Technical training.
Product information.

G12 LCI PHEV High-voltage Components

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1902 3/1/2019

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: November 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)

G12 LCI PHEV High-voltage Components

Contents

G12 LCI PHEV High-voltage Components

Contents

G12 LCI PHEV High-voltage Components

1. Introduction

1.1. Initial information

With the new BMW 745e xDrive, BMW is adding a further innovative model variant to The Ultimate Driving Machine. With its plug-in hybrid drive, the latest BMW 7 Series variant combines brand-typical driving dynamics with the option of driving electrically and emissions-free during shorter local journeys, while at the same time offering maximum efficiency over long distances.

This reference material only covers the new BMW 745e xDrive in comparison with its predecessor, the BMW 740e iPerformance. Here, knowledge of the predecessor (G12 PHEV) and high-voltage technology of hybrid generation 3.0 is a requirement.

Further information can be found in the listed documents:

Further information
• G12 PHEV High-voltage Components Reference Manual • G12 PHEV High-voltage Battery Unit Reference Manual • G12 LCI PHEV High-voltage Battery Reference Manual

Only Service employees who meet all the requirements are permitted to work on the designated high-voltage components: suitable qualifications, compliance with the safety rules, procedure following the exact repair instructions.

G12 LCI PHEV High-voltage Components

1. Introduction

Work on live high-voltage components is expressly prohibited. Prior to every operation which involves a high-voltage component, it is essential to disconnect the high-voltage system from the voltage supply and to secure it against unauthorized return to service.

1 Charging plug is not connected to the vehicle.

2 Enter the PARK vehicle condition (e.g. by holding down the volume control button).

3 Wait until the vehicle enters "Sleep" mode (identifiable by the fact that the inscription in the START/STOP button is not illuminated).

4 Open high-voltage service disconnect.

5 Secure the high-voltage service disconnect to prevent the high-voltage system against restarting.

6 Activate PAD mode (e.g. by operating the start/stop button three times within 0.8 s).

7 Wait until the Check Control message "High-voltage system switched-off" is displayed in the instrument cluster.

8 Enter PARK vehicle condition.

1.2. Positioning

The BMW 745e xDrive, whose development code is G12 LCI PHEV, is based on the G12 LCI. It is the first vehicle of the new **hybrid generation 4.0**, laying the foundation stone for a series of plug-in hybrid electric vehicles which above all have greater ranges than their predecessor models.

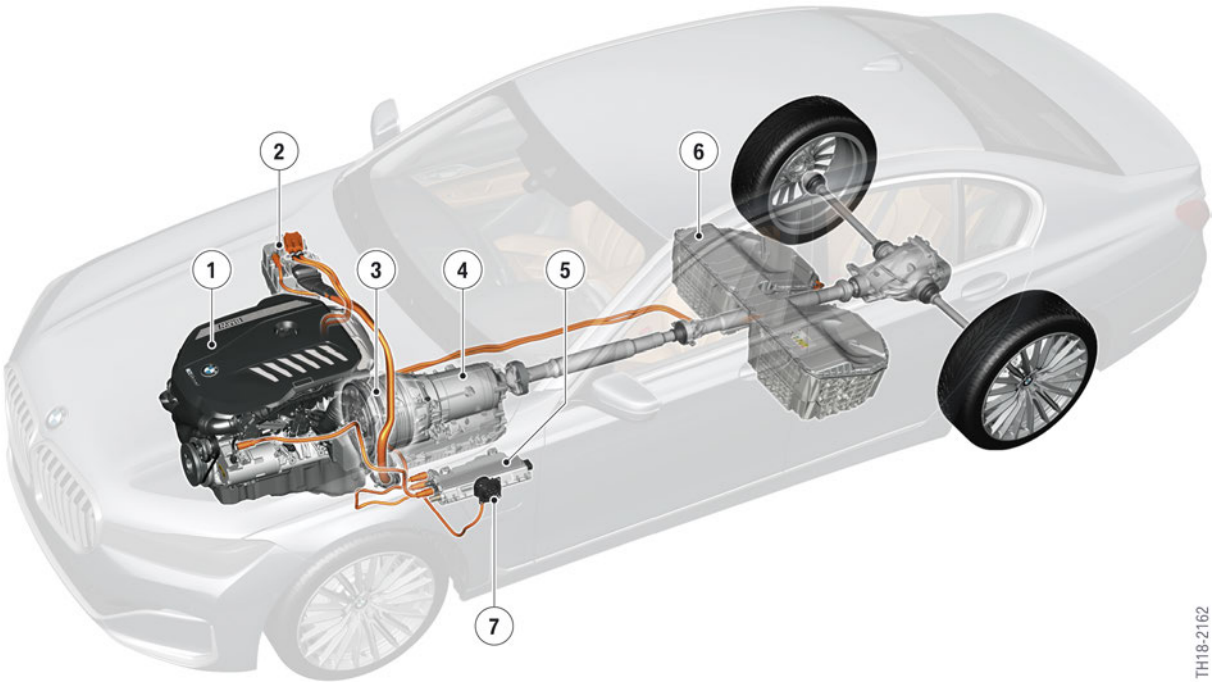
The model designation "iPerformance" and the associated exterior identifying features are no longer used for vehicles of hybrid generation 4.0.

Technically, hybrid generation 4.0 is mostly based on the drive technology used in the BMW iPerformance models (hybrid generation 3.0). The G12 LCI PHEV is a full hybrid vehicle with a lithium-ion high-voltage battery, which can be charged, for example, using a household socket.

The abbreviation PHEV in the development code stands for **P**lug-in **H**ybrid **E**lectric **V**ehicle.

G12 LCI PHEV High-voltage Components

1. Introduction



G12 LCI PHEV Hybrid drive (example with rear-wheel drive shown)

Index	Explanation
1	Combustion engine B58B30M1
2	Electrical Machine Electronics (EME)
3	Electrical machine
4	Automatic transmission GA8P75HZ
5	Convenience charging electronics (KLE)
6	High-voltage battery
7	Charging socket

The higher model designation in comparison with the predecessor model is already an indication of this. The drive of the G12 LCI PHEV consists of a **6-cylinder engine** with TwinPower exhaust turbocharger technology, an 8-speed automatic transmission and an electrical machine. The main advantage of the drive system deployed in the G12 LCI PHEV is the enhanced drive power compared to the predecessor model (293 kW (398 hp) combined system power).

The electric drive of the G12 LCI PHEV enables all-electric driving and thus emissions-free driving at speeds up to 87 mph. The maximum electric range is approx. 24 miles with xDrive.

The driving and drive system modes have been merged and simplified. With the newly assigned Driving Experience Control in the G12 LCI PHEV, the driving modes ADAPTIVE, SPORT, **HYBRID** and **ELECTRIC** can be selected. Each of the last two driving modes can be individualized with regard to efficiency or dynamics. The drive system modes are no longer used in the familiar form. With the ELECTRIC drive system mode, the G12 LCI PHEV runs with all-electric driving at up to 87 mph.

G12 LCI PHEV High-voltage Components

1. Introduction

1.3. Identifying features

1.3.1. Exterior

The exterior identifying features have been significantly reduced in comparison with the BMW iPerformance models of hybrid generation 3.0.

G12 LCI PHEV Exterior identifying features

Index	Explanation
1	Model designation "745e" on the tailgate, right
2	Acoustic cover with "eDrive" inscription
3	Charging socket cover

The acoustic cover of the combustion engine is significantly more unobtrusive with a smaller "eDrive" model inscription. The following exterior identifying features are **no longer** used:

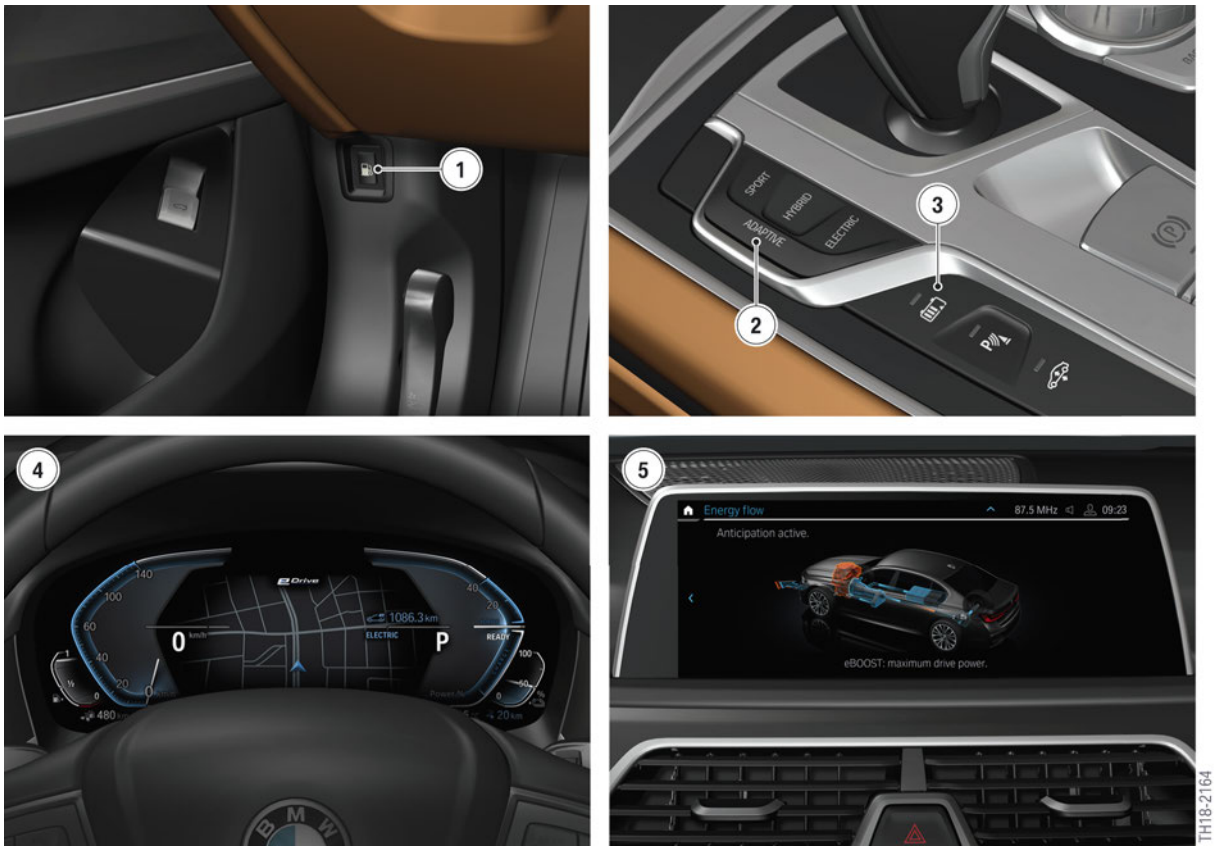
- "eDrive" inscription on both C-pillars
- Hub cap with blue identification
- "i" model inscription on both front side panels
- Blue marking of the air flaps.

G12 LCI PHEV High-voltage Components

1. Introduction

1.3.2. Interior

The most conspicuous new feature of the interior equipment is the new Driving Experience Control with the new driving modes. The familiar eDrive button is no longer present. Its place is taken by the Battery Control button.



G12 LCI PHEV Exterior identifying features

Index	Explanation
1	Refuelling button
2	Driving Experience Control with the driving modes ADAPTIVE, SPORT, HYBRID and ELECTRIC
3	Battery Control button
4	Hybrid-specific displays in the instrument cluster, (KOMBI)
5	eDrive menus in the Central Information Display, (CID)

The installation location of the refuelling button is unchanged on the lower A-pillar trim panel in the driver's footwell.

G12 LCI PHEV High-voltage Components

1. Introduction

1.4. Technical data

Combustion engine and transmission	Unit	BMW 740i xDrive G12 LCI	BMW 740e xDrive G12 PHEV	BMW 745e xDrive G12 LCI PHEV
Design		R6	R4	R6
Number of valves per cylinder		4	4	4
Displacement	[cm^3]	2998	1998	2998
Transmission		GA8HP51Z	GA8P75HZ	GA8P75HZ
Drive		AWD	AWD	AWD
Maximum power, combustion engine	[kW (hp)] [rpm]	250 (340) 5500 – 6500	190 (258) 5000 – 6500	210 (286 hp)
Maximum torque of combustion engine	[Nm] [rpm]	450 1500 – 5200	400 1550 – 4400	450 1500 – 3500
Complete system power	[kW (hp)]		240 (326)	293 (398)
High-voltage battery unit			Lithium-ion	Lithium-ion
Electrical machine peak power	[kW]		83	83
Maximum torque, electrical machine	[Nm]		250	265

Vehicle performances	Unit	BMW 740i xDrive G12 LCI	BMW 740e xDrive G12 PHEV	BMW 745e xDrive G12 LCI PHEV
Acceleration 0 – 60 mph	[s]	4.8	5.1	4.9
Maximum speed	[mph]	130	130	130

Consumption and emissions	Unit	BMW 740i xDrive G12 LCI	BMW 740e xDrive G12 PHEV	BMW 745e xDrive G12 LCI PHEV
Average fuel consumption*	[l/100 km]	–	2.0	2.0 – 2.4**
Average CO_2 emissions*	[g/km]	–	45	45 – 55**

G12 LCI PHEV High-voltage Components

1. Introduction

Dimensions and weights	Unit	BMW 740i xdrive G12 LCI	BMW 740e xDrive G12 PHEV	BMW 745e xDrive G12 LCI PHEV
Vehicle curb weight	[lbs]	4380	4740	4847
Payload US	[lbs]	899	899	833
Fuel tank capacity	[gallons]	20.6	12.1	12.1
Luggage compartment volume	[litres]	515	420	420

– Values were unavailable by the editorial deadline.

* As per the EEC definition (KV01) and with standard tires

** Specifications according to WLTP, depending on fitted equipment

1.5. Equipment

The range of optional equipment on offer for the G12 LCI PHEV also differs. The most important optional equipment that the G12 LCI PHEV does **not** offer is briefly summarized below:

- Active comfort drive with road preview (OE 2VS)
- Space saver spare (OE 300)
- Remote control parking(OE 5DV)

The optional equipment Steptronic sport transmission with shift paddles (SA 2TB) is also used for the first time in the G12 LCI PHEV.

1.6. Overview of changes

The following table provides an overview of the changes to the G12 LCI PHEV in comparison with the G12 PHEV:

G12 LCI PHEV High-voltage Components

1. Introduction

Component / system	G12 PHEV BMW 740e xDrive	G12 LCI PHEV BMW 745e xDrive
Combustion engine	B48B20O0	B58B30M1
Vacuum supply	Mechanical and electrical vacuum pump	Mechanical vacuum pump
Transmission	8-speed automatic transmission with dual-mass flywheel, additional torsional vibration damper, separating clutch and additional electrical transmission oil pump	Adjustments to the 6-cylinder engine: damping characteristics of the dual-mass flywheel and of the additional torsional vibration damper Greater number of discs in the separating clutch K0 4 instead of 3 planetary gears in gear set 2
Electrical machine	GC1P25A (83 kW, 250 Nm) Permanently energized synchronous machine with internal rotor and separating clutch in the automatic transmission, transmission oil cooling	GC1P25M (83 kW, 265 Nm) Software adaptations, permanently energized synchronous machine with internal rotor and separating clutch in the automatic transmission, transmission oil cooling
Brake system	Hybrid brake system with modified DSC unit, electrical vacuum pump, vacuum sensor and brake pedal angle sensor	DSCi brake system
Driving dynamics systems	Two-axle ride level control with Electronic Damper Control (EDC) and mechanical anti-roll bars Optional equipment Integral Active Steering (12 V)	On the whole, more sporty setting: More rigid setting of the Electronic Damper Control (EDC) Harder setting for mechanical anti-roll bars on front and rear axle and thus less rolling motion of the vehicle
Vehicle Sound Generator (VSG)	Separate control unit with integrated loudspeakers on the K CAN3	Function takeover by Receiver Audio Module (RAM) with connected loudspeaker
Driving and drive system modes	4 driving modes (ECO PRO, COMFORT, SPORT, ADAPTIVE) 3 drive system modes (AUTO eDrive, MAX eDrive, BATTERY CONTROL), all can be combined	4 driving modes and BATTERY CONTROL, can be partially individualized
High-voltage battery	Generation 3.0 cell capacity 26 Ah	Generation 4.0 cell capacity 34 Ah

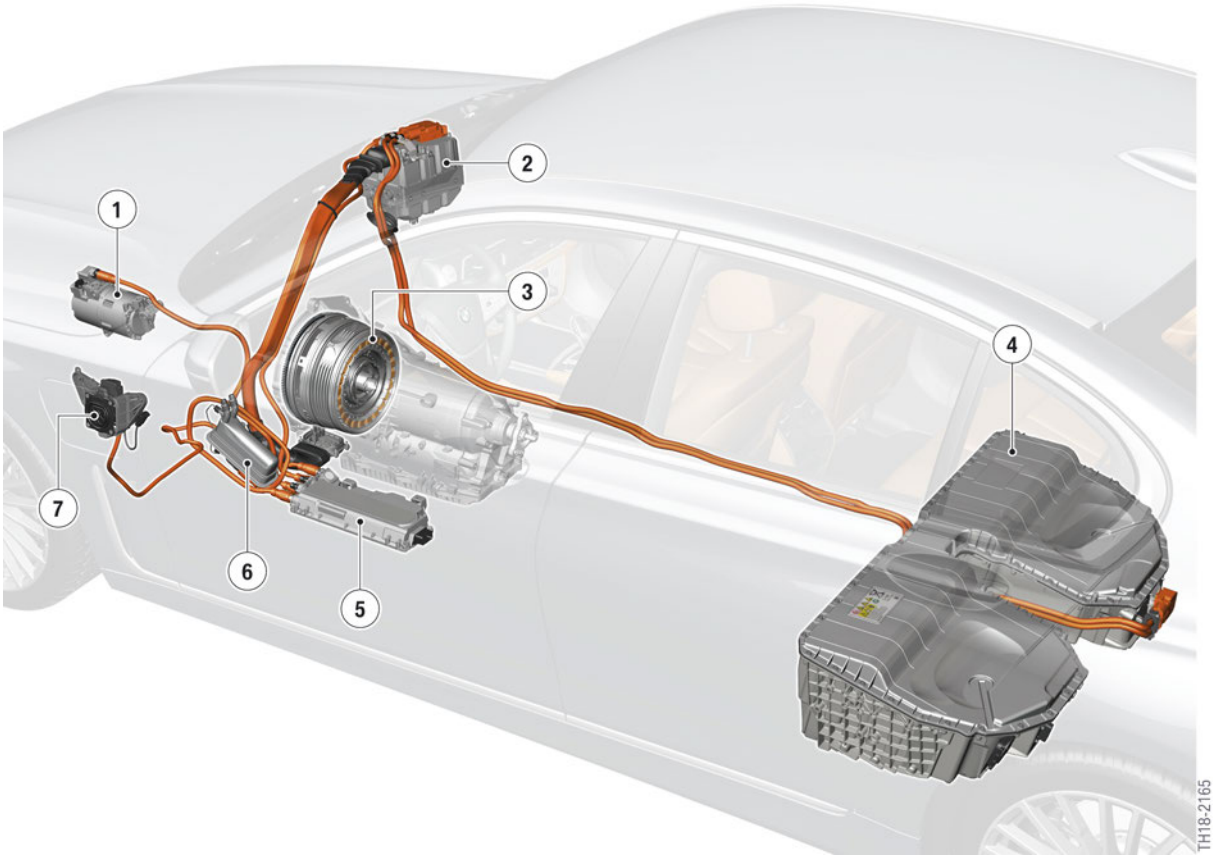
G12 LCI PHEV High-voltage Components

1. Introduction

More detailed information on the alterations to the high-voltage battery can be found in "G12 LCI PHEV High-voltage Battery".

1.7. Hybrid generation 4.0

With the G12 LCI PHEV, the BMW Group is deploying hybrid generation 4.0.



G12 LCI PHEV High-voltage system

Index	Explanation
1	Electric A/C compressor (EKK)
2	Electrical Machine Electronics (EME)
3	Electrical machine
4	High-voltage battery
5	Convenience charging electronics (KLE)
6	Electrical heating (EH)
7	Charging socket

G12 LCI PHEV High-voltage Components

1. Introduction

The most extensive **changes / new features** in the vehicle compared to hybrid generation 3.0 are:

- 6-cylinder engine replaces the 4–cylinder engine
- Increase in the cell capacity in the high-voltage battery
- Variant of the drive system modes.

Many high-voltage components and hybrid-specific adaptations have been adopted for the G12 LCI PHEV **unchanged** from hybrid generation 3.0 (excluding minor changes to software or adaptations to the 6-cylinder engine):

- Electrical machine
- Automatic transmission GA8P75HZ
- Electrical Machine Electronics (EME)
- Convenience charging electronics (KLE)
- Electric A/C compressor (EKK)
- Electrical heating (EH)
- Fuel supply with pressurized fuel tank below the luggage compartment
- High-temperature and low-temperature coolant circuits
- 12 V power supply with vehicle battery and auxiliary battery in the luggage compartment (supplementary start system)
- Auxiliary battery with separate intelligent battery sensor (IBS2) and separate safety battery terminal (SBK 2)
- High-voltage service disconnect in the luggage compartment on the right and rescue disconnect in the engine compartment on the right.

1.7.1. Training

Qualification to work on the high-voltage system of the G12 LCI PHEV can be acquired via the respective **web-based training** if the service employee meets the following **requirements**:

Performing work on high-voltage components

- Valid "High-voltage Components" certification for another vehicle of hybrid generation **3.0**
  OR
- Valid "High-voltage Components" certification for another vehicle of hybrid generation **4.0**

Working on the high-voltage battery

- Valid "G12 LCI PHEV High-voltage Components" certification

  AND
- Valid "High-voltage Battery" certification for another vehicle of high-voltage battery generation **3.0** or **4.0**.

G12 LCI PHEV High-voltage Components

1. Introduction

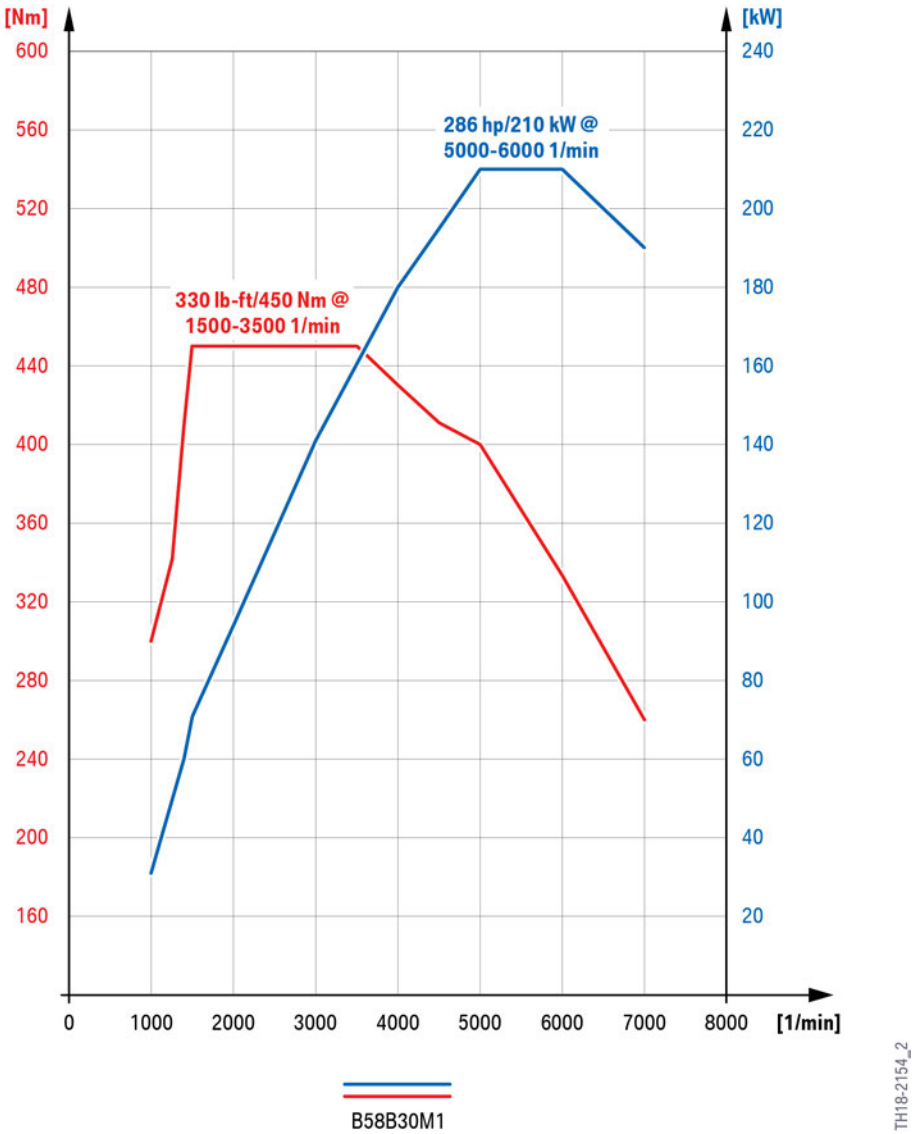
As the list indicates, a first-time qualification for hybrid generation 4.0 can be acquired via web-based training if the relevant valid qualification for hybrid generation 3.0 has already been obtained. Face-to-face training specifically for qualification for hybrid generation 4.0 is then not required.

G12 LCI PHEV High-voltage Components

2. Drive

2.1. Modified B58TU engine

In the G12 LCI PHEV, the B58B30M1 is a constituent part of the hybrid drive. The 3.0-liter engine generates an output of 286 hp and a maximum torque of 330 lb-ft.



Torque and power output diagram of the B58B30M1 in the G12 LCI PHEV

The most extensive changes compared to the conventional B58TU engine are:

- Simplified belt drive
- Vibration damper with rigid belt pulley
- Mechanical vacuum pump (despite DSCi brake system)

G12 LCI PHEV High-voltage Components
2. Drive

- Improved air intake system with resonator
- Starter motor adapted to the more frequent starting operations
- Wiring harness adapted to the engine peripherals.

G12 LCI PHEV B58B30M1 engine

Some of the changes are discussed in more detail in the following subchapters.

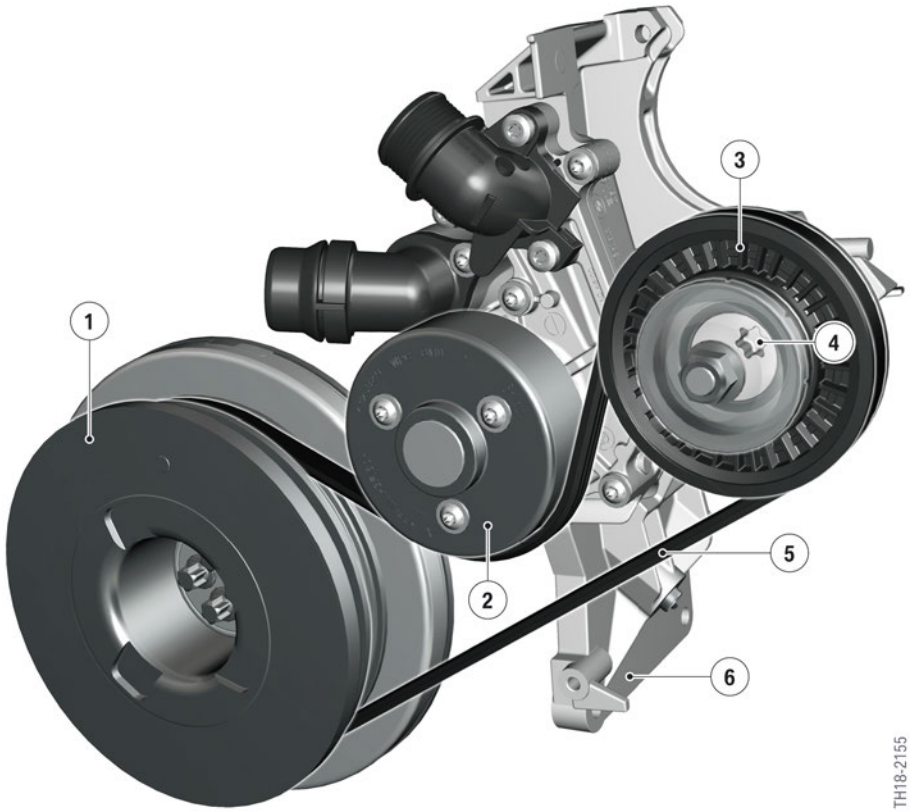
2.1.1. Belt drive

For deployment in the G12 LCI PHEV, the belt drive has been modified compared to the B58TU engine in a conventional vehicle. The elimination of the alternator and mechanical air conditioning compressor enabled a reduction in the width of the belt from 6 ribs to 3 ribs.

The vibration damper has also been adapted to the modified belt drive. A viscous vibration damper with rigid belt pulley is used.

G12 LCI PHEV High-voltage Components

2. Drive



G12 LCI PHEV Belt drive B58B30M1

Index	Explanation
1	Viscous vibration damper with rigid belt pulley
2	Coolant pump belt pulley
3	Tensioning pulley
4	Eccentric tensioning device
5	Elastic belt
6	Component carrier

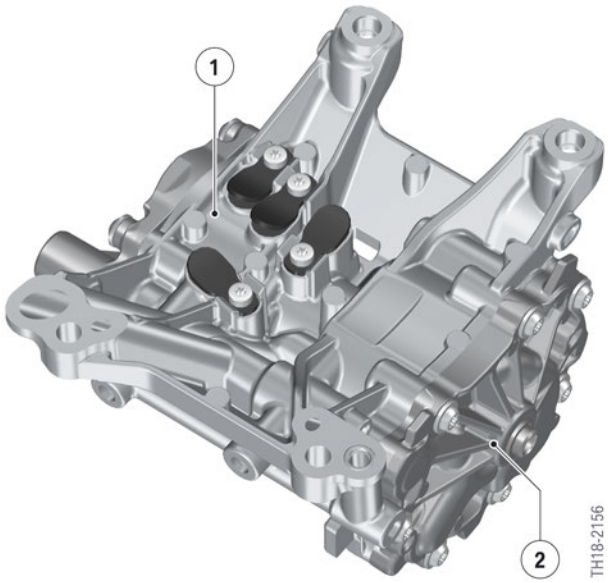
The belt is tensioned via an eccentric tensioning pulley mounted on the component carrier. The dust-protected tensioning device is located under a cover on the tensioning pulley.

A belt that is not tensioned in line with accepted technical principles can lead to loss of function of the driven component or to damage. The notes and instructions in the current repair instructions therefore apply.

G12 LCI PHEV High-voltage Components
2. Drive

2.1.2. Vacuum supply

The installation of the DSCi brake system means that the electrical vacuum pump is not required in the G12 LCI PHEV. The controlled damping mounts, however, will continue to be fitted.



G12 LCI PHEV Oil vacuum pump in the B58TU engine

Index	Explanation
1	Integrated mechanical vacuum pump
2	Tandem oil pump

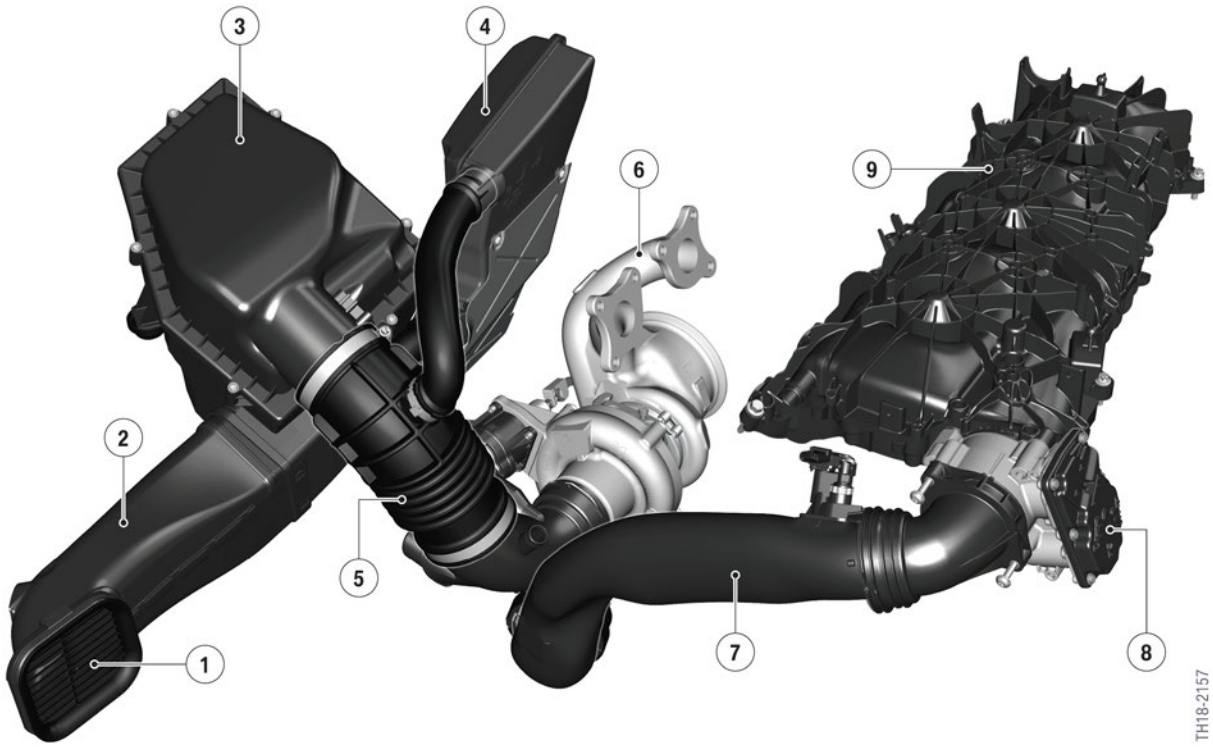
The B58TU engine in the G12 LCI PHEV has the mechanical vacuum pump integrated in the oil pump. This already generates sufficient vacuum during both the initial and supplementary start of the combustion engine to switch the engine mounts to "soft".

G12 LCI PHEV High-voltage Components

2. Drive

2.1.3. Air intake system

The air intake duct of the B58TU engine has been revised with regard to flow control, efficiency and reduction of the installation space.



G12 LCI PHEV Air intake system, B58TU engine

Index	Explanation
1	Unfiltered air intake with grille
2	Unfiltered-air duct
3	Intake silencer
4	Resonator
5	Clean air pipe
6	Exhaust turbocharger for cylinder-head integrated exhaust manifold
7	Charge air hose
8	Throttle valve
9	Air intake system with integrated indirect charge air cooler

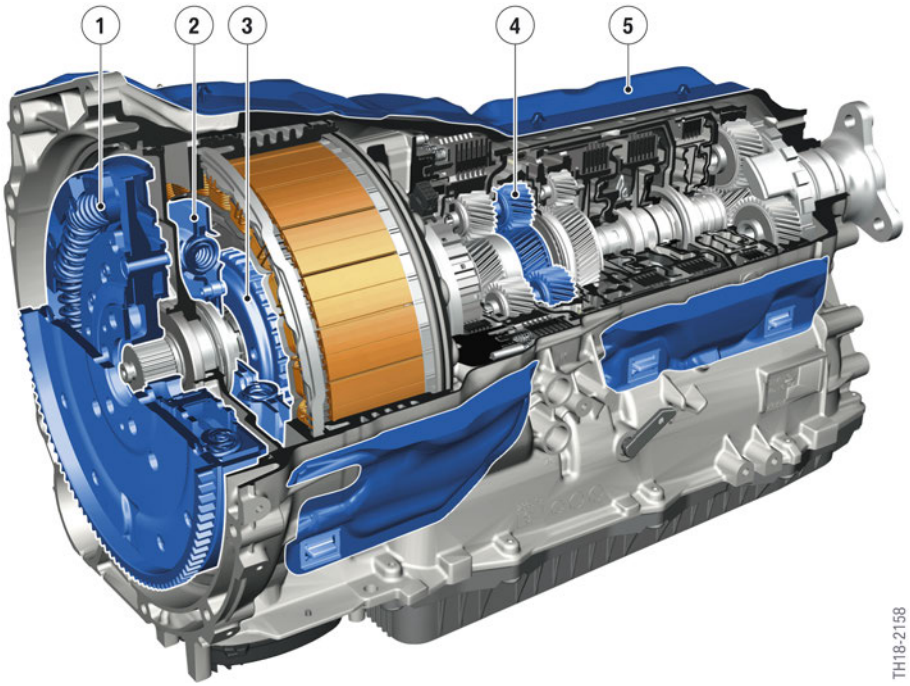
The resonator on the clean air pipe has been reduced in size and provides an improvement in acoustics. It is fitted with a heat protection plate.

G12 LCI PHEV High-voltage Components

2. Drive

2.2. Automatic transmission

In order to adapt the GA8P75HZ transmission to the 6-cylinder engine, the changes listed below have been made (in comparison with the GA8P75HZ transmission in the G12 PHEV).



Overview of changes GA8P75HZ

Index	Explanation
1	New configuration of the damping characteristics of the dual-mass flywheel
2	New configuration of the damping characteristics of the additional torsional vibration damper
3	Increase in the number of discs in the separating clutch K0
4	Increase in number of planetary gears from 3 to 4 in gear set 2
5	Adaptive changes to the SynTAK trim panel

There have been no changes to the electronic emergency transmission release in comparison with the predecessor model.

G12 LCI PHEV High-voltage Components

2. Drive

2.3. Electrical machine

The electrical machine is a component that has been adopted from vehicles of hybrid generation 3.0. However, the permanently energized synchronous machine is activated with higher currents by the Electrical Machine Electronics (EME), increasing the maximum torque from 250 Nm to **265 Nm**.

The torque increase meant that a new type approval test was carried out and the last letter in the designation of the electrical machine was changed as follows: GC1P25M.

The electrical machine is a high-voltage component!

High-voltage component warning sticker

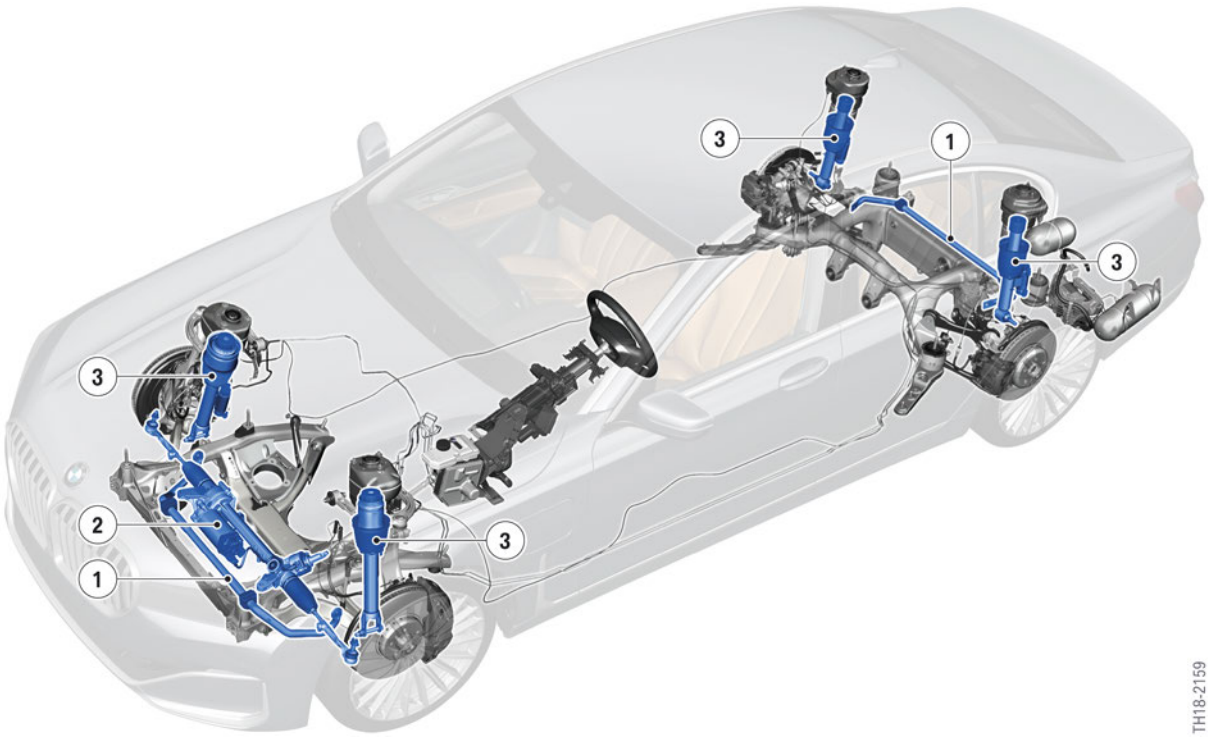
Only Service employees who meet all the requirements are permitted to work on the designated high-voltage components: suitable qualifications, compliance with the safety rules, procedure following the exact repair instructions.

G12 LCI PHEV High-voltage Components

3. Chassis and Suspension

3.1. Driving dynamics systems

With the introduction of the more powerful B58TU engine in the hybrid drive, the driving dynamics systems were also optimized and given a more sporty configuration. The following graphic provides an overview of the changes to the standard suspension in comparison with the standard suspension of the G12 PHEV.



G12 LCI PHEV Overview of changes to driving dynamics systems

Index	Explanation
1	Harder setting for mechanical anti-roll bars on front and rear axle and thus less rolling motion of the vehicle
2	More sporty setting of the Electronic Power Steering (EPS)
3	More rigid setting of the Electronic Damper Control (EDC)

3.2. Hybrid brake system

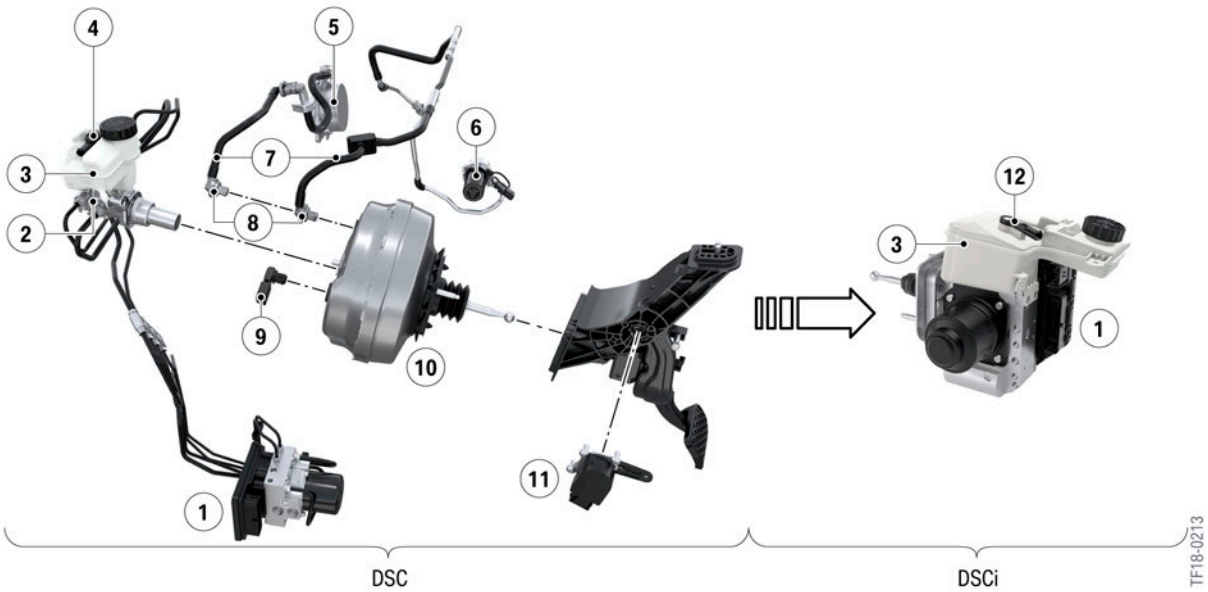
3.2.1. Overview

Also in the G12 LCI PHEV, the deceleration is composed of a **hydraulic** braking proportion and a **regenerative** braking proportion.

G12 LCI PHEV High-voltage Components

3. Chassis and Suspension

In contrast to the predecessor model, the new **DSCi brake system** is deployed. A comparison of the previous system structure of the DSCi brake system reveals a clear reduction in the number of components required. The regenerative braking within the DSC brake system, which was previously implemented, is easily performed with the DSCi brake system. This means it does not need any extra DSCi variant for a hybrid vehicle.



System overview of DSC and DSCi brake system (example)

Index	Explanation
DSC	Dynamic Stability Control
DSCi	Dynamic Stability Control integrated
1	DSC unit
2	Tandem brake master cylinder
3	Expansion tank
4	Brake fluid level switch
5	Mechanical vacuum pump
6	Electrical vacuum pump
7	Vacuum line
8	Non-return valve
9	Brake vacuum pressure sensor
10	Brake servo
11	Brake pedal travel sensor
12	Brake fluid level sensor

G12 LCI PHEV High-voltage Components

3. Chassis and Suspension

The following components which enabled the hybrid functions of the DSC brake system used until now are no longer present in the G12 LCI PHEV:

- Electrical vacuum pump
- Specially modified DSC unit
- Brake vacuum pressure sensor
- Brake pedal angle sensor.

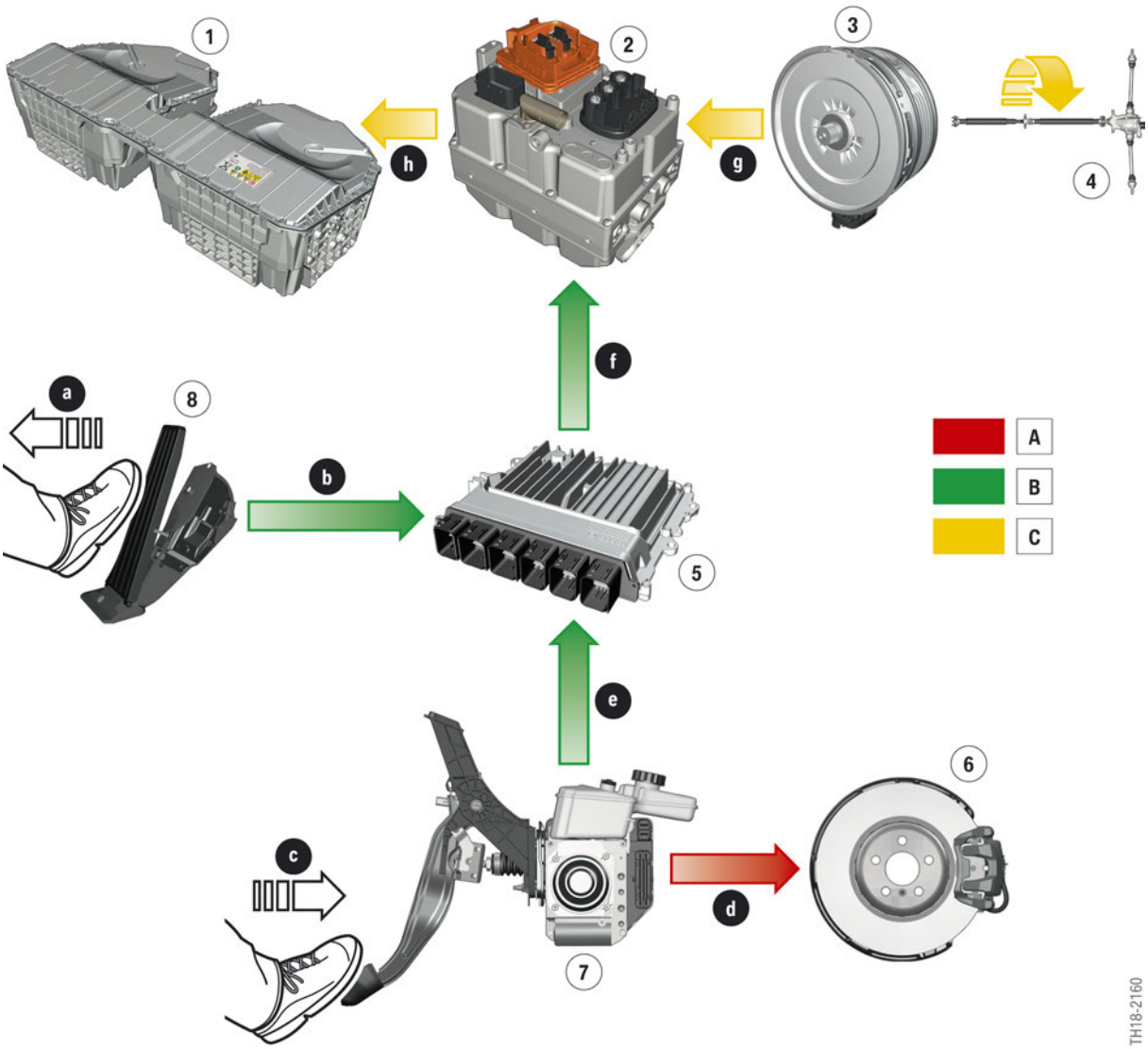
The mechanical vacuum pump is still present in the G12 LCI PHEV to supply the controlled damping mount with vacuum (see subchapter "Vacuum supply").

This chapter only provides you with an overview of the DSCi brake system. More detailed information and service notes can be found in the "DSCi" Reference Manual.

G12 LCI PHEV High-voltage Components

3. Chassis and Suspension

3.2.2. System overview



System overview of hybrid brake system

Index	Explanation
A	Hydraulic braking
B	Signal path
C	Regenerative braking
1	High-voltage battery
2	Electrical Machine Electronics (EME)
3	Electrical machine
4	Drivetrain
5	Digital Motor Electronics (DME)

Index	Explanation
6	Wheel brakes
7	Brake pedal with DSCi unit
8	Accelerator pedal module
a	Releasing the accelerator pedal
b	Electrical signal "accelerator pedal angle" from the accelerator pedal module to the DME (coasting energy recovery)
c	Operation of the brake pedal
d	Hydraulic pressure from the DSC to the wheel brakes
e	Bus message "recuperation torque" from the DSCi to the DME
f	Bus message "recuperation torque" from the DME to the EME (coasting energy recovery and regenerative braking)
g	Electrical energy generated by the electrical machine (high AC voltage)
h	Rectified high voltage (DC) for storage in the high-voltage battery

3.2.3. Regenerative braking

The regenerative braking enables brake energy regeneration. The electrical machine works here as an alternator and brakes the sprockets via automatic transmission – propeller shaft – rear axle differential – output shafts. Using the energy generated here, the high-voltage battery is charged via the electrical machine electronics (EME).

Energy recovery takes place as soon as the accelerator is not operated. Depending on the driving mode selected, the deceleration which occurs during the coasting energy recovery is different.

When the driver presses the brake pedal, the brake request is sensed via a brake pedal travel sensor integrated in the DSCi unit. Two driver separator valves prevent the hydraulic pressure generated from being able to act in the direction of the wheel brake. Instead, the hydraulic pressure passes through the opened simulator valve to the brake pedal force simulator. An elastomer inside the brake pedal force simulator generates the customary counter-force.

The sensor signal of the brake pedal travel sensor is processed by the DSCi control unit and the "recuperation torque" is forwarded to the Electrical Machine Electronics (EME). In response, the EME activates the electrical machine as an alternator and the vehicle is decelerated by the energy recovery.

The maximum permissible brake force by brake energy recovery is subject to stability monitoring of slip, lateral accelerations and stability control processes. It is thus ensured that the vehicle constantly remains in a stable driving condition, also during brake energy regeneration.

The energy recovery level is reduced or is not permitted in the following operating conditions:

1 On detection of adversely affected driving stability, the energy recovery level is reduced.

2 If emergency braking is detected, the deceleration request is implemented purely hydraulically in order to ensure fast implementation of the hydraulic interventions at the individual wheels as required.

3 If no energy recovery is available (for example fully charged high-voltage battery or temperature limits exceeded), the deceleration is implemented purely hydraulically.

4 At driving speeds below approx. 10 mph.

3.2.4. Hydraulic braking

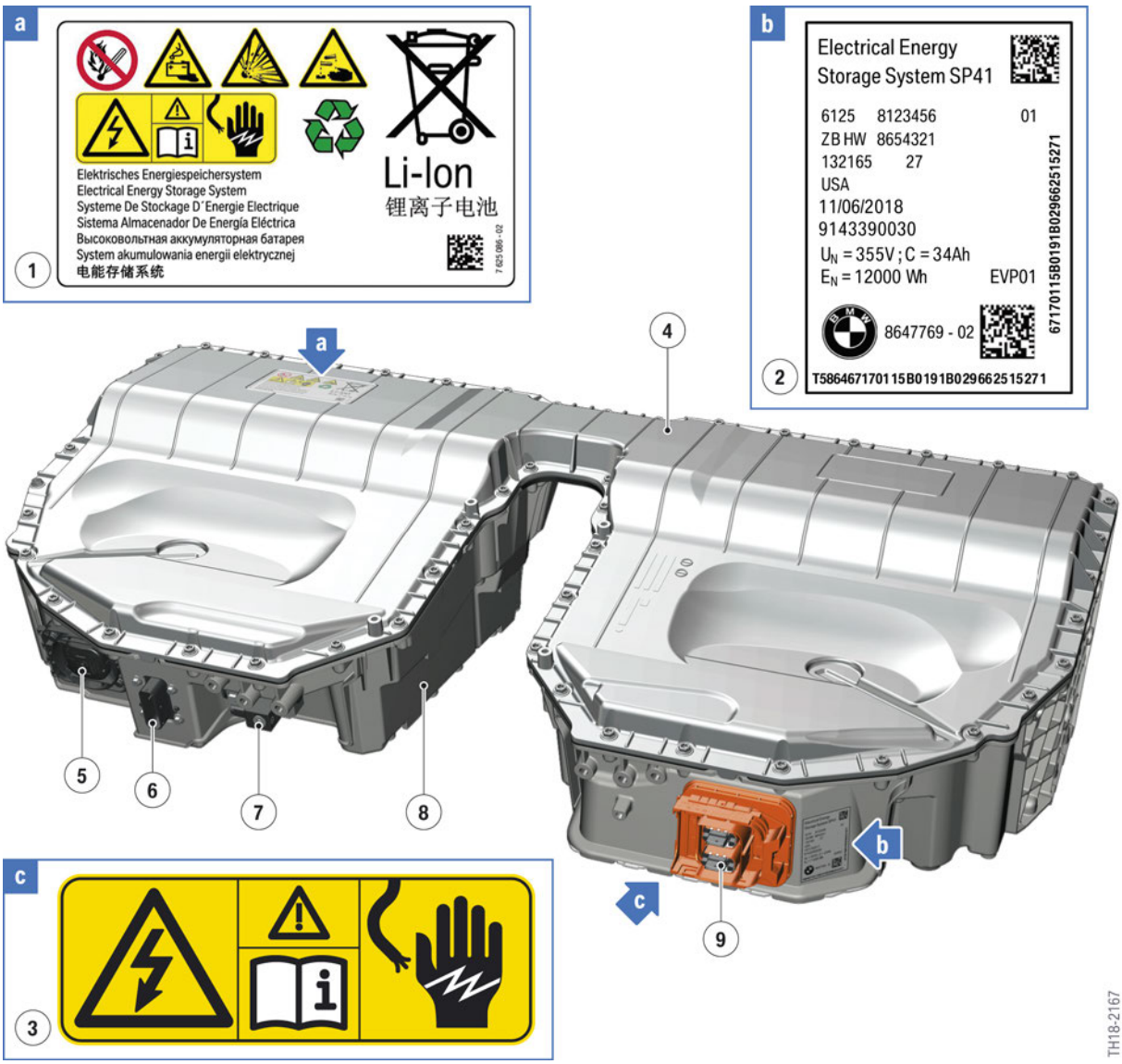
If the brake request exceeds the deceleration possible as a result of energy recovery, the linear actuator is activated. The electro-hydraulic brake pressure generated in this way is routed through the opened linear actuator changeover valves in the direction of the wheel brakes. The vehicle decelerates in this situation both hydraulically and via the electrical machine.

G12 LCI PHEV High-voltage Components

4. High-voltage Battery

4.1. Overview

With the G12 LCI PHEV, high-voltage battery generation 4.0 is deployed for the first time. The basic layout of the lithium-ion battery is the same as that for the high-voltage battery of the G12 PHEV and the G30 PHEV. The most significant change from the predecessor model is that the cell capacity has been increased from 26 Ah to **34 Ah**.



G12 LCI PHEV Stickers and connections of the high-voltage battery

Index	Explanation
1	High-voltage battery unit warning sticker
2	Type plate with technical data
3	High-voltage component warning sticker
4	Upper housing section of the high-voltage battery

G12 LCI PHEV High-voltage Components

4. High-voltage Battery

Index	Explanation
5	Venting unit
6	Connection for signal connector
7	Connection for refrigerant lines
8	Lower housing section of the high-voltage battery
9	High-voltage connection

Neither the connections nor the mounting of the high-voltage battery have been changed. The procedure for installation must continue to be complied with (four-eyes principle, documentation etc.).

The type plate is now visible with the high-voltage battery installed. Previously, it was located on the upper housing section.

Technical data

Technical data	G12 PHEV (SP06)	G12 LCI PHEV (SP41)
Voltage	351.4 V (nominal voltage) Min. 269 V – Max. 398 V (voltage range)	355 V (nominal voltage) Min. 269 V – Max. 403 V (voltage range)
Battery cells	Lithium-ion	Lithium-ion
Number of battery cells	96 in series	96 in series
Number of cell modules	6	6
Cell voltage	3.66 V	3.69 V
Capacitance	26 Ah	34 Ah
Storable amount of energy	9.2 kWh	12 kWh
Usable energy	7.4 kWh	10.4 kWh
Max. power (discharge)	83 kW (short-term)	83 kW (short-term)
Maximum power (AC charging)	3.7 kW	3.7 kW
Weight	112.6 kg (without retaining brackets)	118.5 kg (without retaining brackets)
Dimensions	541 mm x 1134 mm x 271 mm	541 mm x 1134 mm x 271 mm
Cooling system	Refrigerant R1234yf	Refrigerant R1234yf

More information regarding the high-voltage battery can be found in "G12 LCI PHEV High-voltage Battery".

The high-voltage battery is a high-voltage component!

G12 LCI PHEV High-voltage Components

4. High-voltage Battery

Only Service employees who meet all the requirements are permitted to work on the designated high-voltage components: suitable qualifications, compliance with the safety rules, procedure following the exact repair instructions.

4.2. Charging

4.2.1. Standard charging cable

For charging on the AC power mains, the G12 LCI PHEV has the standard charging cable of the 2nd generation. The standard charging cable is delivered with a bag and is stowed in the luggage compartment on the left-hand side.

G12 LCI PHEV High-voltage Components

4. High-voltage Battery

Standard charging cable generation 2

Index	Explanation
1	Main plug
2	Electrical Vehicle Supply Equipment (EVSE)
3	Charging plug

The maximum charge current level at household sockets is market-specific. Depending on the variant, the high-voltage vehicle can be charged with 6 to 15 A.

The standard charging cable of the 2nd generation has the following features:

- Power: 2.3 kW (10 A / 230 V)
  (until now 2.7 kW)
- Protection against contact and water ingress (IP degree of protection): IP 67
  (until now IP 54)
- Temperature sensor system:
  1 temperature sensor in the EVSE
  2 temperature sensors in the mains plug (phase and neutral conductor).

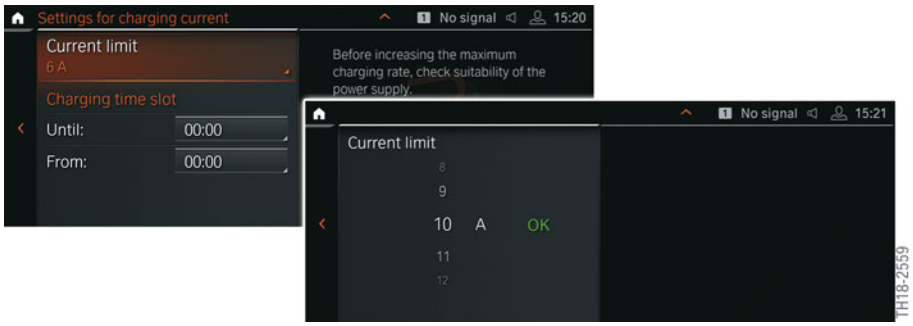
G12 LCI PHEV High-voltage Components

4. High-voltage Battery

To protect the standard charging cable, the temperature in the EVSE and mains plug is monitored. Power consumption is reduced or temporarily switched off completely by the EVSE if the temperature exceeds a specified value.

4.2.2. Adjusting the charge current level

The charge current level when charging with the standard charging cable at the power socket can also be set in the G12 LCI PHEV. What is new is that the charge current level can be set precisely in Amperes.



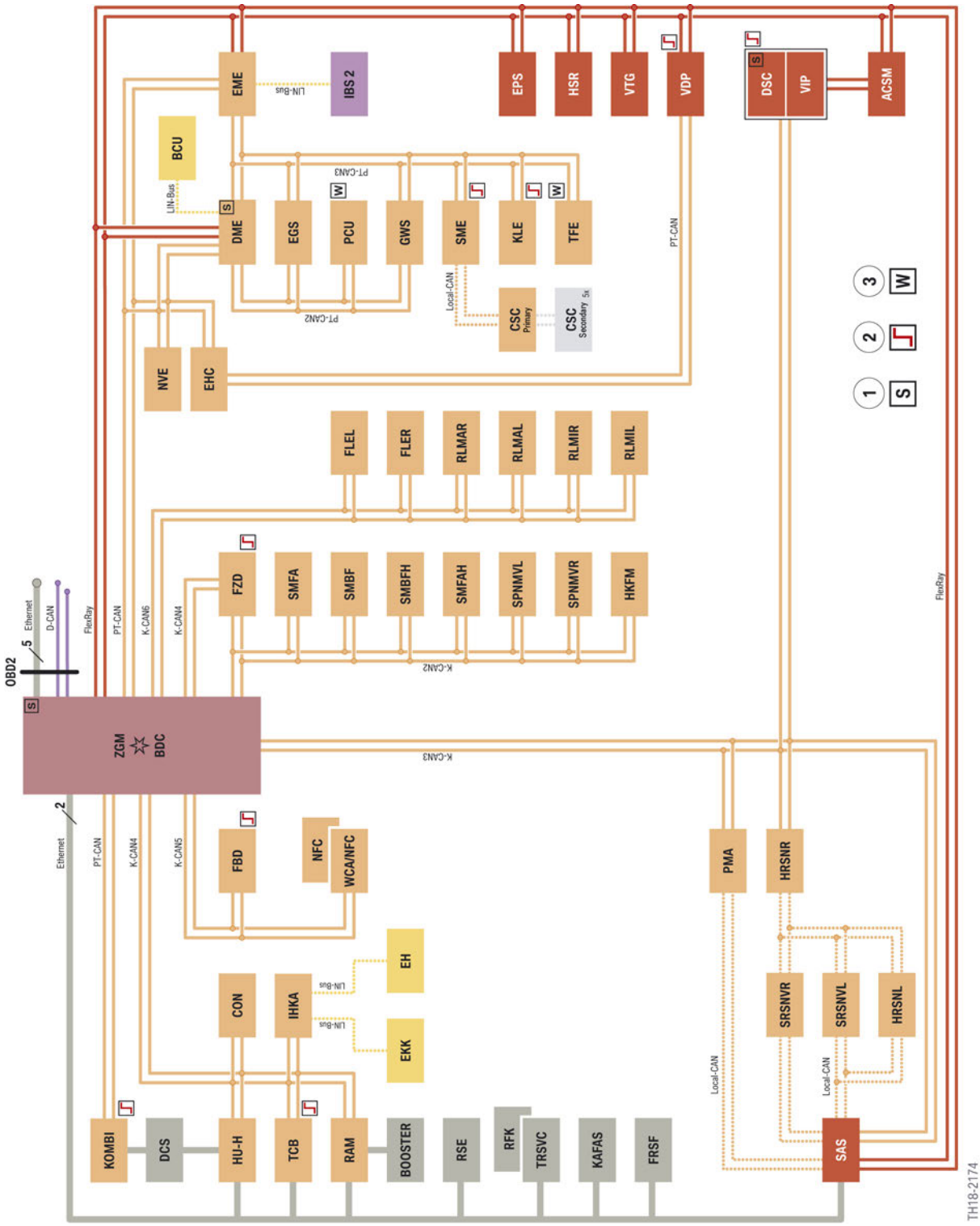
G12 PHEV Menu for the setting the charge current level

The maximum charge current must always be reset to the customer's settings following a workshop visit.

G12 LCI PHEV High-voltage Components

5. Low-voltage Vehicle Electrical System

5.1. Bus overview



G12 LCI PHEV Bus overview

G12 LCI PHEV High-voltage Components

5. Low-voltage Vehicle Electrical System

Index	Explanation
ACSM	Advanced Crash Safety Module
BCU	Battery Charge Unit
BDC	Body Domain Controller
Booster	Booster
CON	Controller
CSC primary	Primary cell supervision circuit
CSC secondary	Secondary cell supervision circuit
DCS	Driver Camera System
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
EGS	Electronic transmission control
EH	Electrical heating
EHC	Electronic ride height control
EKK	Electric A/C compressor
EME	Electrical Machine Electronics
EPS	Electromechanical Power Steering
FDB	Remote control receiver
FLER	Frontal Light Electronics Right
FLEL	Frontal Light Electronics Left
FRSF	Front radar sensor long range
FZD	Roof function center
GWS	Gear selector switch
HU-H	Head Unit High
HKFM	Tailgate function module
HRSNL	Rear radar sensor short range left
HRSNR	Rear radar sensor short range right
HSR	Rear axle slip angle control
IBS 2	Intelligent battery sensor 2
IHKA	Integrated automatic heating / air conditioning
KAFAS	Camera-based driver assistance systems
KLE	Convenience charging electronics
KOMBI	Instrument cluster
NFC	Near Field Communication
NVE	Night Vision Electronics
PCU	Power Control Unit

G12 LCI PHEV High-voltage Components
5. Low-voltage Vehicle Electrical System

Index	Explanation
PMA	Parking Maneuver Assistant
RAM	Receiver Audio Module
RFK	Rear view camera
RLMAL	Rear light module outer left
RLMAR	Rear light module outer right
RLMIL	Rear light module inner left
RLMIR	Rear light module inner right
RSE	Rear Seat Entertainment
SAS	Optional equipment system
SME	Battery management electronics
SMBF	Front passenger seat module
SMFA	Driver's seat module
SMBFH	Seat module, front passenger's side, rear
SMFAH	Seat module, driver's side, rear
SPNMVL	Seat pneumatics module front left
SPNMVR	Seat pneumatics module front right
SRSNVL	Side radar sensor short range front left
SRSNVR	Side radar sensor short range front right
TCB	Telematic Communication Box
TFE	Hybrid pressure refuelling electronic control unit
TRSVC	Top rear side view camera
VDP	Vertical Dynamic Platform
VIP	Virtual Integration Platform
VTG	Transfer box
WCA/NFC	Wireless charging station with control electronics for Near Field Communication
ZGM	Central gateway module
1	Start-up node control units for starting and synchronizing the FlexRay bus system
2	Control units authorized to perform wake-up function
3	Control units also connected at terminal 15WUP

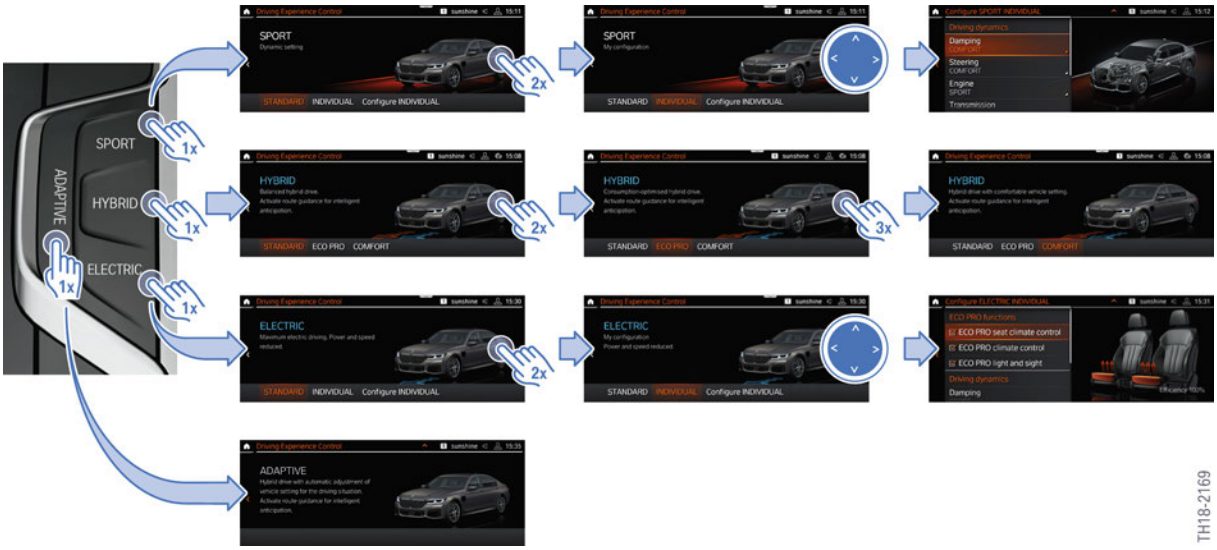
G12 LCI PHEV High-voltage Components

6. Displays and Operation

6.1. Driving modes

6.1.1. Overview

The driving and drive system modes have been merged and can be activated using the new Driving Experience Control. The separate eDrive button which can be used to shift through the drive system modes is no longer used. Its place is taken by the Battery Control button.



G12 LCI PHEV Overview of driving modes

The HYBRID driving mode is divided into 3 specified variants and/or attributes. It is possible to shift through these variants by repeatedly pressing the corresponding button on the Driving Experience Control. Alongside the standard variant, the SPORT and ELECTRIC driving modes have an individual variant which the driver can also shift through by repeatedly pressing the Driving Experience Control. In addition, these two driving modes can be configured using the controller.

The familiar ECO PRO functions can be activated in the HYBRID ECO PRO and ELECTRIC INDIVIDUAL driving modes.

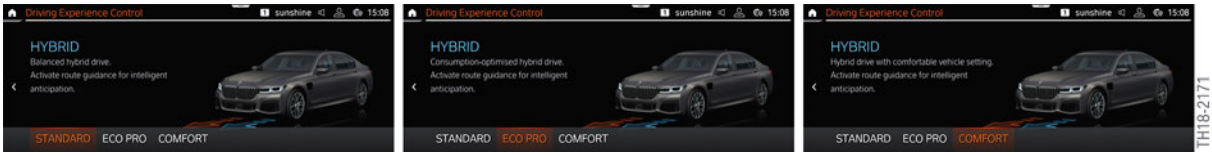
A shift of the gear selector switch to the manual position is possible in almost any driving mode. It is only in the case of the ELECTRIC driving mode that manual shifting (also via the shift paddles on the steering wheel) leads to a switch into the HYBRID driving mode with its last selected variant.

6.1.2. HYBRID

In the HYBRID driving mode, the vehicle chooses the optimum drive combination depending on the state of charge of the high-voltage battery and accelerator pedal position. If the driver's power request exceeds the maximum available electrical power, the combustion engine is activated automatically and comfortably.

G12 LCI PHEV High-voltage Components

6. Displays and Operation



G12 LCI PHEV Attributes of HYBRID driving mode

The HYBRID driving mode is available with 3 attributes:

- STANDARD
- ECO PRO
- COMFORT.

STANDARD

The attribute of the HYBRID STANDARD driving mode corresponds to the combination of COMFORT and Auto eDrive mode from the predecessor model. HYBRID STANDARD is always active after a new vehicle start.

Exception:

- The gear selector switch is in the Manual / Sport program position.
- The ELECTRIC INDIVIDUAL driving mode has been selected as the standard driving mode and is available.

The HYBRID STANDARD mode can in principle be divided into 2 parts: The charge depleting phase and the charge sustaining phase.

In the charge depleting phase, the G12 LCI PHEV can be driven electrically at up to approx. 68 mph. The combustion engine is activated at speeds above 68 mph or for high power requirements. The combustion engine is switched off if the speed falls below 65 mph into the electric driving range.

In the charge sustaining phase, accelerations up to approx. 25 mph and constant-speed driving up to approx. 37 mph are possible as all-electric driving. During operation at low speeds, driving states in which the combustion engine is off alternate with driving states in which the combustion engine is running.

Outside this efficiency-optimized eDrive range, the combustion engine is automatically started in case of high load and speed demands.

In general, the following applies to the electric drive: If the vehicle is driven after a long immobilization period at very cold ambient temperatures, this may result in a power reduction of the electrical drive or it may not be available at all. The reason for this may be an excessively low cell temperature in the cell modules of the high-voltage battery.

ECO PRO

The HYBRID ECO PRO driving mode rigorously supports a driving style that reduces consumption and its attribute corresponds to the combination of ECO PRO and Auto eDrive of the predecessor model. In this driving mode, the G12 LCI PHEV offers its maximum range. Essentially the following measures help to increase the range:

- A modified accelerator pedal characteristic curve and shift program with automatic transmission helps the driver adopt a driving style that optimizes fuel consumption
- No boost function available (except with kickdown)
- Coasting
- The combustion engine is switched off in the case of coasting at up to 100 mph
- Power reduction of the electrical comfort consumer units such as mirror, seat or rear window heating
- Power reduction of heating / air-conditioning system.

Individualization in the same way as in the predecessor model is no longer possible in the HYBRID ECO PRO mode. The attribute corresponds to specified parameters.

COMFORT

The attribute of the HYBRID COMFORT driving mode corresponds to the combination of COMFORT PLUS and Auto eDrive mode from the predecessor model.

Here, the combustion engine and automatic transmission are shifted into a very comfortable attribute; the Electronic Damper Control (EDC) is shifted into a soft attribute. In this way, a vehicle setting configured for comfort is assumed, ensuring optimal travel comfort.

6.1.3. ELECTRIC

The attribute of the ELECTRIC driving mode corresponds to the combination of COMFORT and MAX eDrive mode of the predecessor model. In contrast to the HYBRID driving mode, in ELECTRIC INDIVIDUAL the driver has the possibility to adjust settings with regard to efficiency and driving dynamics.

G12 LCI PHEV Attributes of ELECTRIC driving mode

The ELECTRIC driving mode is available with 2 attributes:

- STANDARD
- INDIVIDUAL

STANDARD

With a sufficient charge state of the high-voltage battery, all-electric driving of the vehicle with maximum output of the electric drive is possible for up to **24** miles . In this case, the maximum speed of 87 mph is the same as in the predecessor model.

In the STANDARD variant, all ECO PRO settings are switched off and the damping and steering are set to "Comfort" (see ELECTRIC INDIVIDUAL).

The following events can mean that the ELECTRIC driving mode cannot be selected or is disabled:

- High-voltage battery state of charge too low
- Kickdown (switch to HYBRID STANDARD)
- Speed too high
- Gear selector switch in Manual / Sport program (change to HYBRID with the last selected variant)
- Shift paddles on the steering wheel actuated (change to HYBRID with the last selected variant)
- Cell temperature too high / low
- System fault.

INDIVIDUAL

In the new G12 LCI PHEV, the driver has the possibility to individualize the ELECTRIC driving mode and make settings with regard to efficiency and sporting character. ELECTRIC INDIVIDUAL can be selected as the standard driving mode so that this driving mode is active at every engine start. Alongside all other settings, this is saved for the driver profile currently in use.

There is no longer a display of the ECO PRO potential.

6.1.4. SPORT

In the SPORT driving mode, a sporty engine and suspension setting provides an assured and dynamic driving experience.

G12 LCI PHEV Attributes of SPORT driving mode

The SPORT driving mode is available with 2 attributes:

- STANDARD
- INDIVIDUAL

STANDARD

In the SPORT STANDARD driving mode, the combustion engine is always running or running in addition while the vehicle is being driven as soon as the driving mode is activated.

Essentially the following measures contribute to increasing the output and dynamics:

- Alteration of the attributes of the accelerator pedal characteristic curve and the shift program in automatic transmissions for a sporty driving style
- More sporty setting of the driving dynamics systems (damping and steering)
- Higher boost output available

- Combustion engine is not switched off while the vehicle is being driven (only at a standstill)
- No coasting available
- Greater increase in the load point of the combustion engine to ensure sufficiently high battery charge for provision of the boost function.

INDIVIDUAL

In exactly the same way as in ELECTRIC, the SPORT driving mode can be individualized. Here, setting options from the predecessor model are used.

6.1.5. ADAPTIVE

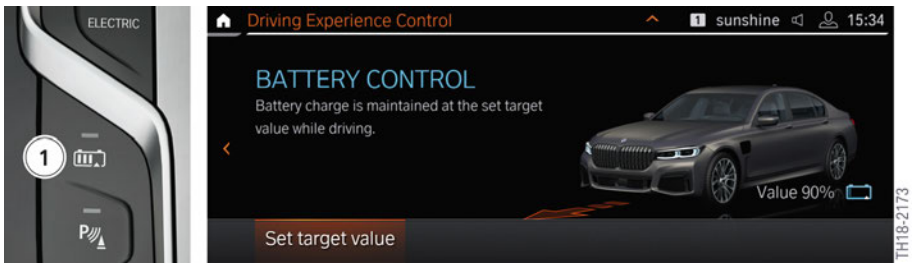
With the ADAPTIVE driving mode, the entire engine and vehicle setting automatically adapts to both the driving situation and the driving style.

6.1.6. Service note

The combustion engine can be started with the vehicle at a standstill, for example for an emission inspection. To achieve this, with activated driving readiness, the brake **and** accelerator must be pressed while drive position P or N is engaged.

6.2. BATTERY CONTROL

The BATTERY CONTROL mode is selected using the separate Battery Control button. Another new feature is the charge target value. This can now be set to a charge state of 30-100% (previously 30-80%).



G12 LCI PHEV BATTERY CONTROL

Index	Explanation
1	Battery Control button

G12 LCI PHEV High-voltage Components

6. Displays and Operation

6.3. Displays in the instrument cluster

6.3.1. Displays of operating conditions

The hybrid-specific operating states and the state of charge of the high-voltage battery are displayed in the instrument cluster (KOMBI) and, if desired, in the Central Information Display (CID).

The following displays are shown in the instrument cluster (depending on the driving situation):

- "Driving readiness" display
- Display for electric driving
- eDrive range
- Display for MAX eDrive
- Display for BATTERY CONTROL
- Display for boost function
- Energy recovery.

G12 LCI PHEV Driving readiness, instrument cluster

Index	Explanation
1	All-electric driving is possible within this speed range. In the ELECTRIC driving mode, the range up to 87 mph is highlighted.
2	Display of the driving mode
3	eBoost; the needle is in the eBoost range during powerful acceleration.
4	All-electric driving distance travelled
5	eDrive range; all-electric driving is possible within this range.

Index	Explanation
6	READY; driving readiness established
7	CHARGE; the needle shows the energy recovery as a function of the deceleration or brake pedal actuation intensity.
8	Charge state of the high-voltage battery with new battery symbol complying with standard.
9	Remaining electric range

In the instrument cluster, the driver is provided with a visual acknowledgement about the level of requested power.

Depending on the activated driving mode, the following additional information is displayed in the form of widgets in the right-hand area of the instrument cluster (KOMBI).

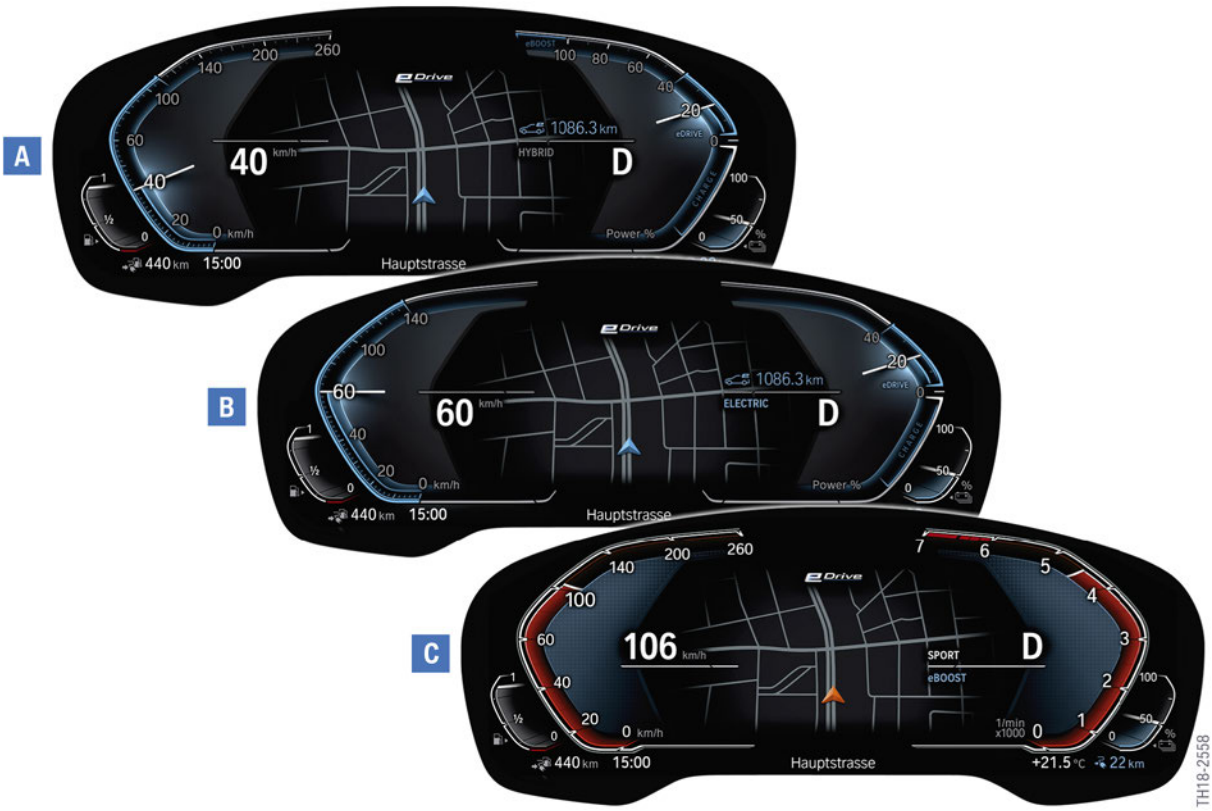
Driving mode	Widget
HYBRID	• Current consumption (fuel) • Consumption display (fuel) • Average consumption (fuel) • Distance recorder for driving without combustion engine
ELECTRIC	• Current consumption (electrical energy) • Consumption display (electrical energy) • Average consumption (electrical energy) • Distance recorder for driving without combustion engine
SPORT	• Coolant temperature

G12 LCI PHEV High-voltage Components

6. Displays and Operation

6.3.2. Display modes

The following graphic shows the instrument cluster (KOMBI) in the various driving modes:



G12 LCI PHEV Driving modes in the instrument cluster

Index	Explanation
A	HYBRID
B	ELECTRIC
C	SPORT

6.4. Displays in Central Information Display

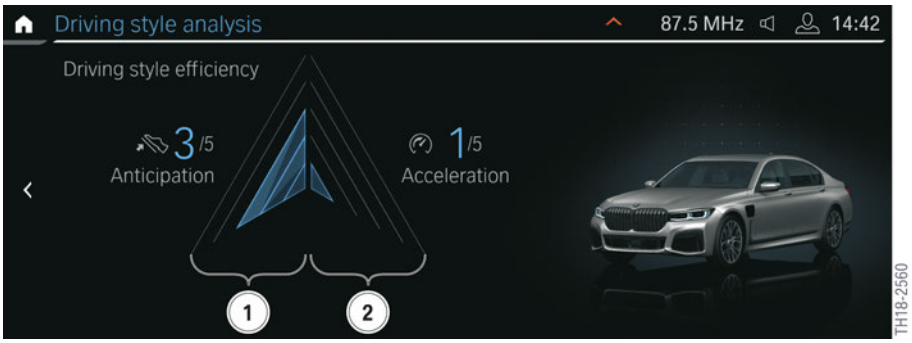
The familiar hybrid-specific displays are used:

- Trip data (previously eDrive use)
- Energy and power flow display
- Adaptation to stretch of road
- Driving style analysis

G12 LCI PHEV High-voltage Components

6. Displays and Operation

The representation of the driving style analysis has been revised. In this way, it helps to develop a particularly efficient driving style and to save fuel and/or electrical energy. The function is only available in the HYBRID ECO PRO driving mode. The efficiency is visualized in the form of a triangle.



G12 LCI PHEV Display of the driving style analysis

Index	Explanation
1	Anticipation
2	Acceleration

The more efficient the driving style, the more bars are displayed in color and the higher the number of points displayed. In the case of an inefficient driving style, on the other hand, a reduced number of bars and a lower number are displayed.