooling) and the high-temperature coolant circuit serves for cooling the engine. The two coolant circuits each have their own expansion tank.

2.5.1. B46TU Engine

The B46TU engine is equipped with an additional coolant shutoff valve. During the engine's warm-up phase it blocks the high-temperature coolant circuit to the expansion tank. As a result, the engine reaches the operating temperature quicker, thus contributing to a reduction in CO2 pollutant emissions. The shutoff value is opened without current.



G29 cooling system for B46TU engine

Index	Explanation
1	Low-temperature radiator
2	High-temperature radiator
3	Electric fan
4	Charge air cooler
5	Expansion tank, low-temperature circuit
6	Expansion tank, high-temperature circuit
7	shutoff valve
8	Intake neck, coolant pump
9	Coolant hose from expansion tank to coolant pump

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2. Engines

2.5.2. B58TU engine

In the B58TU engine 2 additional external radiators are used.

G29 cooling system for B58TU engine

Index	Explanation
1	Radiator installed outside
2	Low-temperature radiator
3	High-temperature radiator
4	Electric fan
5	Charge air cooler
6	Expansion tank, low-temperature circuit
7	Expansion tank, high-temperature circuit
8	Radiator installed outside

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2. Engines

2.5.3. Antifreeze and corrosion inhibitor

The cooling system of the G29 is filled with the new antifreeze and corrosion inhibitor Frostox® HT-12. The new antifreeze and corrosion inhibitor increases the long-term stability and corrosion protection of the components.

It replaces the well-known antifreeze and corrosion inhibitor Glysantin® G48. The two can be distinguished by their color. The G48 can be recognized by the blue color.

The HT-12 comes in **green** and **magenta**. For the initial filling at the factory the **green** BMW antifreeze and corrosion inhibitor HT-12 is used. For service in the Retailer Organization the HT-12 in **magenta** is used for the time being up to 11/2018. The supply of the Retailer Organization with HT-12 in **green** is available as of 11/2018.

Antifreeze and corrosion inhibitor

Index	Explanation
A	Antifreeze and corrosion inhibitor Glysantin® G48
B	Antifreeze and corrosion inhibitor Frostox® HT-12 (color for initial filling in the factory)
C	Antifreeze and corrosion inhibitor Frostox® HT-12 (color in service up to 11/2018)

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2. Engines

The following table provides an overview of the antifreeze and corrosion inhibitors used within the BMW Group:

	Color	Use	Initial filling in the factory	Filling in service
G30	Magenta	R55, R56 with W16 engine	●	●
i3 coolant	Blue	I01 heater circuit	●	●
G48	Blue	BMW Group vehicles up to production June/July 2018	●	●
HT-12	Green	BMW Group vehicles from production July/August 2018	●	
HT-12	Magenta	BMW Group vehicles from production up to 11/2018		●

Since the beginning of July/August 2018 all cooling systems in new vehicle models (depending on the production date and production plant) are supplied with the antifreeze and corrosion inhibitor HT-12.

Like the G48, the HT-12 contains silicate and forms a silicate layer on metallic component surfaces.

The silicate-free antifreeze and corrosion inhibitors (G30, i3 coolant), which are used in the cooling systems of the BMW i3, are the exception. Here organic salts are solely responsible for the corrosion protection. The coolant of the i3 (i3 coolant) can be recognized by the blue color.

Antifreeze and corrosion inhibitors cannot be mixed with each other in any manner. In the case of unauthorized mixing, the antifreeze and corrosion inhibitor may turn into a gel or cause engine damage.

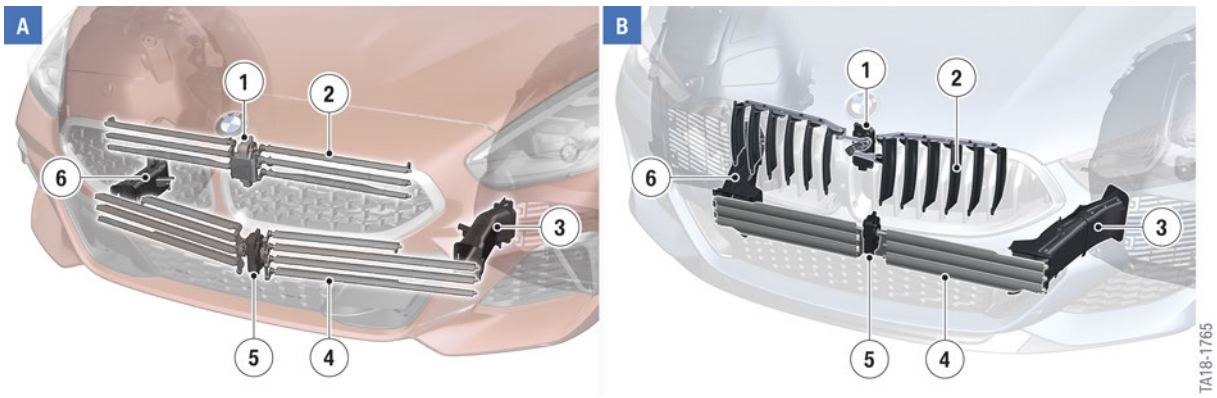
The following table shows the harmless miscibility of the antifreeze and corrosion inhibitors from a technical perspective:

	G30	i3 coolant	G48	HT-12 (green)	HT-12 (magenta) up to 11/2018
G30	●				
i3 coolant		●			
G48			●	●	●
HT-12 (green)			●	●	●
HT-12 (magenta)			●	●	●

The selection of the correct antifreeze and corrosion inhibitor is only possible using the BMW part number. In the event of an incorrect selection of the antifreeze and corrosion inhibitor there is a risk of component damage or failure.

2.5.4. Active air flap control

In the G29 a 2nd generation active air-flap control (used in F15, F16, F4x and F39) is used. It differs from the 3rd generation (used in G3x, G11, G01, G2x, G05 and G15) to the extent that it is **not** in the immediate field of view in the upper cooling air inlet.



Overview of generations of the active air-flap control

Index	Explanation
A	2nd generation active air-flap control in the G29
B	3rd generation active air-flap control in the G15
1	Actuator for air flaps at top
2	Air flaps at top
3	Brake air duct left
4	Air flaps at bottom
5	Actuator for air flaps at bottom
6	Brake air duct right

However, the function and control match that of the 3rd generation:

- 2 separate actuators for upper and lower air flaps.
- Basic logic of operating strategy: First open the lower air flap, then the upper air flap.
- Air flaps can move to several intermediate settings.
- Brake air duct is operated or supplied via the lower flap system.

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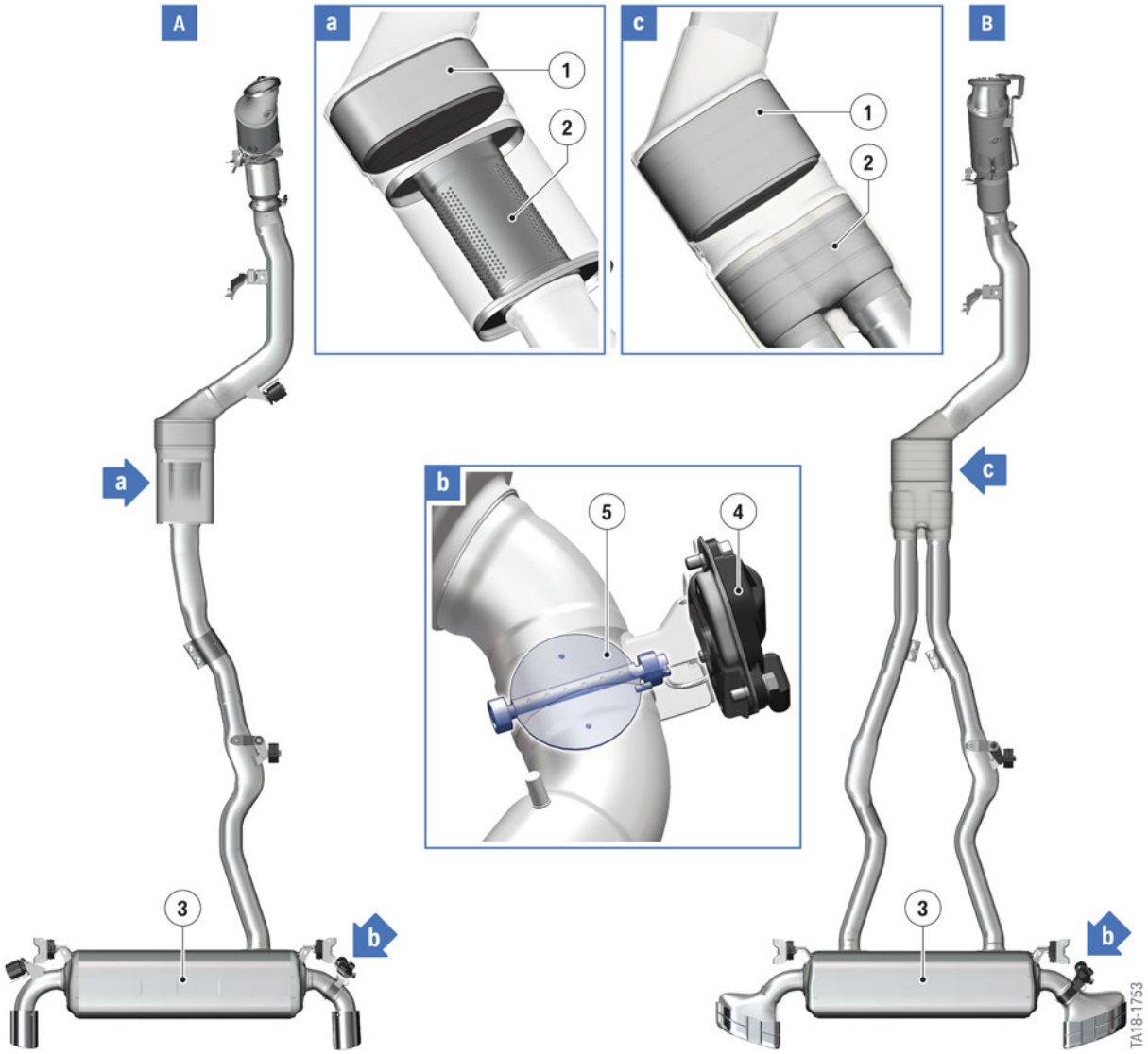
2. Engines

In the predecessor model E89 a 1st generation air flap control was used. This has an actuator for the upper air flap. A lower air flap is only used when a naturally aspirated engine is used. The lower air flap, if present, is passive, i.e. without actuator. Like the 2nd generation, the 1st generation is also not fitted in the immediate field of view.

2.6. Exhaust emission system



G29 exhaust emission system variants

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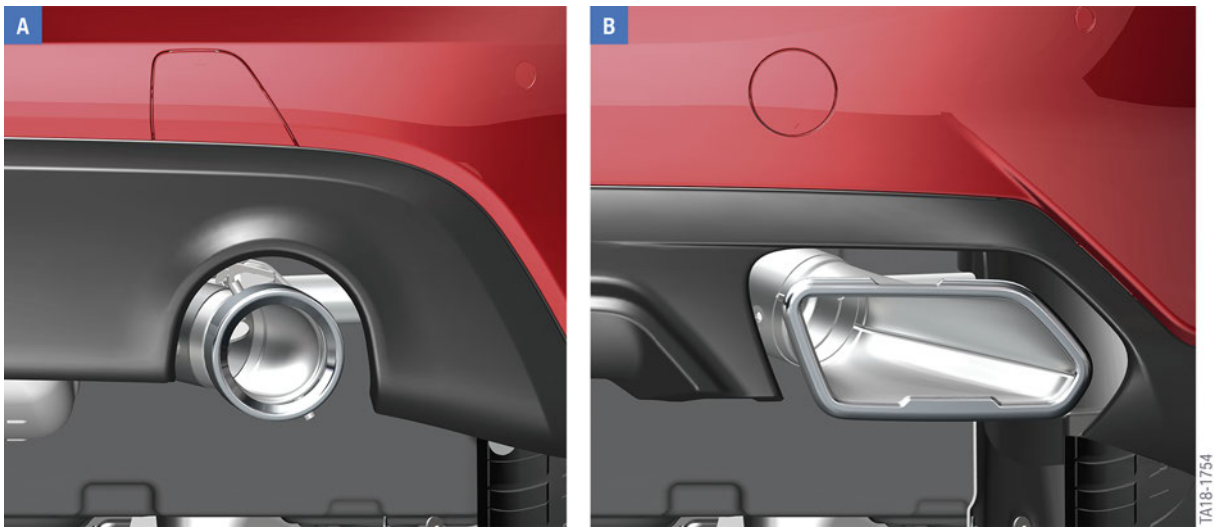
2. Engines

Index	Explanation
A	B46TU engine (single-branch)
B	B58TU engine (two-branch)
1	Petrol particulate filter (Not for the US)
2	Center silencer
3	Rear silencer
4	E-motor exhaust flap
5	Exhaust flap

Different tailpipe trims are used for the two engines:



G29 exhaust tailpipe variants

Index	Explanation
A	Tailpipe trim, B46TU engine
B	Tailpipe trim, B58TU engine

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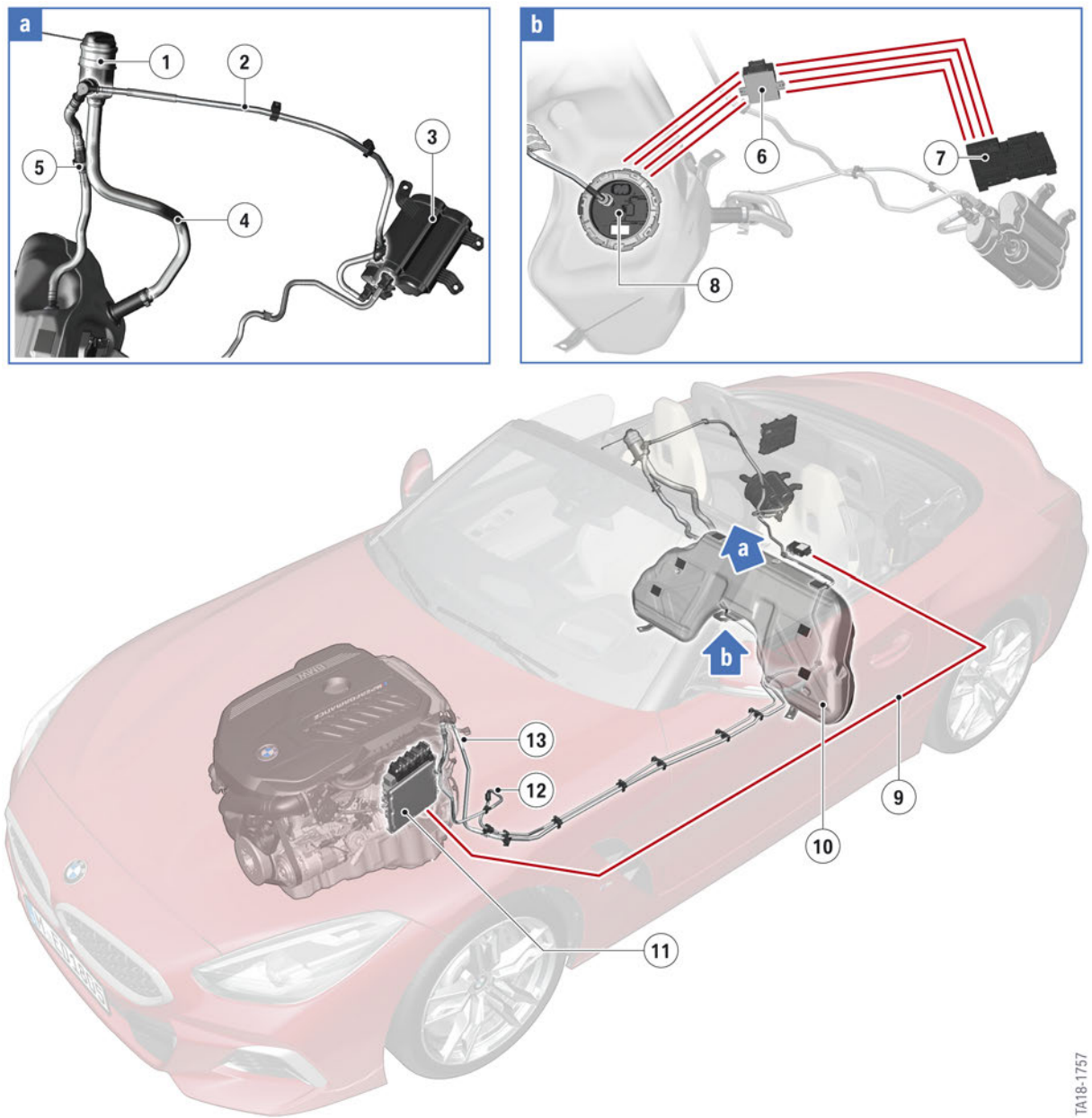
2. Engines

2.7. Fuel supply

In the G29 a fuel tank with 52 liter filling capacity is used.



G29 system overview of fuel supply

Index	Explanation
1	Fluid filler cap
2	Ventilation line, carbon canister
3	Carbon canister
4	Fuel filler neck

Index	Explanation
5	Tank ventilation line
6	Fuel pump control (FPC)
7	Power distribution box, rear right
8	Delivery unit
9	Data line to fuel pump control module
10	Fuel tank
11	Digital Motor Electronics (DME)
12	Fuel feed (from the fuel tank)
13	Purge air line, carbon canister

2.8. Engine electrical system

2.8.1. Engine control

In the G29 the well-known engine control unit generation (8th generation) from Bosch is used.

The integrated supply module is also located in the area of the engine control unit. It supplies the engine control unit and various sensors and actuators at the engine with the required supply voltage.

Control unit code for gasoline engines

The control unit code (DME 8.xT.y) can be broken down as follows:

Abbreviation	Meaning
DME	Digital Motor Electronics
8	Control unit generation
x	Number of cylinders as a hexadecimal figure 4 = 4-cylinder engine 6 = 6-cylinder engine
T	Technical update of engine
y	Vehicle electrical system architecture 0 = BN2020 Service Pack 2015 (introduced with the G12 BMW 7 Series) 1 = BN2020 Service Pack 2018 (introduced with the G05 BMW X5)

- DME 8.4T.1 = B46TU engine
- DME 8.6T.1 = B58TU engine

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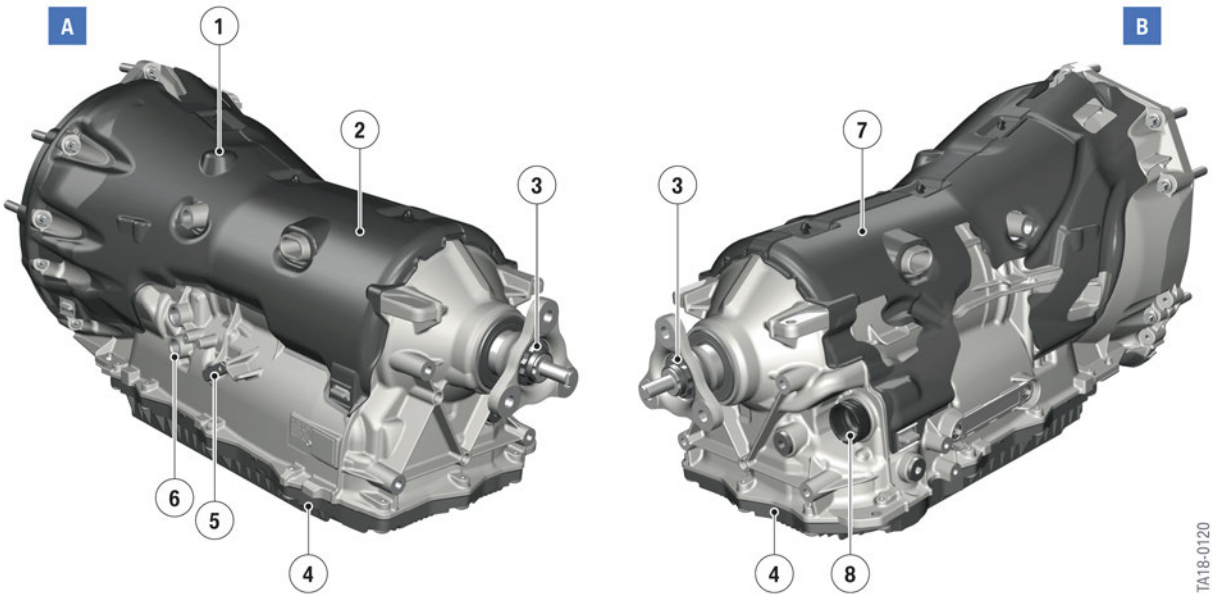
3. Automatic Transmission

3.1. Automatic transmission

3.1.1. Overview

In the G29 the 8HPTU2 automatic transmission, which is familiar from other vehicles, such as G05, G15 and G20, is used. It replaces the 8HPTU automatic transmission.



8HP51 automatic transmission with acoustic cover

Index	Explanation
A	8HP51 view, left
B	8HP51 view, right
1	Transmission breather
2	Two-part acoustic cover (6-cylinder engine)
3	Output shaft
4	Transmission oil sump
5	Mechanism for emergency release
6	Transmission oil output to transmission oil cooler
7	Three-part acoustic cover (4-cylinder engine)
8	Electrical connection (mechatronics to vehicle electrical system)

G29 Powertrain/Chassis

3. Automatic Transmission

The following further developments made it possible to increase the comfort, dynamics and efficiency of the revamped 8-speed automatic transmission in the G29:

- Higher steering axis inclination of the automatic transmission due to larger gear steps.
- Improved dynamic gearshifts thanks to new development of the mechatronics and the electronic transmission control EGS.
- Improved ride comfort through hot-end decoupling of the rotational imbalance of the engine by means of a further developed centrifugal pendulum.
- Reduction of vehicle-specific insulation measures with an acoustic cover (SynTAK) at the transmission.
- Enhanced customer experience due to new operating possibilities with the driving experience switch or shift paddles.

3.1.2. Designation

The designation for the 8HPTU2 automatic transmission has been changed. The designation for the 8HP and the 8HPTU remains the same. The following table provides an overview of the composition of the different transmission codes for the 8HPTU2 automatic transmission.

Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	A	Automatic transmission
3	Number of gears	8	8 forward gears
4	Drive type	L X	Rear-wheel drive Four-wheel drive
5 + 6	Transmittable torque	51 76	500 Nm 750 Nm
7	Steering axis inclination	C D	8,2 8.6
8	Manufacturer	Z	ZF

3.1.3. Sport automatic transmission

In each model of the G29 a Steptronic Sport transmission (SA 2TB) is used as standard. The customer has 2 shift paddles on the steering wheel and additional functions such as:

- Launch Control
- Manual activation of coasting
- Driving into the speed limiter.

3.1.4. ConnectedShift

Use of the navigation data

ConnectedShift uses the navigation data for a forward-thinking shift strategy of the automatic transmission. If, for example, a sharp bend is detected, the automatic transmission shifts down early and the gear is retained in the bend.

The route guidance of the navigation system does not need to be activated for the function. However, the detection of a turn request leads to more precise control of the system. Up-to-date navigation map data also influences the control accuracy.

Use of the radar

A prerequisite for use of this function is the optional equipment "Active cruise control with Stop&Go function" (SA 5DF).

If the vehicle detects rapid approach to an obstacle via the front radar, the electronic transmission control EGS automatically shifts down to a lower gear.

This means that in a situation where the driver does not want to overtake, the higher engine braking torque is used and the driving speed is reduced. In addition, for an imminent overtaking manoeuvre there is increased tensile force reserve available for possible overtaking.

3.1.5. Configuration options

Influence of the driving experience switch

Many drive variants have a SPORT PLUS mode in order to support sporty driving with more powerful engines. The shift characteristics are adapted as follows in the SPORT PLUS mode:

- Sharper design of downshifts on braking
- Further increase of the engine speed in the direction of maximum power.

3.1.6. Extension of the coasting function

During coasting in certain conditions the engine is disconnected from the transmission in drive position D. The kinetic energy of the vehicle is used and the vehicle continues to roll at idle speed with reduced consumption.

Up to now the coasting function was only available in "ECO PRO" mode and can now also be used in the G29 in "COMFORT" mode.

With "ECO PRO" mode there is an attempt to achieve maximum efficiency/fuel economy. For this navigation data is considered in the decision whether coasting is currently useful from an efficiency perspective (proactive driving assistant).

Coasting in "COMFORT" mode is currently not used with the following equipment specifications:

- BMW M Performance Automobile

The extended operating strategy guarantees that the coasting function is only activated when the driving situation permits an energy-related advantage to the coasting overrun. Apart from the navigation data (proactive driving assistant), the accelerator pedal position and the situation in front of the vehicle are also evaluated by means of radar (leading vehicle detection). The leading vehicle detection analyses the distance and the differential speed to the leading vehicle and decides whether coasting is useful in terms of comfort.

With the accelerator pedal position the customer also has the option to specifically activate coasting mode.

- When the accelerator pedal is released slowly, coasting can be manually activated.
- There is no activation with a dynamic driving style and rapid change of the accelerator pedal position.

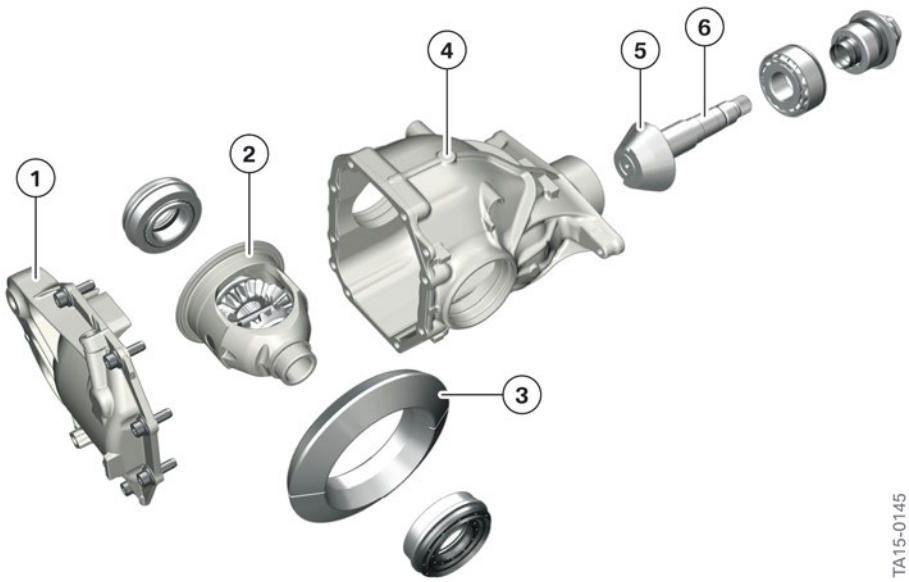
With the new 8HPTU2 automatic transmissions the comfort when deactivating the coasting function was enhanced. As a result, a simultaneous downshift upon deactivation of the coasting function is possible.

3.2. Rear axle final drive

For the G29 two rear axle differentials are available depending on the model and equipment:

- 190AL
- 215LWS

In the sDrive30i the rear axle differential 190AL is used.



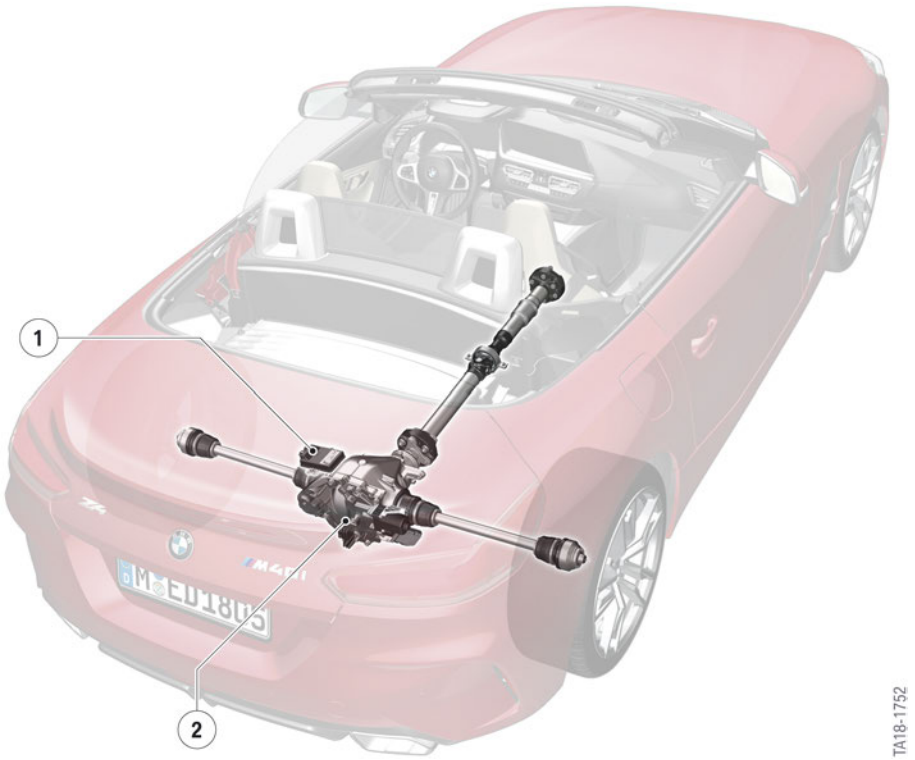
Rear axle differential 190AL

Index	Explanation
1	Housing cover
2	Differential
3	Crown wheel
4	Housing
5	Pinion
6	Transmission input shaft

A regulated rear axle differential lock (HAG 215LWS) can be optionally installed in the sDrive30i and standard in the M40i.

3.3. Regulated rear axle differential lock

In the G29 the regulated rear axle differential lock, which is already known from other vehicles, is used.



G29 overview of the regulated rear axle differential lock

Index	Explanation
1	Control unit for regulated rear axle differential lock (GHAS)
2	Regulated rear axle differential lock

The regulated rear axle differential lock makes possible the reduction of the slip between right and left rear wheel. A maximum lock-up torque of 1500 Nm can be applied.

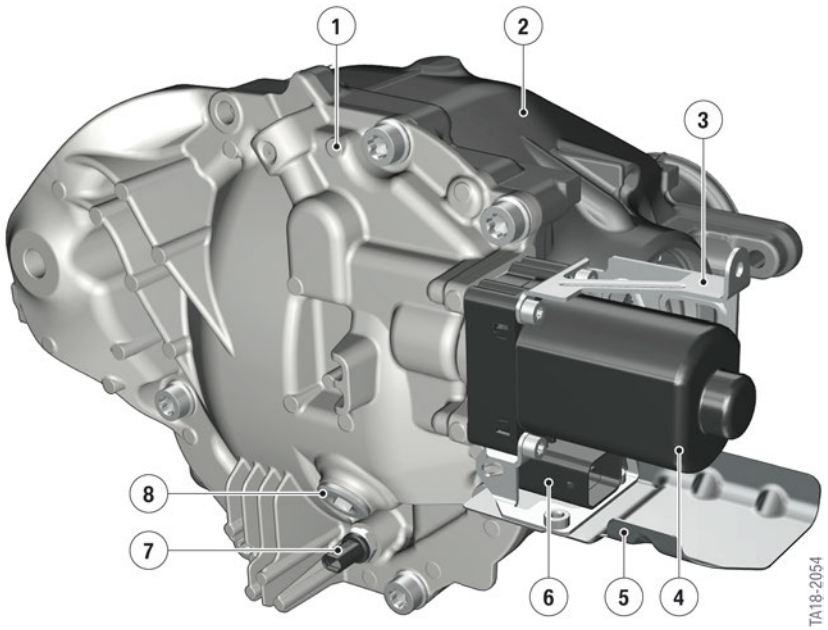
The advantages of the controlled rear axle differential lock are:

- Improved handling
- Optimal traction
- Greater driving stability

The following table provides an overview of the driving situations in which the regulated rear axle differential lock is active:

Driving situation	Regulated rear axle differential lock action
Pullaway	Generation of lock-up torque.
Road with different coefficient of friction on right and left	In the case of an emerging difference in speed at the rear axle, the drive torque is transmitted to the wheel that can transmit more driving power.
Accelerated cornering	The drive torque is transmitted to the outer cornering wheel via the wheel slip of the inner cornering wheel.
Load reversal upon cornering or lane change	A stabilizing torque is generated from the yaw-rate signal if oversteering is detected.
Oversteering	In the case of deliberate oversteering the lock is closed from the yaw-rate signal and the signal of the accelerator pedal position.

3.3.1. Structure and function



External design of regulated rear axle differential lock

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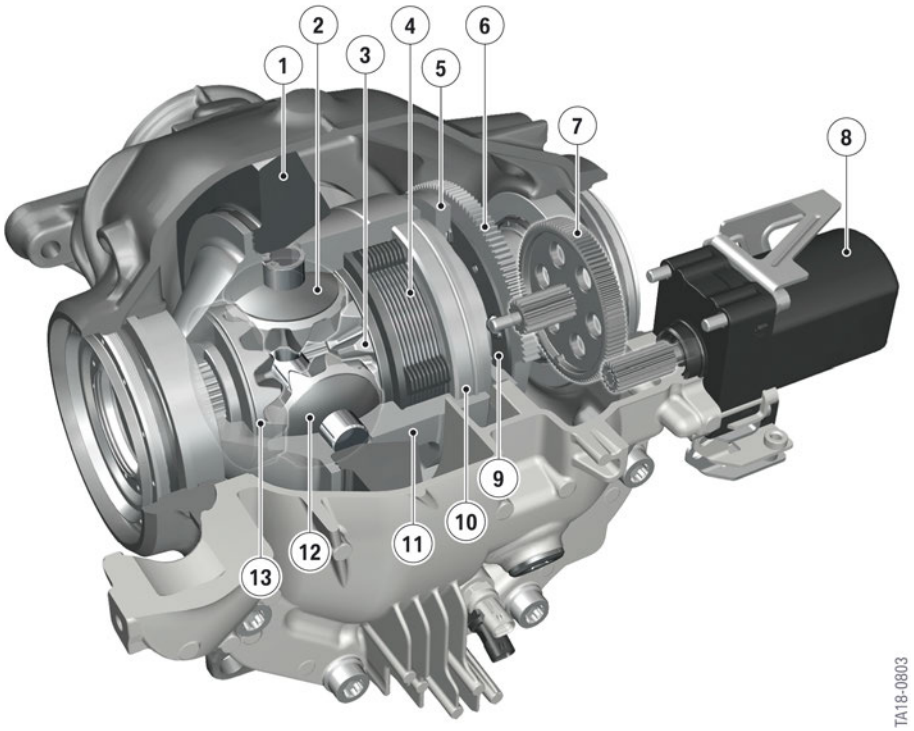
3. Automatic Transmission

Index	Explanation
1	Housing cover
2	Housing
3	Holder for heat shield
4	Electric motor
5	Heat shield
6	Electrical connection, electric motor
7	Transmission oil temperature sensor
8	Fluid filler plug

The lock-up torque is generated by a multidisc clutch. The necessary axial pressure is applied to the multidisc clutch by the electric motor by means of gears and a ball ramp mechanism. The clutch package operates between the expansion tank housing (steel outer discs) and the right output (steel inner discs with carbon friction lining).



Internal design of regulated rear axle differential lock

Index	Explanation
1	Crown wheel
2	Differential bevel gear
3	Output bevel gear
4	Multidisc clutch

Index	Explanation
5	Fixed pressure disc with second half of ball ramp
6	Ball ramp consisting of geared mobile adjusting disc and first half of ball ramp
7	Transfer box
8	Electric motor
9	Ball and spherical washer
10	Differential lid (connected to differential housing, cannot rotate)
11	Differential housing (connected to outer discs)
12	Differential bevel gear
13	Output bevel gear

The central control unit for the calculation of all driving dynamic functions is the Dynamic Stability Control (DSC). It evaluates the driving dynamic parameters provided by other sensors and control units and forwards the calculated lock-up torque to be adjusted to the control unit for the regulated rear axle differential lock (GHAS). This value is transferred on the FlexRay bus to the GHAS control unit.

The GHAS control unit calculates an angle to be adjusted at the ball ramp from the requested lock-up torque of the DSC control unit. The adjusting torque required for control is generated by an electric motor. The electric motor is activated directly by the power electronics of the GHAS control unit with vehicle voltage via a pulse-width-modulated signal. To determine the position and the direction of rotation of the direct current motor it is equipped with 2 hall effect sensors.

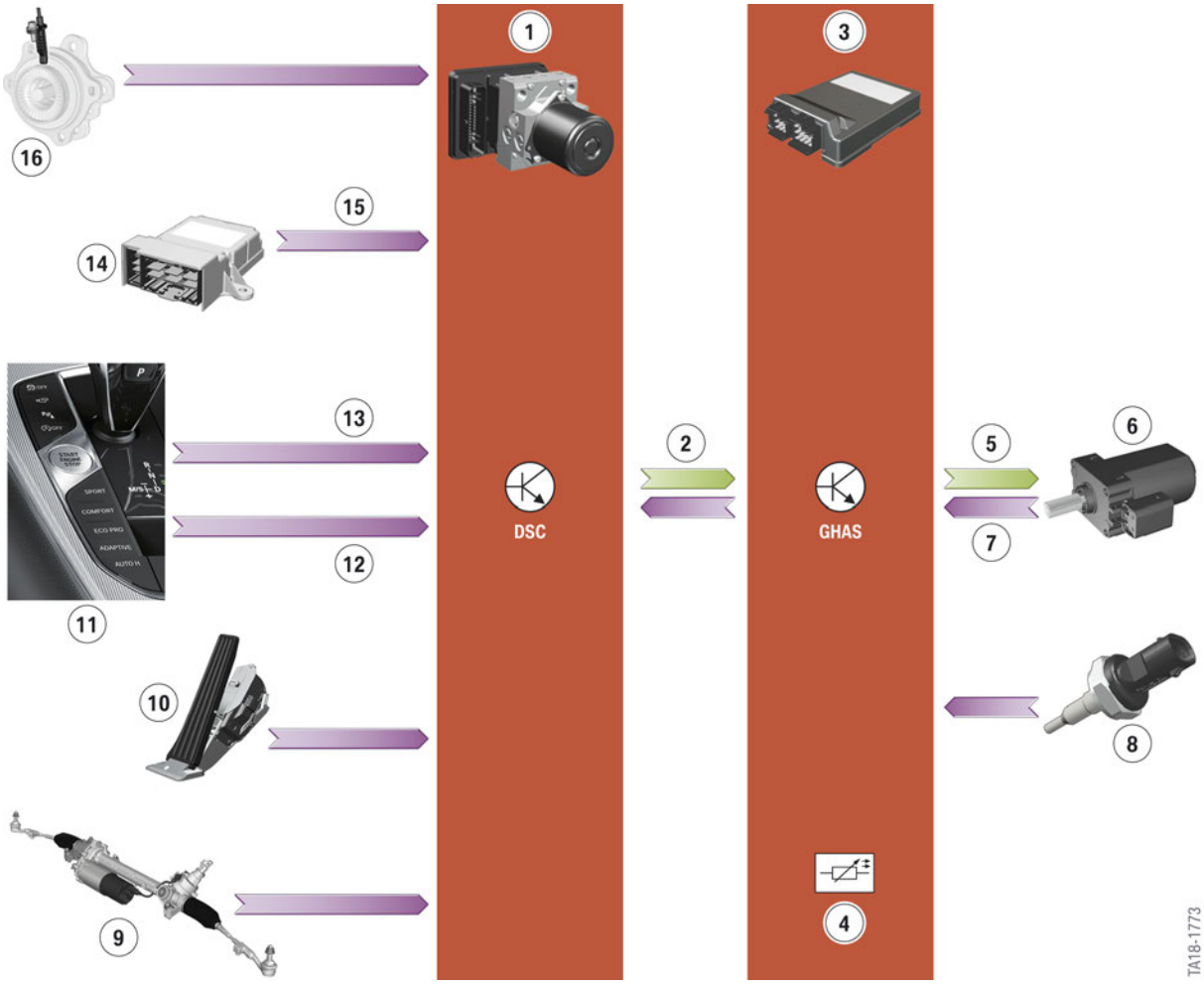
The DSC control unit can also request separate and higher-level locking interventions to stabilize the vehicle both when the DSC control system is activated and deactivated.

Adaptation of multidisc clutch

A calibration is carried out regularly in order to compensate for wear of the clutch. During this calibration a predefined position profile is shut down and by means of the current course of the servomotor the adaptation point (clutch slipping point) of the multidisc clutch is determined. This clutch slipping point adaptation is repeated every time the combustion engine is switched off and compensates the wear during the journey. The clutch slipping point corresponds to the clutch position, at which no torque is transferred by the multidisc clutch, which equals a lock-up torque of 0 Nm.

3.3.2. System overview

The following diagram shows the information required for the functioning of the regulated rear axle differential lock:



System overview of regulated rear axle differential lock

Index	Explanation
1	Dynamic Stability Control (DSC) control unit
2	FlexRay bus
3	Control unit for regulated rear axle differential lock (GHAS)
4	Temperature sensor (control unit)
5	Electric motor actuation
6	Electric motor
7	Position and temperature of electric motor
8	Oil temperature
9	Electromechanical power steering (EPS) control unit

Index	Explanation
10	Accelerator pedal module
11	DSC/DTC switch, driving experience switch
12	Active driving program (SPORT, COMFORT, ECO PRO)
13	DSC/DTC status (DSC/DTC activated/deactivated)
14	Advanced Crash Safety Module (ACSM) control unit
15	Yaw rate, longitudinal and lateral acceleration
16	Wheel speed sensor

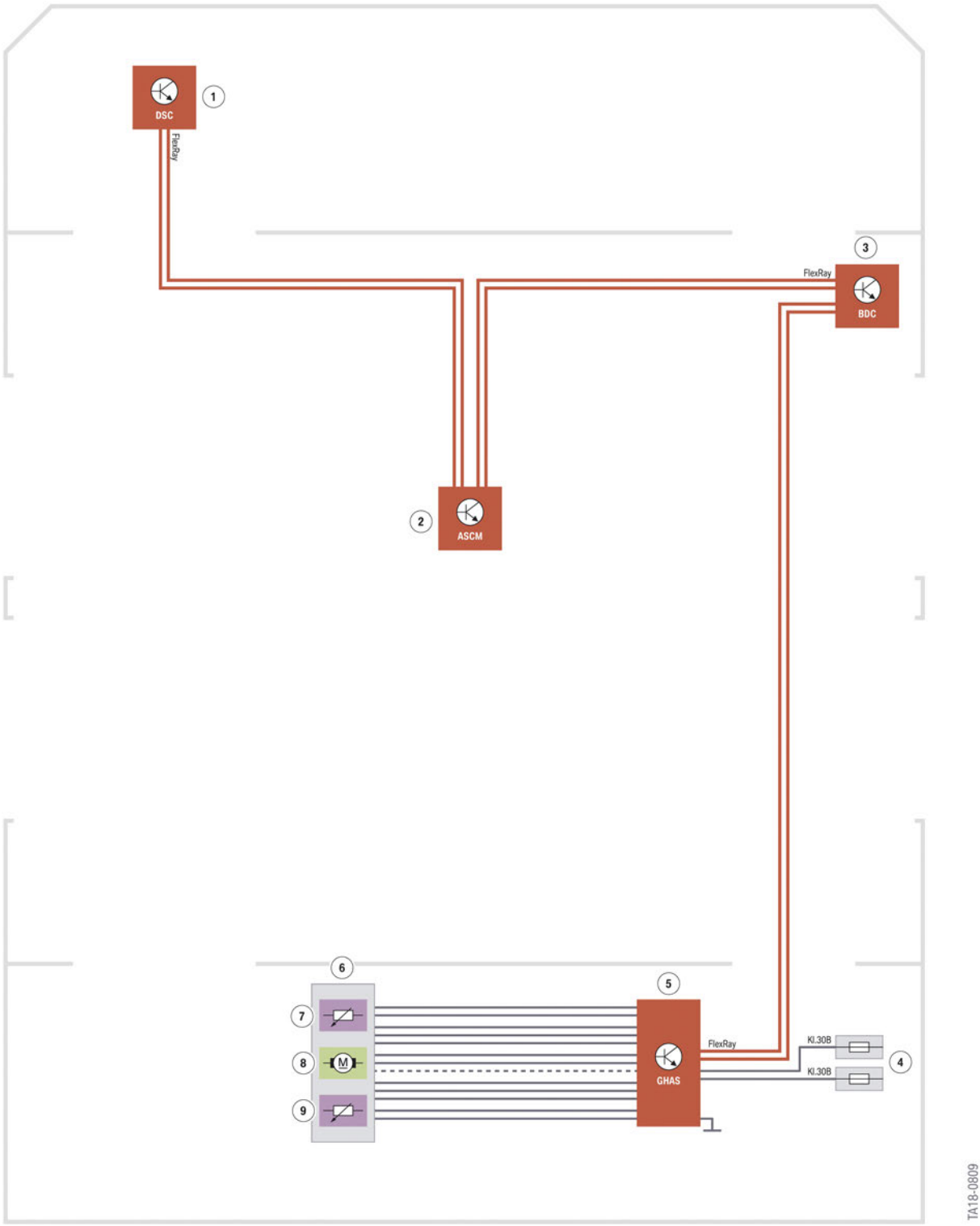
The GHAS considers the following measured values to protect the components and to allow more precise control:

- Rear axle differential oil temperature
- Temperature of GHAS control unit
- Temperature of electric motor

G29 Powertrain/Chassis

3. Automatic Transmission

3.3.3. System wiring diagram



System wiring diagram for regulated rear axle differential lock

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Crash Safety Module (ACSM)
3	Body Domain Controller (BDC)
4	Power distribution box, rear right
5	Regulated rear axle differential lock (GHAS)
6	Electric motor housing
7	Electric motor temperature sensor
8	Electric motor
9	Transmission oil temperature sensor

3.3.4. Note for Service

Oil change

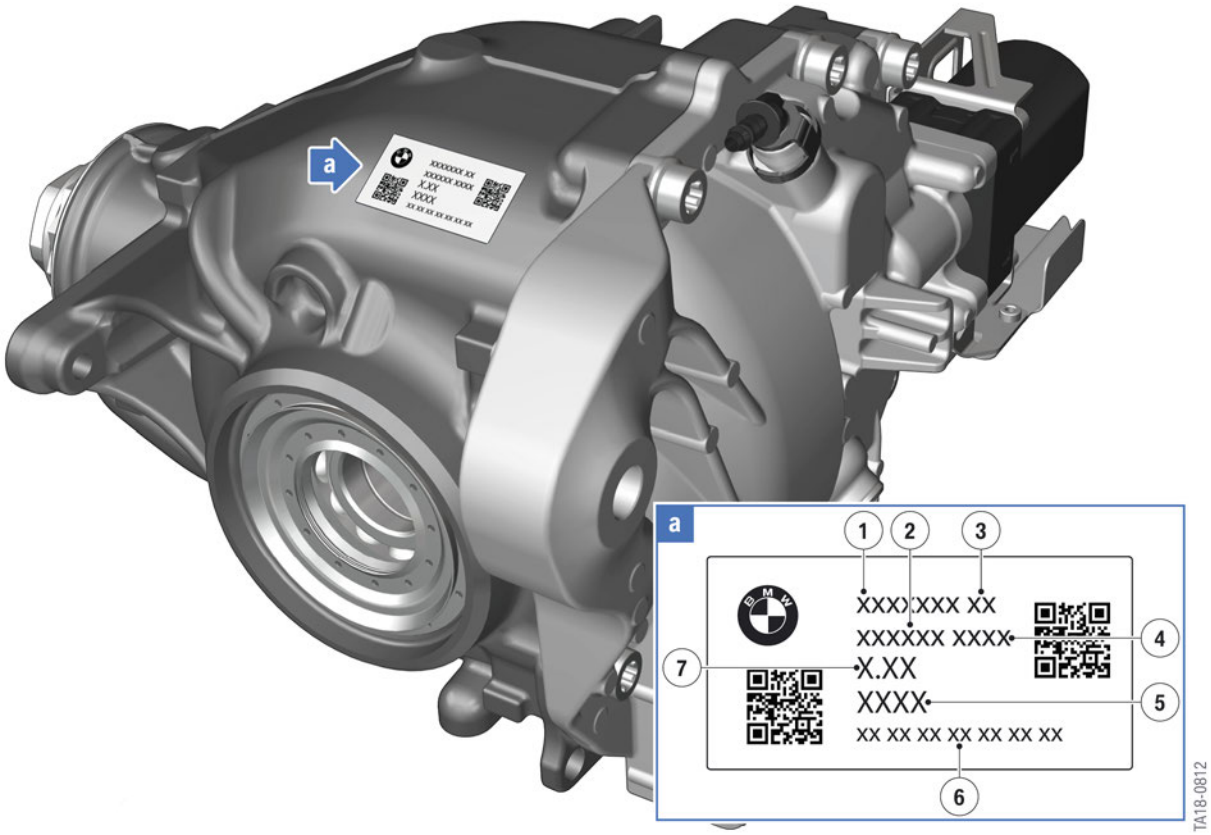
The oil filling of the rear axle differential lock is designed for the entire service life of the assembly.

Vehicles with regulated rear axle differential lock are not designed for use on racing tracks. In the case of use on racing tracks very high temperatures may arise in the rear axle differential which may lead to premature wear of the rear axle differential oil. In the case of a customer complaint "Noises from the rear axle differential", an oil change may be useful before an entire component is replaced.

Classification

Due to the component tolerances of the different components of the regulated rear axle differential lock, the stroke of the ball ramp for closing the multidisc clutch may differ in each case. However, these tolerances can be compensated by adapted control of the electric motor for closing the multidisc clutch.

The respective tolerance or the classification code is determined during production and shown on a type plate of the regulated rear axle differential lock. This type plate is located on the top of the regulated rear axle differential lock.



Classification of regulated rear axle differential lock

Index	Explanation
1	Part number
2	Production date
3	Revision index
4	Production counter
5	Route identification
6	Classification code
7	Ratio

The tolerance can be determined as follows in Service:

- Read out of the classification code via the ISTA diagnosis system.
- Read the classification code off the type plate of the rear axle differential (rear axle differential needs to be lowered).

The 16-digit classification code can be entered in the control unit for the regulated rear axle differential lock (GHAS) using the service function "Correction value of characteristic curve" in the ISTA diagnosis system.

After the following servicing work has been carried out, the classification code must be manually entered in the GHAS control unit:

- Rear axle differential was renewed.
- If the data of the old GHAS control unit can no longer be read out when renewing the GHAS control unit.
- For fault elimination, if invalid or missing correction values were identified in the control unit.

Only the data printed on the type plate can be entered. Incorrectly entered data lead to a decline of the traction or increased wear.

Service functions

Three service functions are currently available for the regulated rear axle differential lock:

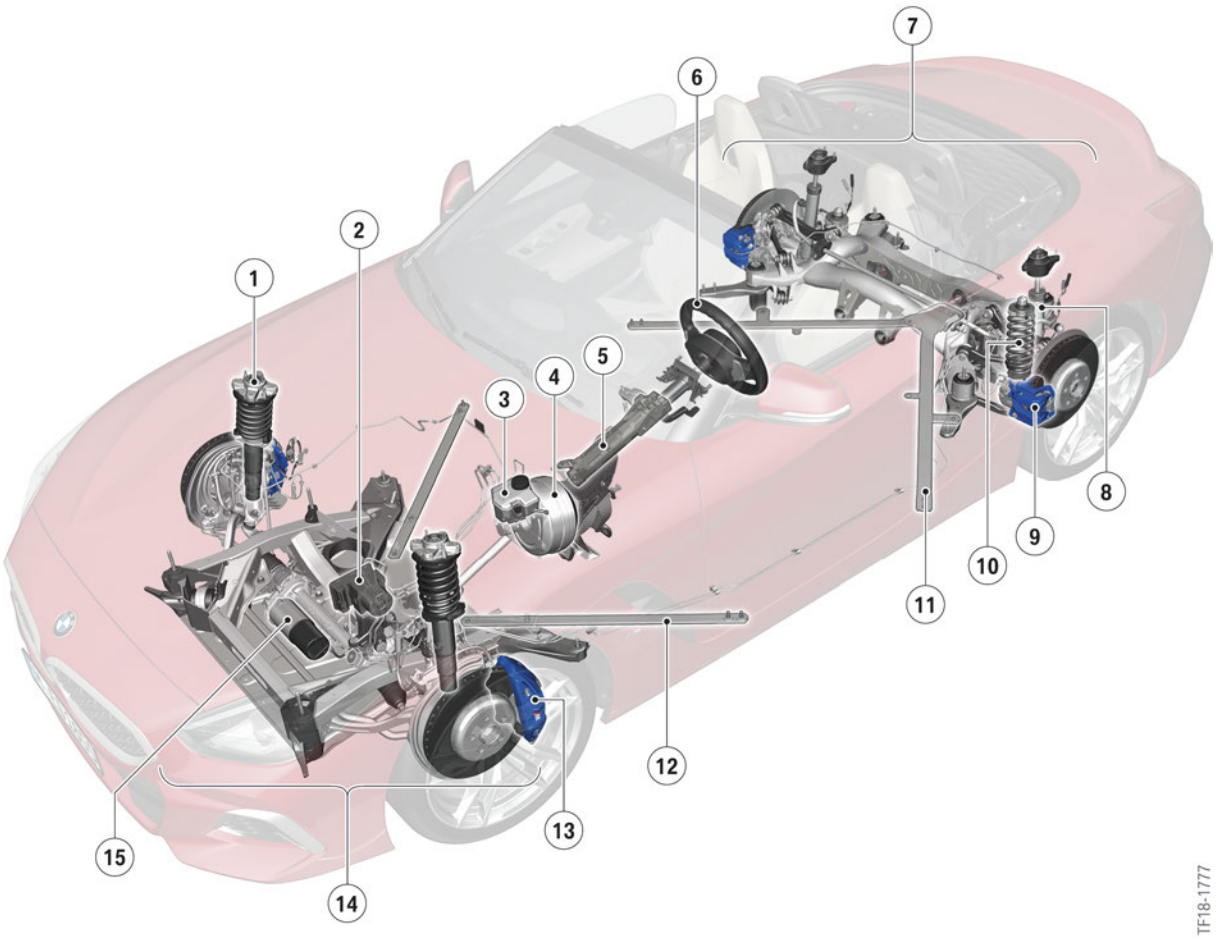
- Delete wear data: This service function must be carried out after the renewal of the electric motor or the entire rear axle differential.
- Renew GHAS control unit: This service function must be carried out after the renewal of the GHAS control unit. This service function is also performed automatically as a post-programming follow-up operation.
- Correction values of characteristic curve: This service function must be carried out after the renewal of the rear axle differential or if the individual data recovery for the GHAS control unit failed. In the second case the rear axle differential must be lowered.

G29 Powertrain/Chassis

4. Chassis and Suspension

4.1. Overview

The chassis and suspension of the G29 were improved compared to its predecessor, the E89, in terms of dynamics while the comfort remains the same. The body structure was geared for rigidity with maximum driving dynamics and stability. An axle layout (50:50) specific to sports cars increases both the driving dynamics and the optional driving dynamics system Electronic Damper Control (EDC).
In the basic version and in the M sports suspension the driving dynamics and the ride comfort were further improved by equipping the shock absorbers at the front with a hydraulic rebound stop (HRS).



G29 chassis and suspension overview

Index	Explanation
1	Front spring strut
2	Dynamic Stability Control (DSC)
3	Brake fluid expansion tank
4	Brake servo
5	Steering column
6	Steering wheel
7	Five-link rear suspension

Index	Explanation
8	Shock absorbers at the rear with EDC valve
9	Brake with electromechanical holding brake of rear axle
10	Rear spring
11	Rear torsion strut
12	Front torsion strut
13	Brake of front axle
14	Twin-arm McPherson strut front suspension
15	Electronic Power Steering (electromechanical power steering) (EPS)

4.1.1. Compared to the predecessor

The following was changed in the G29 in the area of the driving dynamics compared to the E89:

- Shorter wheelbase
- Longer overhangs
- Wider track width (front: +97 mm, rear: +55 mm)
- Larger and wider tires

The following table provides an overview of the chassis and suspension systems used in the G29 compared to the predecessor model E89:

Component	E89	G29
Front axle	Twin-arm McPherson strut front suspension	Twin-arm McPherson strut front suspension
Front suspension	Steel	Steel
Front damping	Conventional or Electronic Damper Control (EDC)	Conventional with Hydraulic Rebound Stop (HRS) or Electronic Damper Control (EDC)
Anti-roll bar, front	Conventional	Conventional
Rear axle	Central link rear axle	Five-link rear suspension
Rear suspension	Steel	Steel
Rear damping	Conventional or Electronic Damper Control (EDC)	Conventional or Electronic Damper Control (EDC)
Rear anti-roll bar	Conventional	Conventional
Front brake	Brake discs up to dia. 348 mm	Brake discs up to dia. 348 mm

Component	E89	G29
Rear brakes	Brake discs up to dia. 324 mm	Brake discs up to dia. 345 mm
Parking brake	Electromechanical holding brake (actuation via EMF control unit)	Electromechanical holding brake (actuation via DSC control unit)
Tire pressure	RDC	RDCi
Front steering	Electronic Power Steering (EPS)	Electronic Power Steering (EPS)

4.1.2. Overview of system descriptions

The systems already familiar from other vehicles will not be examined in any further detail in this document. If required, the detailed system descriptions can be found in the product information listed below.

Topic	Product information
RDCi tire pressure control	G12 Chassis and Suspension
Parking brake	G12 Chassis and Suspension
Electronic Damper Control (EDC)	G12 Chassis and Suspension
Steering	G12 Chassis and Suspension
Electronic tire pressures plate	G30 Chassis and suspension

4.1.3. Chassis and suspension packages

The following chassis and suspension packages are offered in the G29:

- **Basic chassis and suspension**
  The G29 is equipped with steel springs at the front and rear axles. The damping action is effected as standard with conventional shock absorbers. The front shock absorbers are equipped with Hydraulic Rebound Stops (HRS). The springs/dampers on the rear axle are in separate locations.
- **Sports suspension (SA 704)**
  The sports suspension available as optional equipment on the sDrive30i and features a tauter spring/damper design. In this design, the chassis has been lowered by 10 mm.
- **Adaptive M sports suspension (SA 2VF optional for sDrive30i, standard M40i)**
  The Electronic Damper Control (EDC) comes with the optional equipment "M sports suspension". Four continuously adjustable shock absorbers with coupled rebound/ compression stage adjustment produce damping forces according to requirements. The shock absorbers can automatically assume a harder setting (more dynamic/sporty) or softer (more comfortable) setting, depending on the driving manoeuvre.
  For more information on the EDC refer to the chapter "Electronic Damper Control (EDC)".

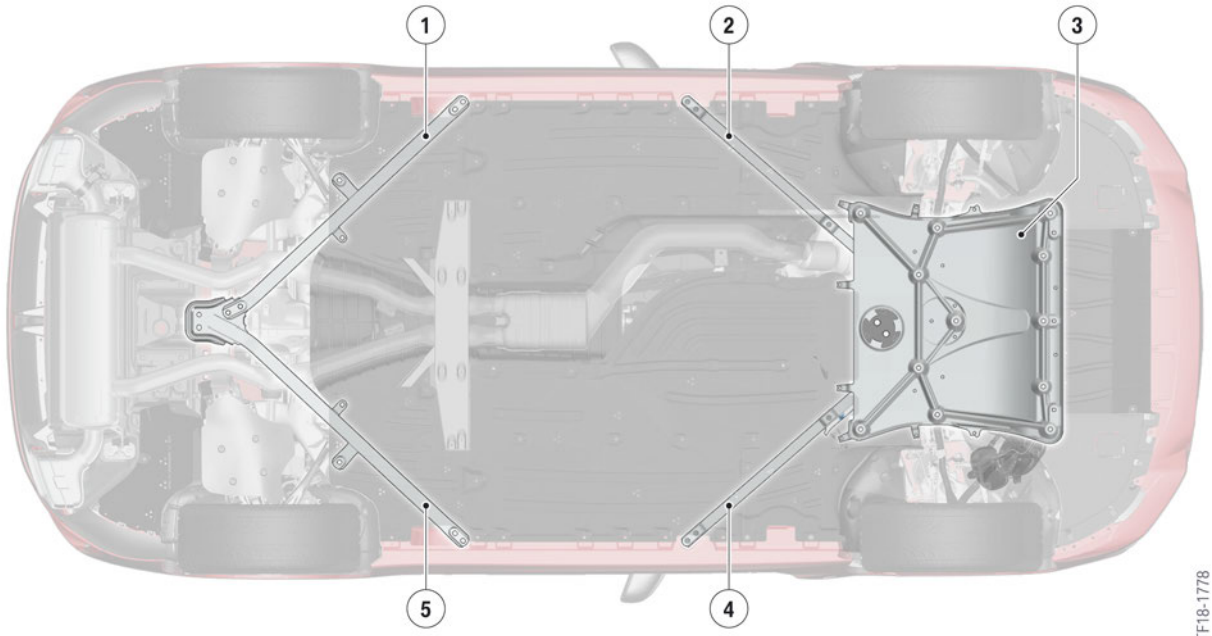
The following table shows the different equipment specifications and scopes in the area of the chassis and suspension for the G29:

System	Basic chassis and suspension	Sports suspension (SA 704)	Adaptive M sports suspension (optional equipment 2VF)
Electronic Power Steering (EPS)	●	●	●
EPS with variable rack geometry	●	●	●
Front shock absorbers with Hydraulic Rebound Stops (HRS)	●	●	-
Electronic Damper Control (EDC)	-	-	●
10 mm lowering	-	●	●

4.2. Stiffening measures

4.2.1. Underbody

Like in the E89, specific torsion struts are used on the front and rear axles to increase the rigidity of the body. They are secured at the body, compression strut and strut mounting. A stiffening plate is also used on the front axle.

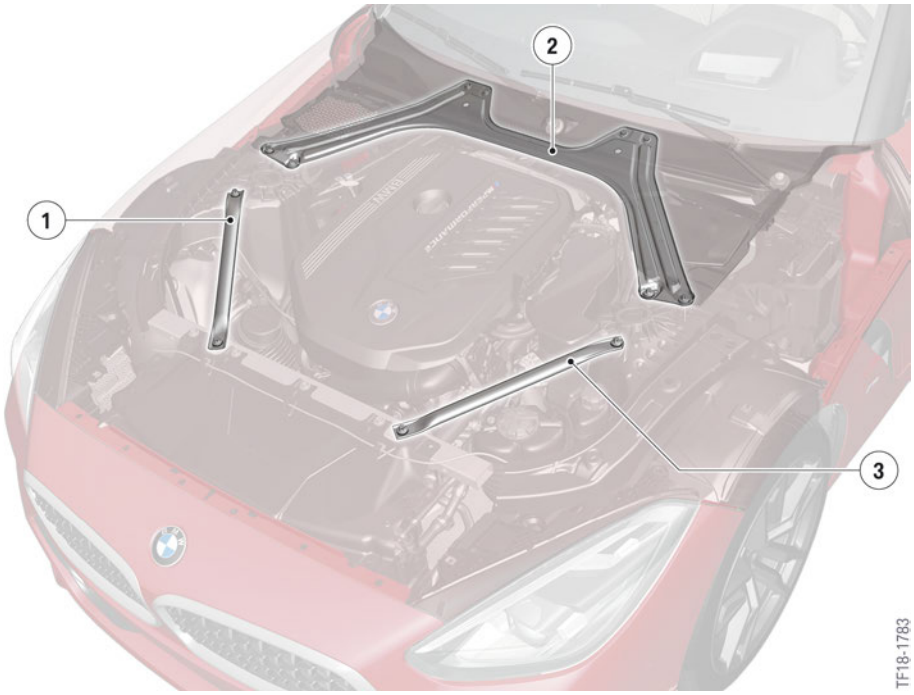


G29 rigidity measures at the vehicle underbody

Index	Explanation
1	Torsion strut at rear right
2	Torsion strut at front right
3	Stiffening plate, front axle
4	Torsion strut, front left
5	Torsion strut at rear left

4.2.2. Engine compartment

Front-end struts and a stiffening plate are used in the engine compartment for stiffening.



G29 rigidity measures in the engine compartment

Index	Explanation
1	Front-end strut right
2	Stiffening plate, engine compartment
3	Front-end strut left

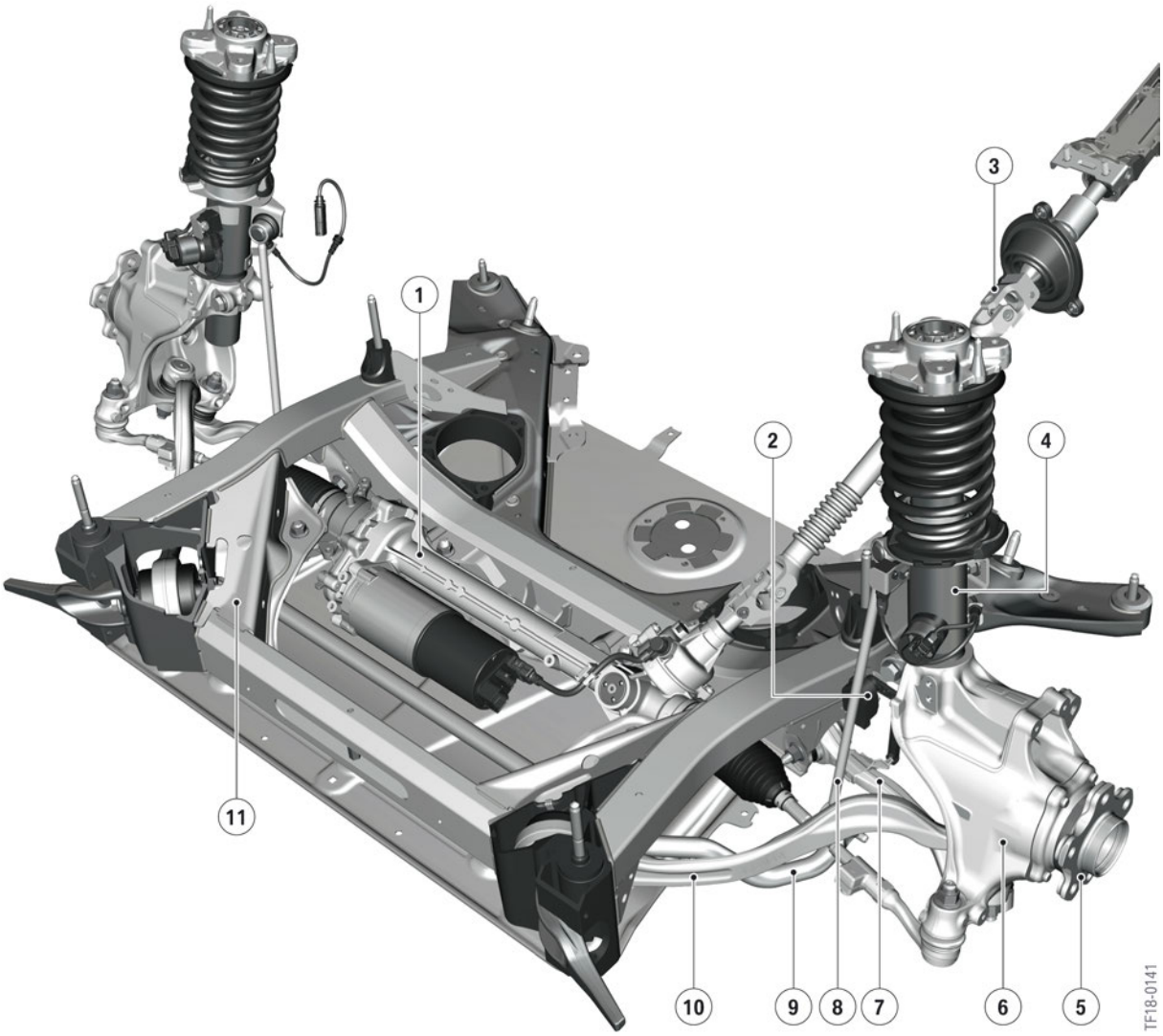
G29 Powertrain/Chassis

4. Chassis and Suspension

4.3. Suspension systems

4.3.1. Front axle

The elastokinematics was optimized at the front axle in terms of steering precision and lateral force potential. This was achieved with the use of an aluminum front axle support designed specifically for the G29, an independent kinematics design and corresponding design of wishbone and tension strut rubber mount.



G29 Twin-arm McPherson strut front suspension

Index	Explanation
1	Steering box
2	Ride height sensor
3	Steering shaft
4	Shock absorber with EDC valve
5	Wheel bearing unit
6	Swivel bearing
7	Wishbone
8	Anti-roll bar link
9	Anti-roll bar
10	Trailing link
11	Front axle support

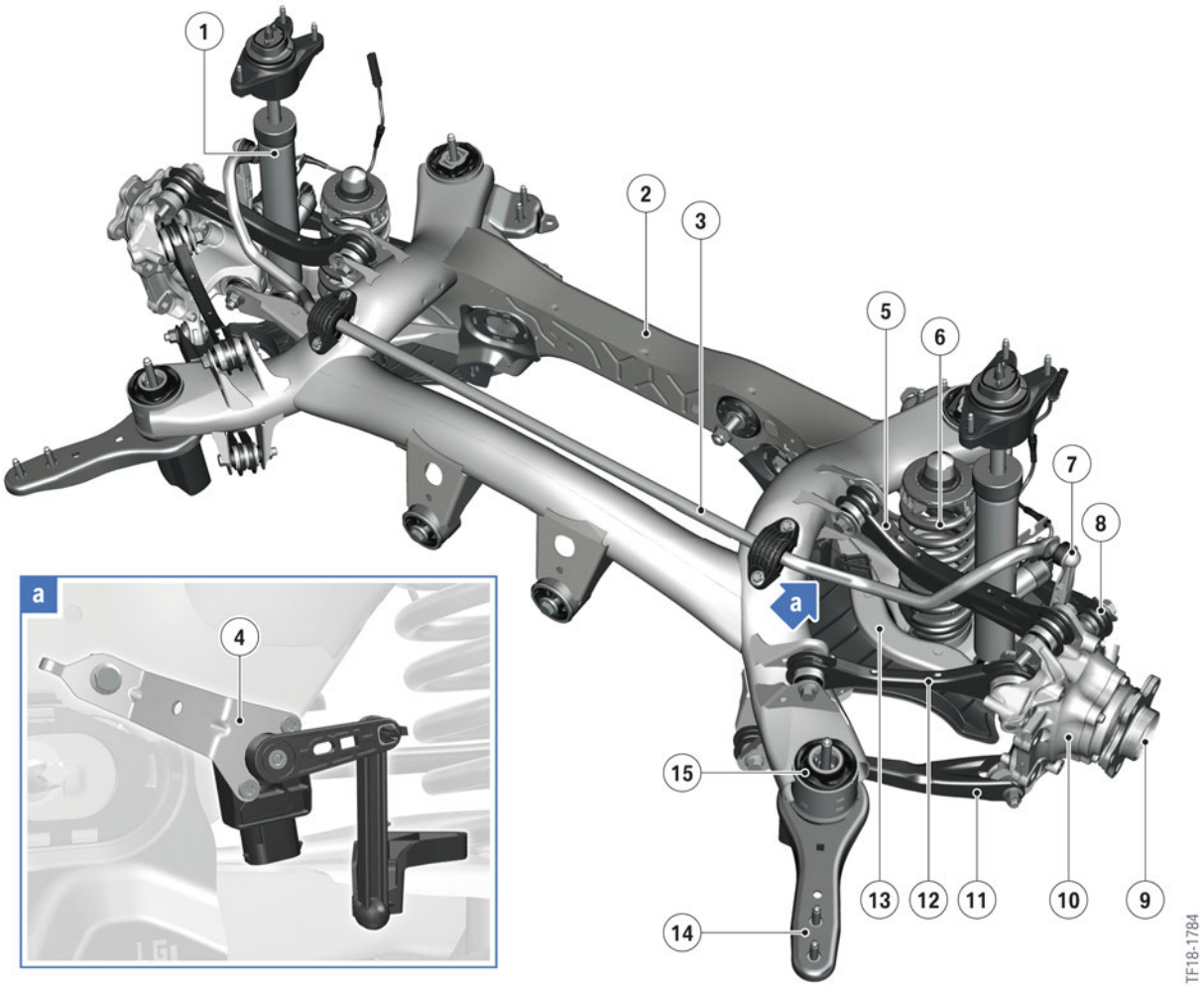
The swivel bearing, wishbone and tension strut are made from aluminum. This means a very low unsprung mass.

4.3.2. Rear axle

The G29 has a five-link rear axle, which was adopted from the G20. However, reinforced wheel carriers and reinforced compression struts are used for the G29.

G29 Powertrain/Chassis

4. Chassis and Suspension



G29 Five-link rear axle

Index	Explanation
1	Shock absorber with EDC valve
2	Rear axle support
3	Anti-roll bar
4	Ride height sensor
5	Wishbone
6	Suspension
7	Anti-roll bar link
8	Camber link
9	Wheel bearing unit
10	Wheel carrier
11	Trailing arm

Index	Explanation
12	Control arm
13	Camber control arm
14	Compression strut
15	Wiper pivot bearing, rear axle support

4.4. Suspension/dampers

4.4.1. Overview

The following overview shows the components of the suspension/damping action used in the G29, depending on the equipment:

Equipment	Axle	Basic chassis and suspension	M Sport suspension OE 704	Adaptive M sports suspension SA 2VF
Twin-tube gas-filled damper with HRS [1]	VA	●	●	-
Twin-tube gas-filled damper	RA	●	●	-
Twin-tube gas-filled damper with EDC valve	VA	-	-	●
	RA	-	-	●
Steel springs	VA	●	●	●
	RA	●	●	●
Anti-roll bar	VA	●	●	●
	RA	●	●	●
Low-slung option	VA	-	10 mm	10 mm
	RA	-	10 mm	10 mm

VA = front axle
RA = rear axle
[1] Hydraulic Rebound Stop (HRS)

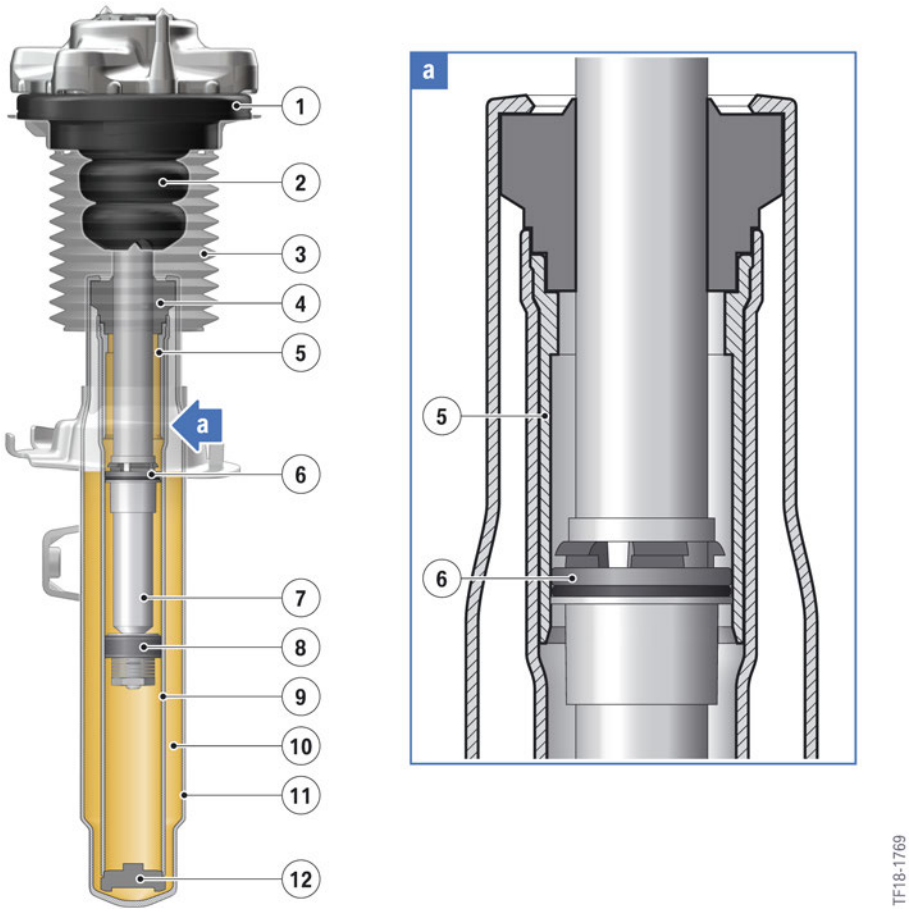
4.4.2. Hydraulic Rebound Stop (HRS)

In order to further improve the driving dynamics and ride comfort, the shock absorbers in the basic version and the M sports suspension were further developed. This could be realized with the use of a Hydraulic Rebound Stop (HRS) in the shock absorbers at the front.

With a rebound stop the range of travel of a shock absorber is limited in order to make possible a soft touch of the bumper at the end stop, also with a high load, in the case of unusually sharp bumps in road (e.g. driving through a pothole, driving over a curb, sharp bumps).

This not only protects the neighboring components, but also reduces the noises arising from these driving situations.

Hydraulic rebound stop (shock absorber at the front)



G29 front shock absorbers

Index	Explanation
1	Support bearing
2	Auxiliary damper (pressure stop)
3	Protective tube
4	Seal and guide of piston rod
5	Sleeve
6	Control ring
7	Piston rod
8	Working piston with piston valve (rebound and compression stage)

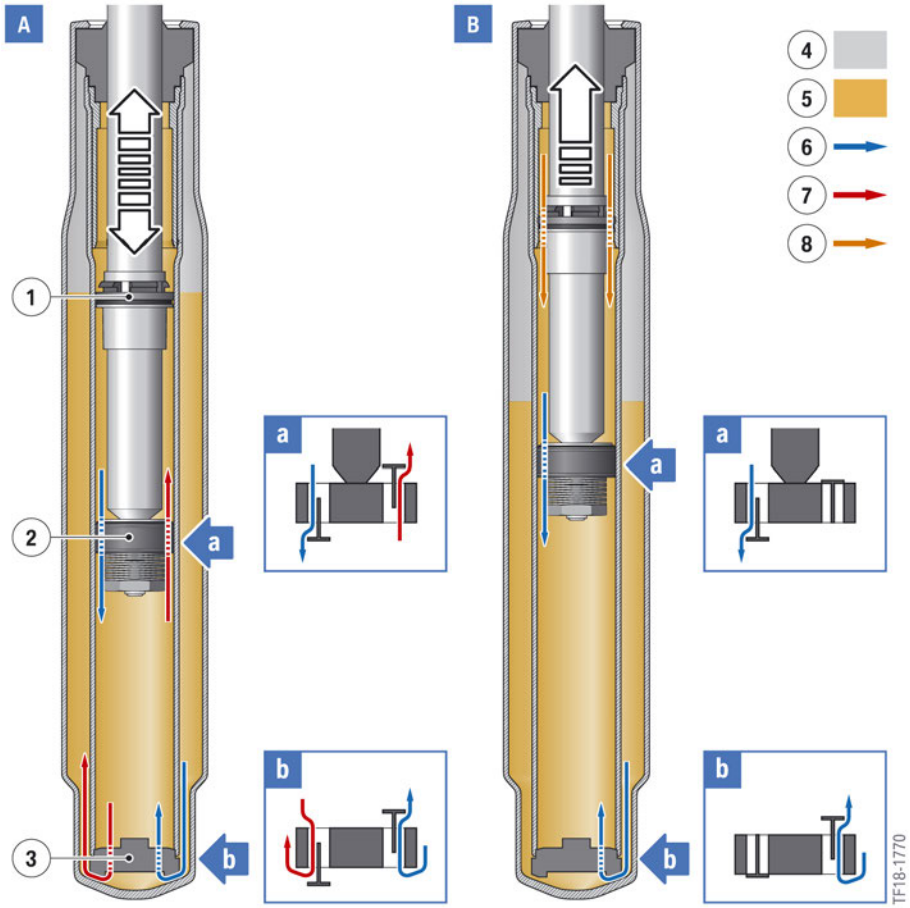
Index	Explanation
9	Working cylinder
10	Equalizing volume for the oil
11	Tank tube
12	Bottom valve (rebound and compression stage)

The front shock absorbers of the E89 were equipped with a mechanical rebound stop. Spring stops have a disadvantage, however, as they only have limited damping capacity. The introduced energy is emitted back to the body when the stop is relieved, which may lead to undesired pitch motions.

In order to further increase the ride comfort of the G29, the front shock absorbers were equipped with a Hydraulic Rebound Stop (HRS) instead of a mechanical rebound stop.

With a small wheel stroke, in normal driving, only the working piston with piston valves (8) and bottom valve (12) have an effect.

If, however, a defined outgoing movement is exceeded (approx. 17 mm), a control ring (8) also positioned on the piston rod drives into a ring-shaped sleeve (7), which is integrated in the working cylinder. The compressed oil volume is driven out of the working space via corresponding throttle cross-sections integrated in the control ring (8) and the outgoing movement is dampened in the stop area. In order to achieve a soft insert of the hydraulic rebound stop, the sleeve was shaped so that its diameter continuously narrows path-dependent. As a result, a progressively increasing force is generated in the rebound direction.



Overview of functions of hydraulic rebound

Index	Explanation
A	Small wheel stroke, in normal driving
B	Outgoing movement > 17 mm
1	Control ring
2	Working piston
3	Bottom valve
4	Gas
5	Hydraulic fluid
6	Oil flow during rebound
7	Oil flow during compression
8	Oil flow in stop range at control ring

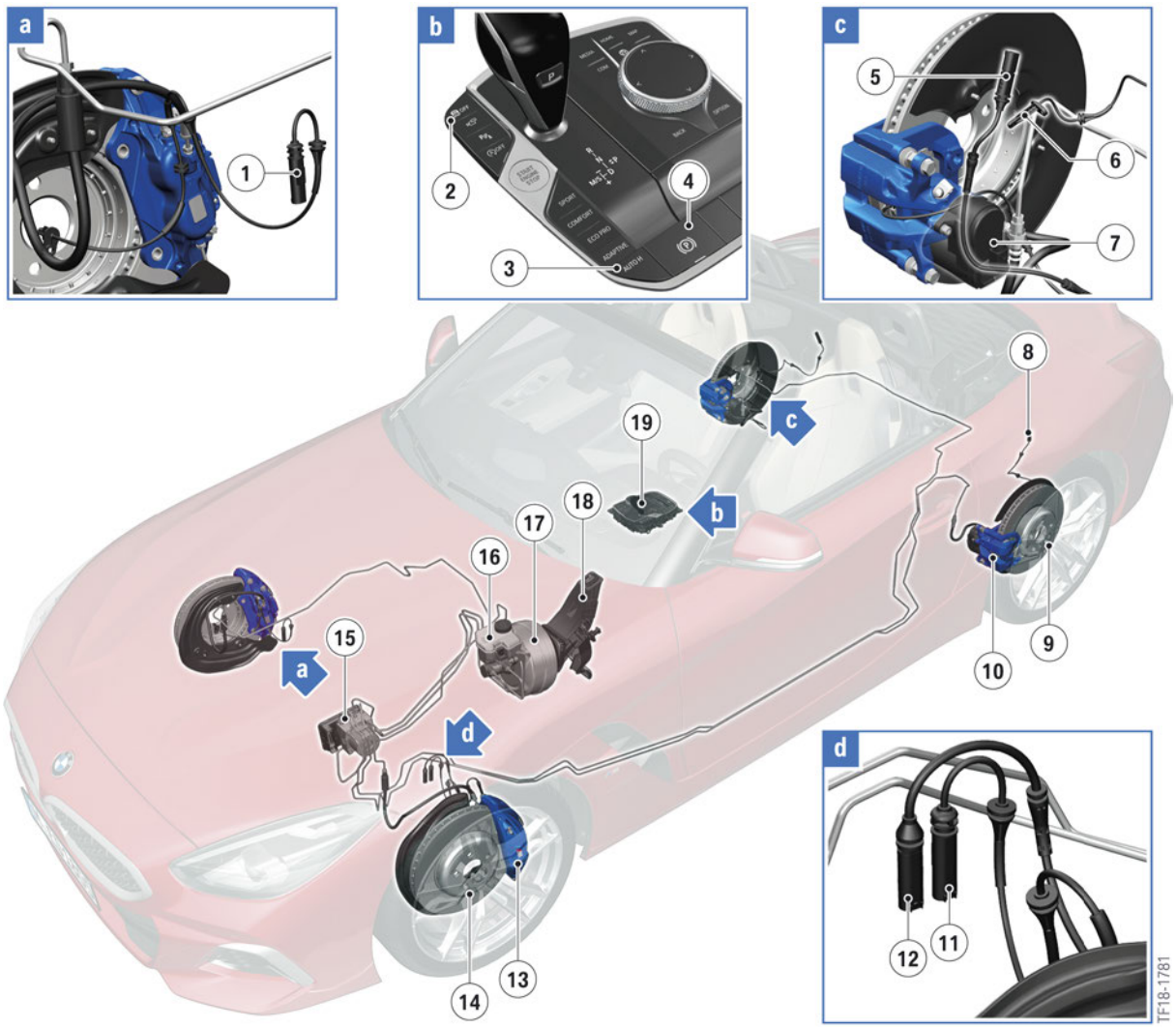
This leads to better slowdown of the wheel, i.e. annoying oscillations are dampened, and a faster restoration of the damper function is achieved. In addition, the end stop forces could be reduced with the hydraulic rebound stop, which means the neighboring components are subject to less load (no force peaks).

G29 Powertrain/Chassis

4. Chassis and Suspension

4.5. Brakes

4.5.1. Overview



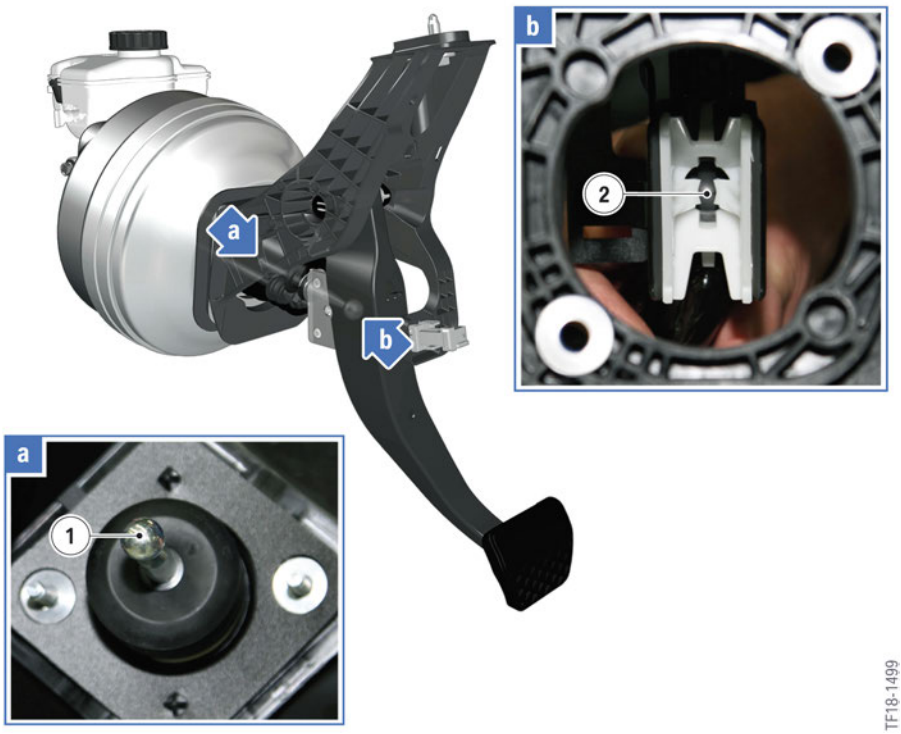
G29 overview of the brake system

Index	Explanation
1	Wheel speed sensor connector, front right
2	DSC button
3	Automatic-hold button
4	Button for electromechanical holding brake
5	Connector for brake pad wear sensor, rear right
6	Wheel speed sensor connector, rear right
7	Electromechanical parking brake actuator

Index	Explanation
8	Wheel speed sensor connector, rear left
9	Brake disc, rear left
10	Brake caliper, rear left
11	Wheel speed sensor connector, front left
12	Brake pad wear sensor connector, front left
13	Brake caliper, front left
14	Brake disc, front left
15	DSC unit
16	Expansion tank
17	Brake servo
18	Pedal mechanism
19	Center console switch cluster

4.5.2. Pedal mechanism mounting

The mounting between the pedal mechanism and the linkage of the brake servo was changed compared to the predecessor model E89. In the G29 the mounting is achieved by clipping the ball head of the linkage of the brake servo into a plastic clip at the pedal mechanism. In the E89 this was achieved with a fork head connection.



Mounting of the pedal mechanism on the brake servo linkage

Index	Explanation
1	Ball head at linkage of brake servo
2	Plastic clip at the pedal mechanism

A special tool is needed to undo this connection.

Special tool for removing the pedal mechanism

When working on the pedal mechanism, always observe the instructions in the current repair instructions.

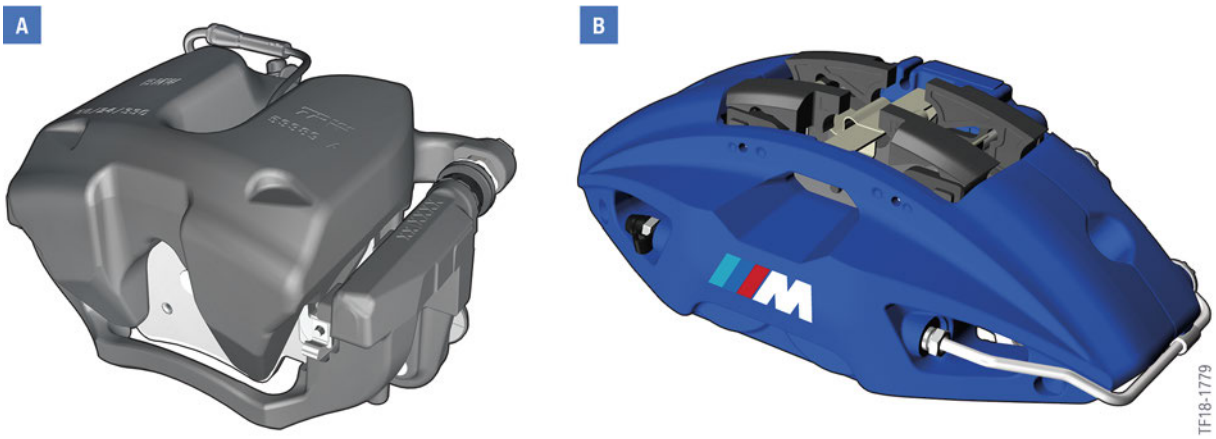
4.5.3. Service brake

Depending on the vehicle and vehicle equipment, various brake calipers are used at the front and rear axle.

G29 Powertrain/Chassis

4. Chassis and Suspension

Front axle

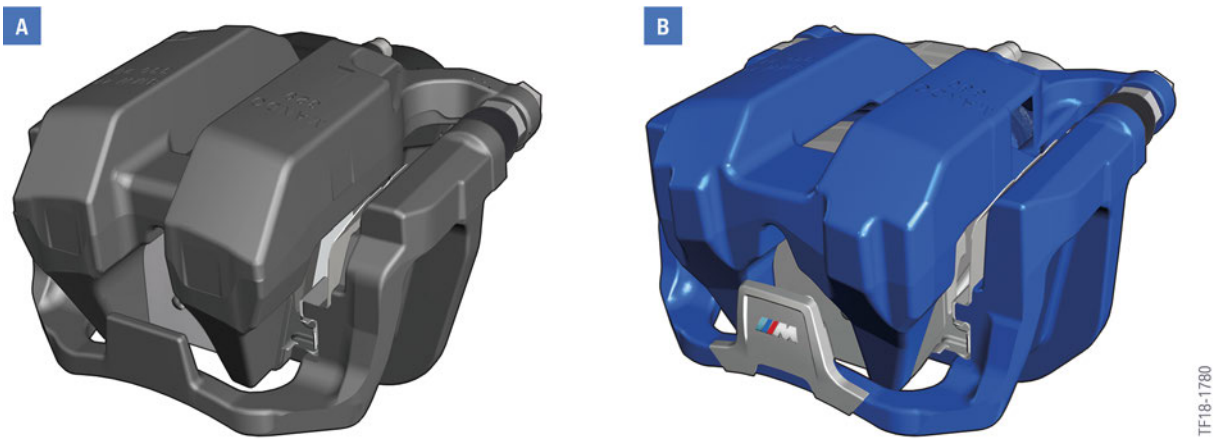


G29 brake caliper variants, front axle

Index	Explanation	Design	Material	Manufacturer	Variable	Brake disc
A	Basic brake	floating caliper	Aluminum	TRW®	17”	330 x 24
B	Sport brake	fixed caliper	Aluminum	Brembo®	17”	348 x 36

Rear axle

Floating caliper brakes with one piston are used on the rear axle. They include the electromechanical holding brake actuator.

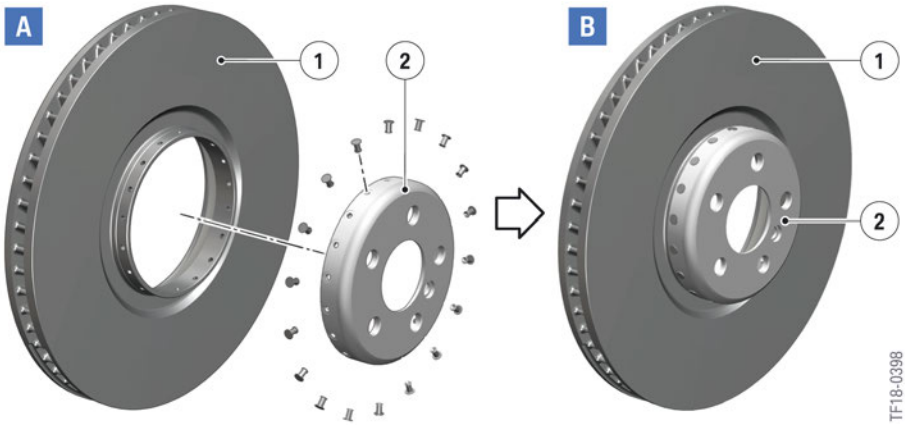


G29 brake caliper variants, rear axle

Index	Explanation	Material	Manufacturer	Variable	Brake disc
A	Basic brake	Aluminum	Mando®	17”	330 x 20
B	Sport brake	Grey cast iron	Mando®	17”	345 x 24

Brake disc

All G29 variants contain a riveted lightweight construction brake disc. The weight reduction is achieved by using a brake disc chamber made of aluminum.



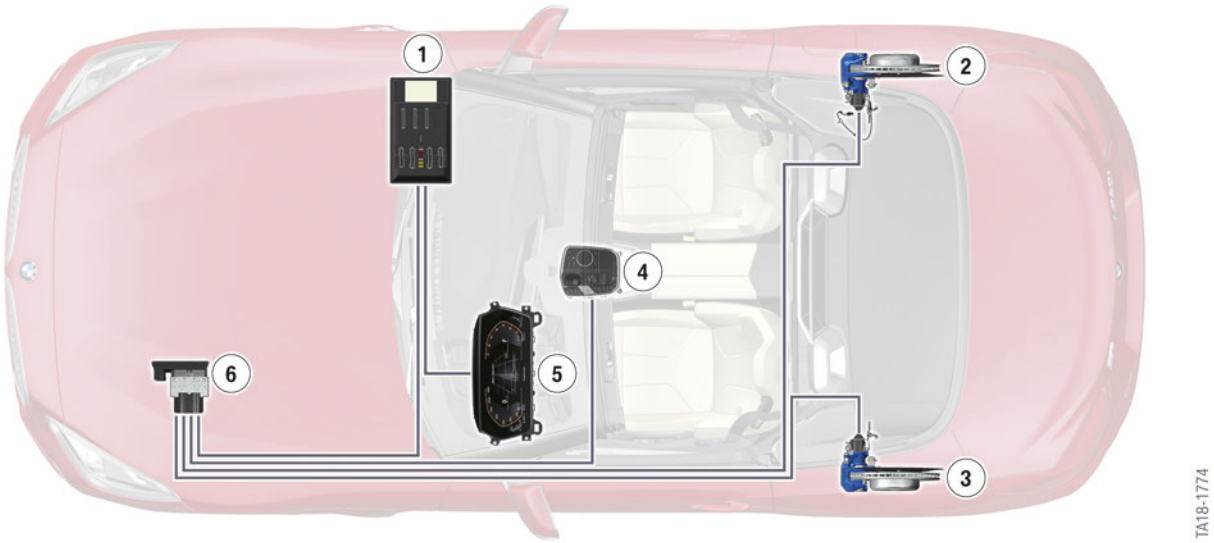
G29 brake disc

Index	Explanation
A	Two-part lightweight construction brake disc, dismantled view (cannot be dismantled in service)
B	Two-part lightweight construction brake disc, assembled view
1	Friction surface
2	Brake disc chamber

Only the complete brake disc can be renewed in service. Separation of the rivets is not permitted.

4.5.4. Parking brake

The electromechanical holding brake in the G29 differs to the predecessor E89 in that a separate control unit for the actuation of the electromechanical holding brake could be dispensed with. The actuation in the G29 is effected via the Dynamic Stability Control DSC. In the E89 the actuation of the electromechanical holding brake is effected via the control unit for the electromechanical parking brake EMF.



G29 electromechanical holding brake

Index	Explanation
1	Body Domain Controller (BDC)
2	Actuator, electromechanical holding brake, rear right
3	Actuator, electromechanical holding brake, rear left
4	Button for electromechanical holding brake
5	Instrument cluster (KOMBI)
6	Dynamic Stability Control (DSC)

At the center console switch cluster there is a parking brake button for activating or deactivating the electromechanical holding brake. The driver is informed about the current system status via the parking brake indicator light in the instrument cluster KOMBI.

Dynamic emergency braking

If the parking brake button is operated during the journey above a defined driving speed, the DSC unit initiates a dynamic emergency braking operation. This means the pump and the changeover valves in the DSC unit are activated and a pressure build-up occurs in all 4 wheel brakes. The slip limits of all wheels are monitored with the assistance of the wheel speed sensors to ensure stable deceleration until the vehicle comes to a standstill.

The two actuators of the electromechanical holding brake are activated as soon as the vehicle comes to a standstill and the vehicle is secured against rolling away.

Automatic release of the parking brake

This function allows the driver to drive off when the electromechanical holding brake is activated without operating the parking brake button to release the brake.

Prerequisites for releasing the electromechanical holding brake:

- Driver's door is closed
- Vehicle condition DRIVING
- Activated electromechanical holding brake
- Drive position engaged
- Accelerator pedal operated

Brake test stand

Test stand mode is integrated in the Dynamic Stability Control DSC for checking the braking power of the parking brake on a brake test stand. With the activation of test stand mode the electromechanical holding brake is activated via the parking brake button and the brake forces are determined.

Test stand mode is automatically detected by means of a plausibility check (wheel speed comparison). The detection takes a maximum of 5 seconds (can be recognized by flashing of the red parking brake indicator light in the KOMBI).

After activation of test stand mode the system is in test stand mode. This condition is acknowledged by the indicator light of the parking brake starting to flash at a frequency of 1 Hz.
The electromechanical holding brake can be applied in up to 5 stages using the parking brake button. The flashing frequency of the parking brake indicator light changes from 1 Hz to 3 Hz when the parking brake button is pressed in test stand mode.

If the parking brake button is operated continuously, the system automatically increases the braking power in increments up to the maximum braking power.

The following points must be observed during the test:

- Do not press accelerator pedal
- Drive position N (neutral)
- Do not press the footbrake

Replacing brake pads

In order to replace the brake pads of the rear parking brake calipers, it is first necessary to turn back the drive spindle in the brake caliper. This can be done either with a special tool manually, or with help of the workshop system. The parking brake button is blocked to prevent use after activation of workshop mode via the workshop system. This prevents injury during the brake service.

The parking brake button is enabled again at the start of a journey or after deactivation of workshop mode.

The parking brake has a roller mode in order to permit determination of the brake forces on a brake test stand. This mode is detected automatically on the basis of a plausibility check (wheel speed comparison).

Emergency release

A manual emergency release is possible via the spindle drives of the brake calipers. The actuator needs to be disassembled first. Following an emergency release, the electromechanical holding brake must be initialized.

Before performing a manual emergency release, the vehicle must be secured against rolling away.

4.6. Wheels/Tires

4.6.1. RDCi tire pressure control

The G29 is equipped with the well-known RDCi system. The following immobilization periods are required to teach-in new wheel electronics.

Vehicle condition	5 minutes	17 minutes
Parking	●	
Residing	●	
PAD mode (testing-analysis-diagnosis)	●	
Driving		●

Warnings

The warning system for the RDCi tire pressure control has been continually developed and modified to meet customer needs during the various development stages. The warning system provides information promptly in the event of pressure deviations and thus makes an important contribution to avoiding vehicle breakdowns as a result of insufficient tire pressures.

At present it is possible to distinguish between three warning levels.

- **Warning level 1**
  Warning level 1 is a message to the customer that the tire pressure has dropped 21–25% tire pressure loss (cold pressure) as a result of natural diffusion (tire pressure loss). There are no technical problems and it is possible to drive on without concern. For this reason a CC message (tire inflation notice) is displayed to the driver for information.
- **Warning level 2**
  The warning level 2 message is shown when the tire pressure has dropped below the legal thr eshold and the customer's comfort and safety is impaired. Accordingly, a yellow warning light is displayed to the driver in the instrument cluster KOMBI as well as a CC message (pressure warning). However, the customer can continue to drive moderately at up to 130 km/h (80 mph). The tire pressure should, however, be corrected as soon as possible.

- **Warning level 3**

  The yellow warning light is shown in the instrument cluster KOMBI if the tire pressure drops suddenly or falls below the threshold value of warning level 3 (tire pressure < 1.5 bar). The driver also receives a CC message (breakdown warning) in which he is requested to stop carefully and visually check the tires. If possible, the tire pressure should be corrected.

It is possible to drive on at a maximum speed of 80 km/h (50 mph) if you have run-flat tires (RSC).

Notes for Service

All 3 warnings are an indication of dropped tire pressure. The RDCi system is therefore working correctly and without faults since it performs its task of monitoring the tire pressures. Electrical vehicle diagnosis is not necessary in this case, as no fault memory entry has been stored.

In the case of warning levels 2 and 3, the tire, tire valve and wheel rim must be additionally checked for tightness and damage.

The manufacturer's information must be observed in the event of any work on the wheels and tires, without fail. Failure to observe these requirements can lead to serious accidents.

4.6.2. Electronic tire pressures plate

As in the G30, the electronic tire pressure specification is also used in the G29. The adhesive tire pressure label is supplemented here by an additional user menu in the Central Information Display (CID).

Unlike the tire pressures plate sticker, the electronic tire pressures plate permanently monitors the nominal pressures taking into consideration the current temperatures. This means that it determines the optimum tire pressure at any temperature and displays it in the central information display.

After the wheels have completed their teach-in drive, the nominal pressures can differ from the actual values determined and entered in the workshop. The background reason for this is the incorporation of the temperatures following a completed teach-in drive. The customer should be informed that although the tire pressures have been checked, these can constantly change depending on the temperature. However, the tire pressures should be adjusted again at an early opportunity if the difference is permanently more than 0.2 bar.

The displayed nominal pressure must be set if only the tire pressure is adjusted and no new wheels are fitted. Resetting the RDCi system (RDCi reset) as required on previous vehicles is no longer necessary. The RDCi warning pressures that are currently valid always relate to the nominal pressure displayed in the CID.

4.6.3. RDC test tool

In the G29 tire-specific data is attached to the tire sidewall in machine-readable format (QR code).

QR code on tires

Index	Explanation
1	RDC test tool
2	QR code
3	Tire sidewall
4	Wheel electronics

This makes it possible to read tire-specific data, such as tire manufacturer, tire size and tire type, using a so-called RDC test tool and to send the data by radio to the corresponding wheel electronics. The calibration of the wheel electronics in the event of a tire change is made considerably easier.

With the RDC test tool the tire pressures of the individual tires can also be read out. This can be useful for troubleshooting at the RDC system.

Further information is provided in the product information for the ST1906 "RDC Tool".

4.7. Steering

The G29 has the Electronic Power Steering (EPS) with axially parallel design (EPS-APA), which is familiar from other series.

The variable sport steering (SA 2VL) is used in the G29 as standard. The more direct steering gear ratio when compared to the basic version of the EPS and the reduced steering angle which is required as a result achieves a more direct vehicle response and higher agility. This comes in handy during avoidance manoeuvres for example. The steering column can be adjusted mechanically.

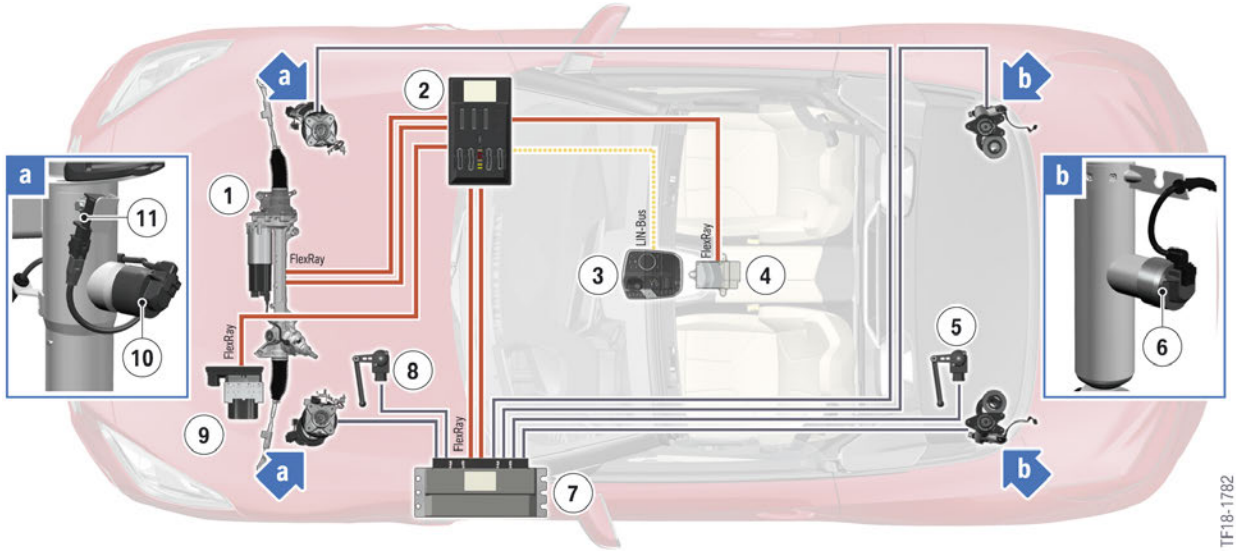
G29 Powertrain/Chassis

4. Chassis and Suspension

4.8. Electronic Damper Control (EDC)

4.8.1. Overview

The Electronic Damper Control (EDC) is a variable, electronically regulated shock absorber adjustment system for the control of the vertical dynamics and is used in the G29 with the chassis and suspension package "Adaptive M suspension" (SA 2VF). It improves the tire comfort of the vehicle while at the same time increasing the driving dynamics. The driver can choose between the more comfortable or more sporty sides of the vehicle's character by means of the drive dynamic control switch.



G29 system overview of Electronic Damper Control (EDC)

Index	Explanation
1	Electronic Power Steering (electromechanical power steering) (EPS)
2	Body Domain Controller (BDC)
3	Driving Experience Control (FES)
4	Advanced Crash Safety Module (ACSM-High)
5	Ride height sensor, rear left
6	EDC valve, rear
7	Vertical Dynamic Platform (VDP)
8	Ride height sensor, front left
9	Dynamic Stability Control (DSC)
10	EDC valve, front
11	Vertical acceleration sensor

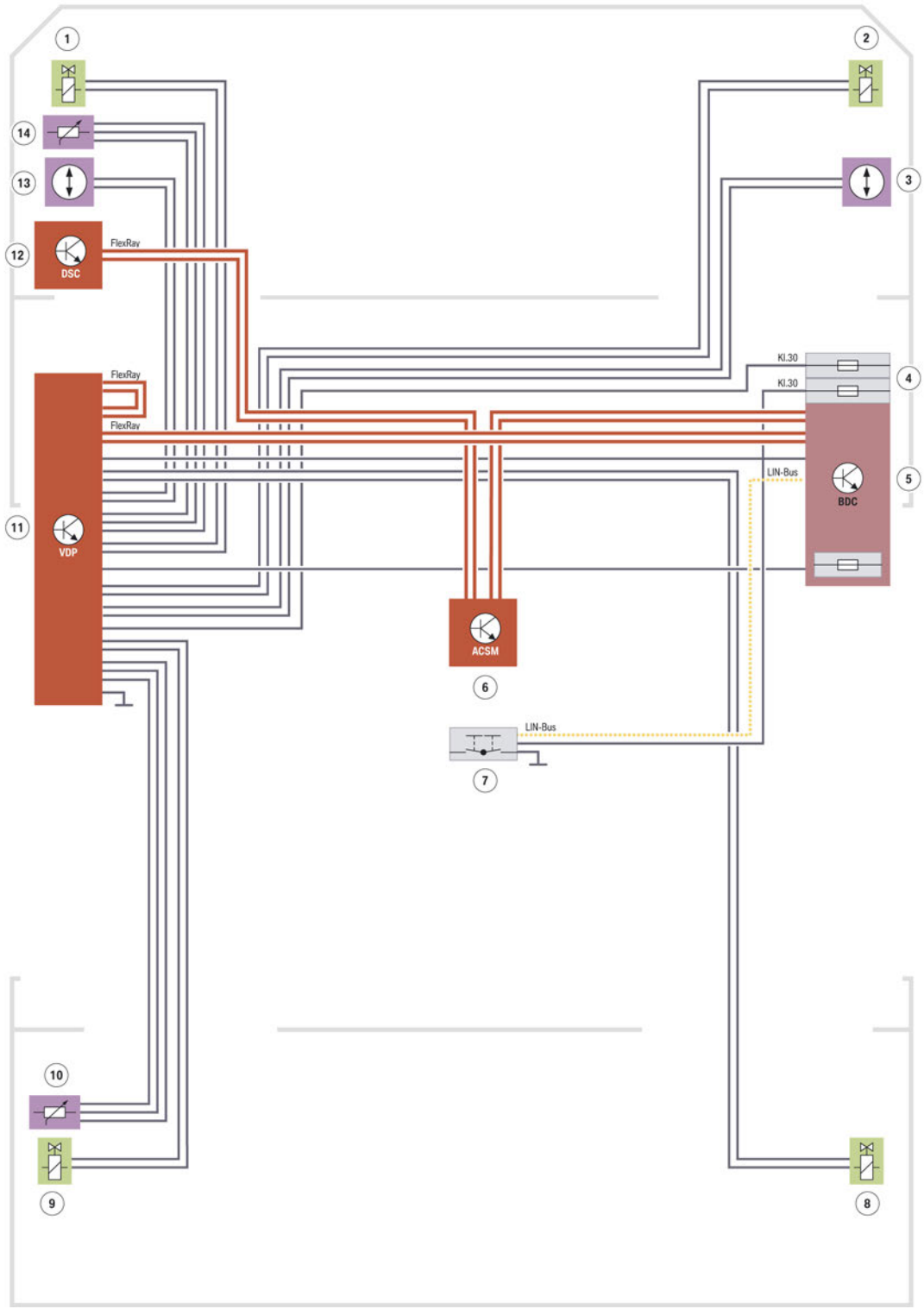
The G29 is fitted with 2 vertical acceleration sensors at the front. The body movements (pitching, rolling and lifting) are detected by the Advanced Crash Safety Module (ACSM).

For this purpose, an enhanced Advanced Crash Safety Module (ACSM High) is installed in the G29 in combination with the Electronic Damper Control (EDC). This detects the body movements by means of additional sensors and makes this information available to the vertical dynamic platform (VDP) control unit.

	ACSM-Low	ACSM-High
Basic chassis and suspension	•	
Sports suspension	•	
M sports suspension		•

A ride height sensor is used additionally on the left side of the front and rear axles. Like the vertical acceleration sensors, these are also read out by the vertical dynamic platform (VDP) control unit.

4.8.2. System wiring diagram



G29 System wiring diagram for Electronic Damper Control (EDC)

G29 Powertrain/Chassis

4. Chassis and Suspension

Index	Explanation
1	EDC valve, front left
2	EDC valve, front right
3	Front right vertical acceleration sensor
4	Power distribution box, front
5	Body Domain Controller (BDC)
6	Advanced Crash Safety Module (ACSM)
7	Driving experience switch
8	EDC valve, rear right
9	EDC valve, rear left
10	Ride height sensor, rear left
11	Vertical Dynamic Platform (VDP)
12	Dynamic Stability Control (DSC)
13	Vertical acceleration sensor, front left
14	Ride height sensor, front left

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