Reference Manual

F91/F92
COMPLETE VEHICLE

Technical Training

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Technical training.
Product information.

F91/F92 Complete Vehicle.

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BMW Group University
Technical Training
ST1915 9/1/2019

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: July 2019

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.

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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 Manual
- Integrated Service Technical Application
- Aftersales Information Research (AIR)

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1. Introduction.

From October 2019 BMW M GmbH presents, with the new BMW M8 Coupé and the new BMW M8 Competition Coupé as well as the new BMW M8 Convertible and the new BMW M8 Competition Convertible, four new models at the top of its model range. The new models draw the strength for their outstanding performance attributes from the most powerful engine ever developed for BMW M GmbH cars: the V8 powerplant with M TwinPower Turbo technology and high-speed concept.

The performance-oriented character of the engine, transmission and chassis enables the new BMW M8 Coupé and the new BMW M8 Convertible to accelerate from 0-62 mph in 3.3 or 3.4 seconds.

The model-specific chassis technology is designed and tuned to meet the specific demands of racetrack use. The special features include a newly developed integrated braking system which in its M-specific configuration delivers two different characteristic brake pedal curves.

The interior of the new performance sports car combines a typical M cockpit layout with progressive luxury.

The new Setup button in the center console facilitates direct access to the settings for engine, dampers, steering, M xDrive and braking system in order to match these individually to the driver's personal preferences and the driving situation.

A further innovation is the M Mode button in the center console, which can be used to influence the driver assistance systems and the displays in the instrument cluster and in the Head-up Display. The ROAD and SPORT settings can be activated with the M Mode; the TRACK setting designed exclusively for use on racetracks is also available in the Competition models.

1.1. M history

1.1.1. E31 BMW 850CSI

The E31 850CSI is not the direct predecessor of the BMW M8, but is an 8 Series of the E31 built by M GmbH which was however identified as a BMW M8 in the registration papers at the time. The actual BMW M8 was only built as a prototype in 1990, but never progressed beyond the prototype stage.

Around 1510 BMW 850CSI vehicles were built between 1992 and 1996. With the 12-cylinder S70B56 engine with 5576 cc displacement, 280 kW (380 hp) and 550 Nm torque, the BMW 850CSI reached a top speed of 155 mph with an acceleration of 0-62 mph in 6 seconds.

E31, BMW 850CSI

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1. Introduction.

1.2. Vehicle profiles

1.2.1. Vehicle profile: F91 BMW M8 Convertible

F91, M8 Convertible (Competition)

- **Design and aerodynamics:** M-specific characteristics in front, side and rear area. Unique aerodynamic design in front, side and rear area and vehicle underbody.
- **Engine/transmission/drivetrain:** V8 high-performance engine. Efficient, with even more powerful and more spontaneous linear power development. Three selectable engine dynamics control programs. M automatic transmission with Drivelogic. M all-wheel drive, fully variable between the front and rear axles, or between the rear and front axles, with the option of selecting a pure rear wheel drive that enables the customer to handle the vehicle in highly dynamic situations. Electronically regulated M rear axle differential lock.
- **Engine sound:** Ambitiously sporty in both the lower and upper speed and performance range, as well as an Active Sound Design system which makes the engine sound in the passenger compartment, in conjunction with the original noise, a desired overall experience. The engine sound can be influenced via the setting of the exhaust flaps with a button. On request, with the Sport exhaust system.
- **Steering:** Direct and precise variable M EPS with selectable Servotronic support (at 2 stages). M steering wheel including M shift paddles and with 2 mounted freely programmable buttons.
- **Chassis/chassis dynamics design:** Adaptive M suspension, selectable driving dynamics programs from comfortable to sporty in 3 stages. Optimal driving precision and adapted interplay of steering, suspension and damping action according to the selected program.

M Dynamic Stability Control integrated M DSCi with 2 characteristic brake curves and 3 Drive modes configurable by the customer. Three additional modes in the M DSCi OFF mode; the following are available: 4WD, 4WD Sport and 2WD, which represents rear wheel drive.

- **Seating comfort:** M Sport seats with high-quality upholstery in "fine-grain merino" plain or two-color leather.
- **Interior equipment:** M instrument cluster, M Drive menu, M Head-up Display, M-specific decorative strips, M footrest and sill trims.
- **Display and operation:** Additional exclusive M MODE for rapid configuration of the vehicle to the individual customer experience. Two programs are available: "ROAD" and "SPORT".
- **Assistance systems:** The driver assistance systems are available to the same extent as in the G14, with the exception of the parking assistant.

Further information on the driver assistance systems and their function can be found in the product information “ST1833 G15 Driver Assistance Systems".

1.2.2. Vehicle profile: F92 BMW M8 Coupé

F92, M8 Coupé (Competition)

- **Design and aerodynamics:** M-specific characteristics in front, side and rear area. Unique aerodynamic design in front, side and rear area and vehicle underbody. CFRP roof as standard equipment.
- **Engine/transmission/drivetrain:** V8 high-performance engine. Efficient, with even more powerful and more spontaneous linear power development. Three selectable engine dynamics control programs. M automatic transmission with Drivelogic. M all-wheel drive, fully variable between the front and rear axles, or between the rear and front axles, with the option of selecting a pure rear wheel drive that enables the customer to handle the vehicle in highly dynamic situations. Electronically regulated M rear axle differential lock.
- **Engine sound:** Ambitiously sporty in both the lower and upper speed and performance range, as well as an Active Sound Design system which makes the engine sound in the passenger compartment, in conjunction with the original noise, a desired overall experience. The engine sound can be influenced via the setting of the exhaust flaps with a button. On request, with the Sport exhaust system.
- **Steering:** Direct and precise variable M EPS with selectable Servotronic support (at 2 stages). M steering wheel including M shift paddles and with 2 mounted freely programmable buttons.
- **Chassis/chassis dynamics design:** Adaptive M suspension, selectable driving dynamics programs from comfortable to sporty in 3 stages. Optimal driving precision and adapted interplay of steering, suspension and damping action according to the selected program. M Dynamic Stability Control integrated M DSCi with 2 characteristic brake curves and 3 Drive modes configurable by the customer. Three additional modes in the M DSCi OFF mode; the following are available: 4WD, 4WD Sport and 2WD, which represents rear wheel drive.
- **Seating comfort:** M Sport seats with high-quality upholstery in "fine-grain merino" plain or two-color leather.
- **Interior equipment:** M instrument cluster, M Drive menu, M Head-up Display, M-specific decorative strips, M footrest and sill trims.
- **Display and operation:** Additional exclusive M MODE for rapid configuration of the vehicle to the individual customer experience. Two programs are available: "ROAD" and "SPORT".
- **Assistance systems:** The driver assistance systems are available to the same extent as in the G15, with the exception of the parking assistant.

Further information on the driver assistance systems and their function can be found in the product information "ST1833 G15 Driver Assistance Systems".

1.2.3. Vehicle profile for Competition model

- **Design and aerodynamics:** The surround of the BMW M grille, the typical M gills, the mirror hoods and the rear spoiler are finished in high-gloss black as standard. The additional model designation on the rear with the "M8 Competition" lettering ultimately distinguishes the external appearance of the Competition model from the BMW M8.
- **Engine:** V8 high-performance engine. The Competition engine has increased performance figures to 460 kW/625 hp and makes the BMW M8 Competition model 0.1 second faster from 0-62 mph.
- **Engine sound:** M Sport exhaust system with even more sports-style sound both in the lower and upper rev and power bands, more emotive starting sound and an active sound design system. The engine sound can be influenced via the setting of the exhaust flaps with a sound button.

F91/F92 Complete Vehicle.

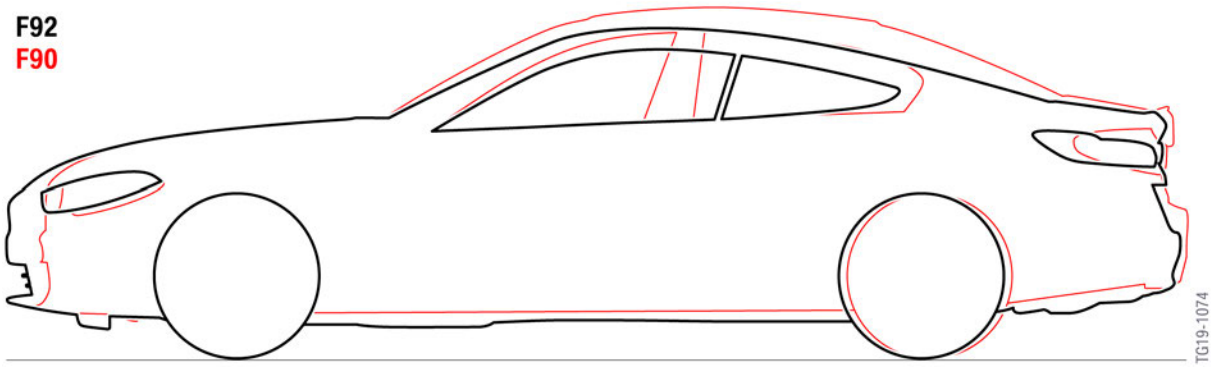
1. Introduction.

- **Chassis/driving dynamics design:** Adaptive M suspension with selectable driving dynamics programs in 3 stages with the emphasis on even more sportiness. The 20" wheels with 275/35 R20 tires at the rear and 285/35 R20 tires at the front underline the external styling of the Competition model.
- **Interior equipment:** Sill trims and a badge on the center console with the "Competition" insignia add the finishing touches to the interior of the Competition model.
- **Display and operation:** In additional to the M MODES "ROAD" and "SPORT" an exclusive "TRACK" mode is available which facilitates the rapid deactivation of various driver assistance systems and display options in the Head-up Display, instrument cluster and assorted safety functions.

F91/F92 Complete Vehicle.

2. Technical Data.

2.1. Silhouette comparison



F92, silhouette comparison F90

2.2. BMW comparison of F91 technical data

Designation	Unit	G14 M850i xDrive	F91 M8	F91 M8 Competition
Engine series		N63B44T3	S63B44T4	S63B44T4
Engine control		DME 8.8T.0	DME 8.8T.0	DME 8.8T.0
Transmission type designation		GA8HP76	M8HP76	M8HP76
Length	[mm]	4851	4871	4871
Width	[mm]	1902	1907	1907
Height	[mm]	1345	1353	1353
Number of seats		4	4	4
Luggage compartment volume	[l]	350	350	350
Maximum speed	[mph]	155	155*/190**	155*/190**
Acceleration 0-62 mph	[s]	3.9	3.4	3.3
Nominal engine power at engine speed	[hp] [rpm]	530 5500-6000	600 6000	617 6000
Power-to-weight ratio	[lbs:hp]	8.9:1	7.6:1	7.3:1
Torque at speed	[lb-ft] [rpm]	553 1800-4600	553 1800-5600	553 1800-5860
Aerodynamics				
c_x (drag coefficient)		0.32-0.34	0.33-0.35	0.33-0.35
A (area)	[m^2]	2.22	2.25	2.25
c_x x A (drag)	[m^2]	0.71-0.75	0.74-0.79	0.74-0.79
Vehicle curb weight				

F91/F92 Complete Vehicle.

2. Technical Data.

Designation	Unit	G14 M850i xDrive	F91 M8	F91 M8 Competition
US	[lbs]	4736	4560	4560
Rear axle load section, empty	[%]	47.7	47.1	47.1
Payload	[lbs]	772	770	770
Permissible total weight	[lbs]	5545	5380	5380
Approximate fuel tank capacity	[gal]	20.1	20.1	20.1

* electronically controlled; ** electronically controlled in conjunction with optional equipment 7ME M Drivers Package

2.3. BMW comparison of F92 technical data

Designation	Unit	G15 M850i xDrive	F92 M8	F92 M8 Competition
Engine series		N63B44T3	S63B44T4	S63B44T4
Engine control		DME 8.8T.0	DME 8.8T.0	DME 8.8T.0
Transmission type designation		GA8HP76	M8HP76	M8HP76
Length	[mm]	4851	4867	4867
Width	[mm]	1902	1907	1907
Height	[mm]	1346	1362	1362
Number of seats		4	4	4
Luggage compartment volume	[l]	420	420	420
Maximum speed	[mph]	155	155*/190**	155*/190**
Acceleration 0-62 mph	[s]	3.7	3.3	3.2
Nominal engine power at engine speed	[hp] [rpm]	530 5500-6000	600 6000	617 6000
Power-to-weight ratio	[lbs:hp]	8.4:1	7.1:1	6.8:1
Torque at speed	[lb-ft] [rpm]	553 1800-4600	553 1800-5600	553 1800-5860
Aerodynamics				
c_x (drag coefficient)		0.33-0.34	0.33-0.35	0.33-0.35
A (area)	[m^2]	2.22	2.25	2.25
c_x x A (drag)	[m^2]	0.73-0.75	0.74-0.79	0.74-0.79
Vehicle curb weight				
US	[lbs]	4478	4295	4295
Rear axle load section, empty	[%]	46.2	45.2	45.2

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2. Technical Data.

Designation	Unit	G15 M850i xDrive	F92 M8	F92 M8 Competition
Payload	[lbs]	772	910	910
Permissible total weight	[lbs]	5280	5260	5260
Approximate fuel tank capacity	[gal]	18	18	18

* electronically controlled; ** electronically controlled in conjunction with optional equipment 7ME M Drivers Package

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3. Body.

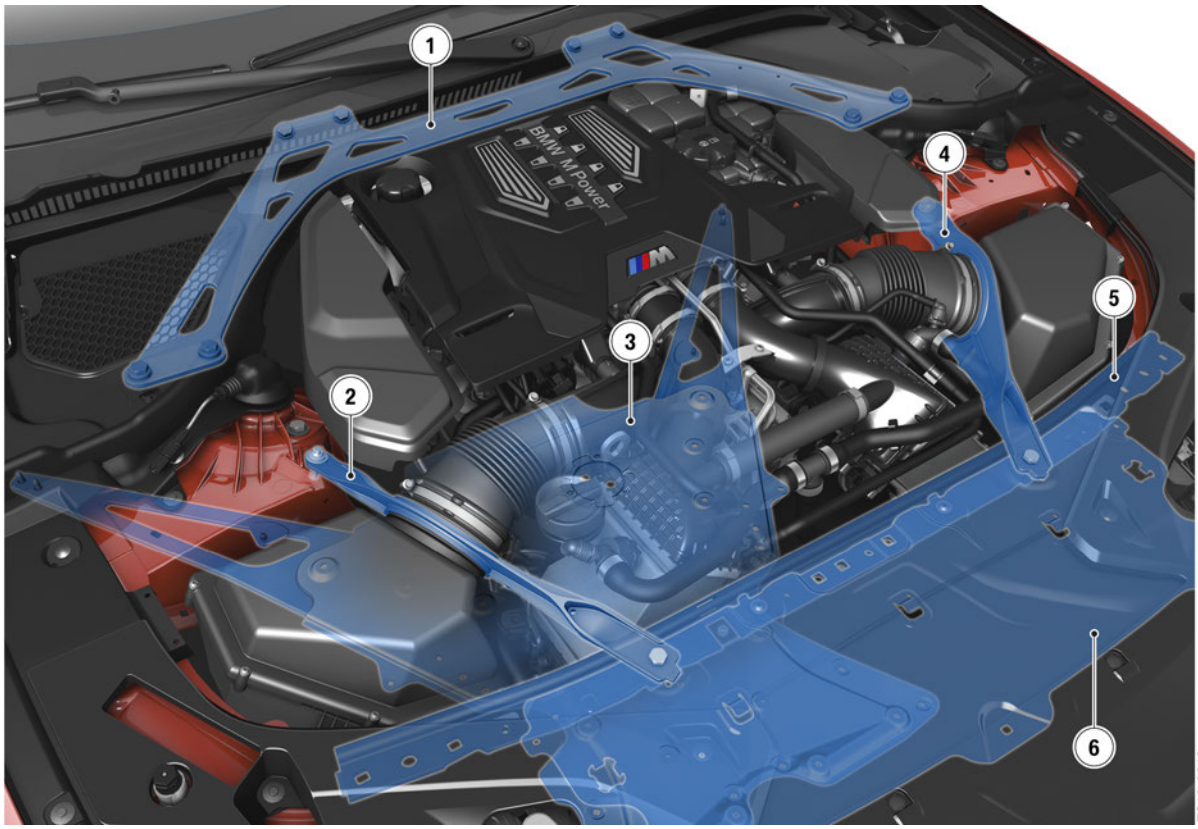
3.1. Rigidity

3.1.1. Chassis components and rigidity concept

Front end area of F91/F92

The following identical measures on the F91 and F92 for attaching the chassis components and increasing the vehicle rigidity have been implemented in the front end area:

- Strut brace bridge carried over from the F90
- Front-end struts as a new part for the F91/F92
- Stiffening plate as a new part on the F91/F92
- Cross-member and perforated plate F9x-specific.



F91/F92, stiffening measures in the forward area

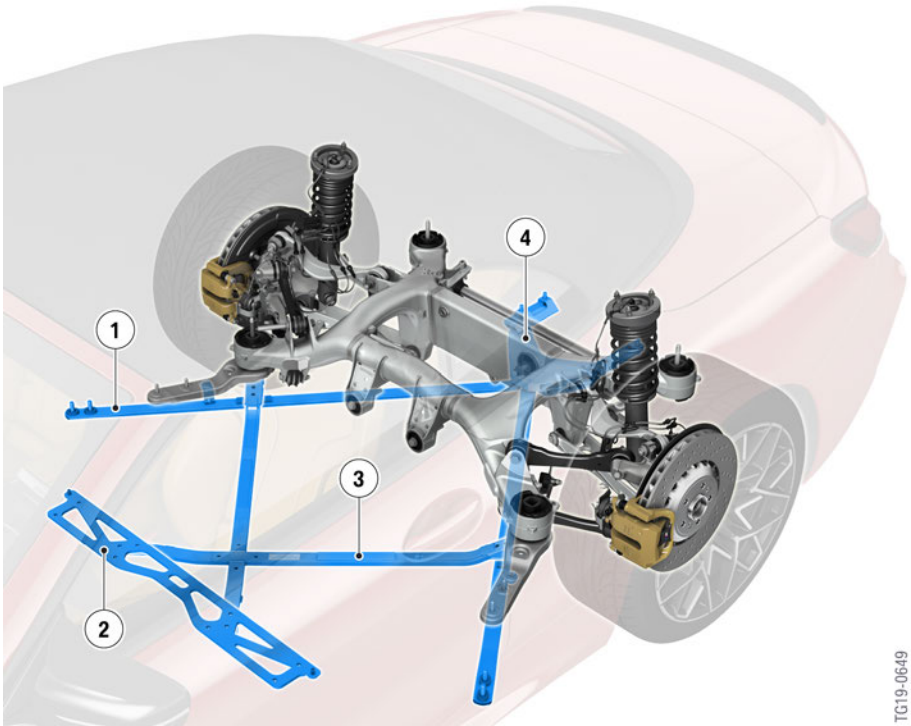
Index	Explanation
1	Strut brace bridge
2	Front-end strut with feed-through, right
3	Stiffening plate
4	Front-end strut with feed-through, left
5	Cross-member
6	Perforated plate

All other measures for stiffening the front end are the same as in the G14/G15 production vehicle.

Rear end area of F91

The following measures for attaching the chassis components and increasing the vehicle rigidity have been implemented in the rear end of the vehicle:

- Steel cross-struts with connection to the rear axle support (carried over from the F90)
- Aluminum cross-member on the underbody in the area of the rear seat bench for mounting the cross-struts (carried over from the F90)
- Strut block in the area of the battery container (carried over from the F91 in the G14)
- Torsion struts with connection to the strut block and to the rear side sill (carried over from the G14).



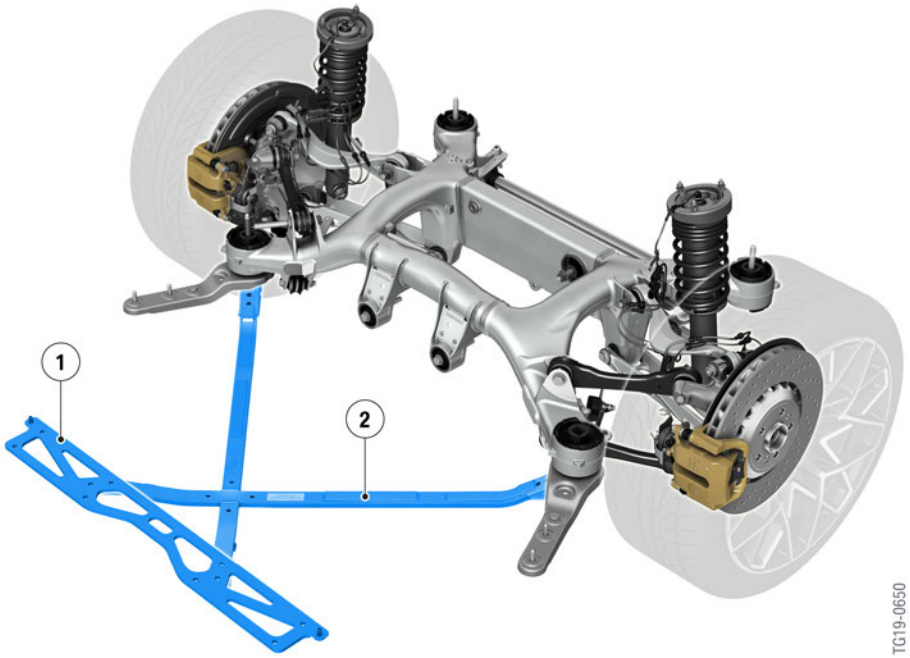
F91, stiffness measures in the rear area

Index	Explanation
1	Torsion struts
2	Cross-member
3	Cross-strut
4	Strut block

Rear end area of F92

The following measures for attaching the chassis components and increasing the vehicle rigidity have been implemented in the rear end of the vehicle:

- Steel cross-struts with a connection to the rear axle support
- Aluminum cross-member on the underbody in the area of the rear seat bench for mounting the cross-struts.



F92, stiffness measures in the rear area

Index	Explanation
1	Cross-member
2	Cross-strut

3.2. Exterior

3.2.1. Front

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3. Body.

Bumper, front

The M-specific design bumper panel features at bottom left and right flaps in black and an additional rubber front spoiler lip for reducing the lift at the front axle. It is painted in the vehicle color, including the PDC sensors. Due to the necessary air inlets no fog lights are offered. The double-rib kidney bars of the BMW M radiator grille are provided as standard in black with high-gloss struts and the BMW M8 model designation for the BMW M8. The optional side view camera and the Automatic Parking Assistant (PMA) sensor are integrated at the front/side similarly to the G14/G15 production vehicle.

The ornamental grilles at the bottom are black. Optionally, radar sensors for the driver assistance systems are installed in the front bumper.

F91/F92, front view

The outside temperature sensor is located behind the radiator grille in the F91/F92. The previous installation location for the outside temperature sensor in the air ducts for brake system cooling was not possible in the F91/F92 since the measured values were not plausible on account of the greater heat dissipated by the S63B44T4 engine and brake system while the vehicle is at a standstill.

Headlights

The front headlights are carry-over parts from the G14/G15. The adaptive LED headlights are installed as standard. The M-specific bumper panel has been adapted to the position and shape of the headlights on the F91/F92.

Hood

The hood on the F91/F92 is, like on the G14/G15, made of aluminum.

The supporting inner structure as well as the outer skin of the hood are made of aluminum.

F91/F92 Complete Vehicle.

3. Body.

Front end and air ducts

There is an adapted air duct behind the bumper panel both for the center radiator assembly and for the upper low-temperature radiator and the two radiators in the wheel arches. The specific lower engine compartment shielding comes in three parts. It includes in the center the air duct of the horizontal engine oil cooler and optimizes its flow. The engine compartment shielding is bolted to the engine oil cooler to guarantee its durability at maximum speed.

3.2.2. Side view

F91, side view (Competition)

F92, side view (Competition)

F91/F92 Complete Vehicle.

3. Body.

Exterior mirror and sill

As standard, the M-specific exterior mirrors are heated and are shaded with integrated additional indicators, have memory and fold-in functions, and the passenger's side exterior mirror has an Automatic Curb Monitor. The glass for each mirror also contain the warnings for the driver assistance systems. The mirror triangle and mirror cap at the bottom, including the weather strips and shaft covers, are grained as standard.

The BMW M8 exterior mirrors have a prominent design and have been optimized in terms of their aeroacoustic properties. The full side sill trim has been carried over from the M Sport package.

F91/F92, side gills and mirror (Competition)

Front side panel

The front side panels of the F91/F92 are made from aluminum.

Striking design features include the so-called M gills and the BMW M8 model designation on the front left and right side panels.

The front side panels are also new due to the tire clearance.

The M side gills lend the front side panel the required structural rigidity. It is therefore necessary when exchanging the M side gills to pay increased attention to the structure of the front side panel.
The instructions in the current repair instructions in ISTA absolutely must be followed.

Rear side panel

The rear side panels have been completely carried over from the G14/G15 production vehicle. To ensure the legally required wheel arch area cover in the rear in the F91/F92, wheel arch covers made of plastic are installed on the rear side panel. The dimensions of the covers are adapted to the country regulations in each case and therefore vary with the national-market version.

F91/F92 Complete Vehicle.

3. Body.

F91 roof

The fully automatic, electro-hydraulic soft top on the F91 has the same design and function as the roof on the G14.

Further information on the fully automatic, electro-hydraulic soft top can be found in the product information "ST1839 G14 Complete Vehicle".

F92 roof

The BMW M8 Coupé also features a CFRP roof with a fiber structure and visible optics which is bonded to the body using an adhesive method. The roofline is aerodynamically contoured in the middle section.

The CFRP roof is a multi-layer design using a wet compression process and is sealed with a layer of clear coat.

F92, CFRP roof (Competition)

The use of a CFRP roof produces a weight saving of 3.3 lbs compared with the standard aluminum roof on the G15. The weight saving in the roof area increases the vehicle's agility and dynamics by lowering the center of gravity.

Rim design, standard equipment/optional equipment

Cast 20" M BMW light-alloy wheels are used as standard at the front and rear. Mixed tires with the sizes 275/35 ZR20 at the front and 285/35 ZR20 at the rear are used. For more information please see the chapter "Wheels/tires".

F91/F92 Complete Vehicle.

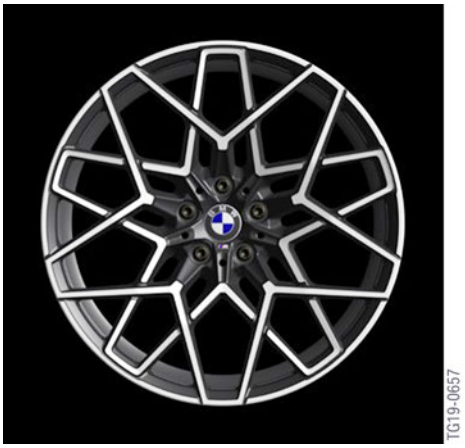
3. Body.

F91/F92, rim design

Index	Explanation
1	20" M double-spoke bi-color wheel, standard equipment 810M
2	20" M double-spoke black wheel, optional equipment 810M
3	20" M Star-spoke bi-color wheel, optional equipment 811M

Rim design, Competition

Forged M light-alloy wheels with 20" and mixed tires in the size 275/35 ZR20 at the front and 285/35 ZR20 at the rear are used on the Competition model. For more information please see the chapter "Wheels/Tires".



F91/F92, Competition rim design

Index	Explanation
1	20" M Star-spoke bi-color wheel, standard equipment 813M (Competition package)

F91/F92 Complete Vehicle.

3. Body.

3.2.3. Rear view

A striking design feature is the 4 round exhaust tailpipes.

F91, rear view (Competition)

F92, rear view (Competition)

The rear bumper panel is a BMW M8-specific design and is a common part on the F91/F92. It is, along with the PDC sensors, painted in the vehicle color and contains the side rear reflectors.

F91/F92 Complete Vehicle.
3. Body.

The BMW M8-specific bottom bumper panel has been newly developed for the F91/F92 and visually accommodates the exhaust system with its 4 round exhaust tailpipes.

A BMW M8-specific rear spoiler forms the closure of the F91/F92 rear end.

3.2.4. Underbody, thermal protection and cooling

Underbody

The complete underbody is fully panelled as part of the aerodynamic concept of the F91/F92 in order to reduce and uniformly distribute the lift at the front and rear axles. This highlights and optimizes the driving dynamics concept, particularly at higher speeds. The underbody panelling was adapted in terms of cooling and flow around and through the drive components and chassis components, without compromising the aerodynamics.

Underbody panelling

New underbody panelling:

- Wheel arch trim panels, front
- Underbody panelling, middle
- Underbody panelling, fuel tank
- Underbody panelling, rear
- Wheel arch trim panel, rear
- Rear diffuser.

Thermal protection

New heat insulation:

- Heat insulation, engine support, left
- Heat insulation, engine support, at the transition to the bulkhead
- Heat insulation, left, from automatic transmission carried over from the F90
- Heat insulation of tunnel carried over from the F90
- Heat insulation of rear silencer, front and rear
- Complete heat insulation of the luggage compartment by 2 heat shields at front and rear prevents excessive heating of the luggage compartment by the exhaust air flow of the rear axle differential.

Cooling

As in the F90, the F91/F92 is equipped with a lithium-ion starter battery for the voltage supply. Due to the packaging-space-based positioning of the lithium-ion starter battery between the rear axle differential and the rear silencer in the luggage compartment as in the G14/G15, a cooling concept is implemented for the lithium-ion starter battery.

To avoid an excess temperature of the lithium-ion starter battery when using on racetracks under thermally unfavorable conditions, the air ducts are installed in the underbody panelling in the area of the luggage compartment well. The air ducts use the aerodynamics of the vehicle underbody to direct the air current under the luggage compartment well for cooling while the vehicle is moving. The cooling of the luggage compartment well generated in this way protects the lithium-ion starter battery against excessive temperatures and thus against long-term damage.

To achieve sufficient cooling of the lithium-ion starter battery by the air ducts, the cooling air intake air vents and outlet air vents must be checked for contamination and even clogging. If contaminated or clogged, remove the contamination or obstruction.

3.3. Interior equipment

3.3.1. Cockpit and steering wheel

M cockpit

F91/F92, M cockpit (Competition)

M leather steering wheel

The M leather multifunction steering wheel is built on a magnesium skeleton and is based on the steering wheel used with the F90 M5. Above the thumb rests are the M shift paddles with M gearshift logic: downshift on the left, upshift on the right.

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3. Body.

The steering wheel has increased in its outer diameter to 380 mm compared with the G14/G15. The steering wheel rim is reinforced and ergonomically optimized from a round to an oval cross-section, improving the driver's grip.

Shift paddle left **"-"** downshift, right **"+"** upshift.

The colored M stitching constitutes another difference from the production steering wheels. The M leather steering wheel in the double-spoke design with a stainless steel center trim and with M inscription is black leather.

The vibration element for lane departure warning and lane change warning is integrated in the steering wheel.

There are 2 red M buttons mounted on top of the multifunction pad because the multifunction button clusters for the driver assistance systems remain on the steering wheel as on the G14/G15. For more details, please see the chapter "M menu".

F91/F92, M leather steering wheel (Competition)

F91/F92 Complete Vehicle.

3. Body.

3.3.2. Seats

M Sport seats

The M Sport seats are standard equipment and are carried over from the F97/F98.

These are fully electric sports seats with integrated side airbag and a seat belt buckle pretensioner. The seats are operated by means of a control switch on each seat. The 3 memory functions for the driver's seat can be retrieved via the 3 buttons in the door trim panel. The control unit is installed at the bottom of the seat. To increase safety, the crash-active head restraints are installed as standard.

M seat features (driver and front passenger):

- Merino leather with perforated 3D stitching, one-color or two-color
- Heated seats
- Electrically adjustable seat length, height, tilt and backrest angle
- Manual head restraint depth and seat depth adjustment
- Memory function for the driver's seat
- Lumbar support
- Pneumatic backrest width adjustment
- Illuminated M logo in the head restraint
- Active seat ventilation as standard equipment SA 453
- In the "Parking" state the head restraint travels downwards fully into the rest state.

Optional equipment for the M Sport seat

- F91-specific head restraints with neck warmer SA 4NH.

Rear seats

The 2-seater design full foam seat with backrest and seat split and an upper body angle of 26° is a carry-over from the G14/G15. The split ratio is 50/50.

3.3.3. Seat belts

The seat belts of the F91/F92 have contrast stitching in the BMW M colors as standard.

F91/F92 Complete Vehicle.
3. Body.

3.3.4. Doors and strips

Doors

Upper door trims (shoulders) in “black soft nappa" leather with contrast stitching.

M decorative strips

The following trims are offered in the F91/F92:

- Carbon fiber.

Sill trims, footrest and mobility kit

- Sill trims with M lettering
- M Competition package illuminated lettering "M8 Competition"
- M footrest (LHD only)
- A Mobility Kit is included with the vehicle as standard.

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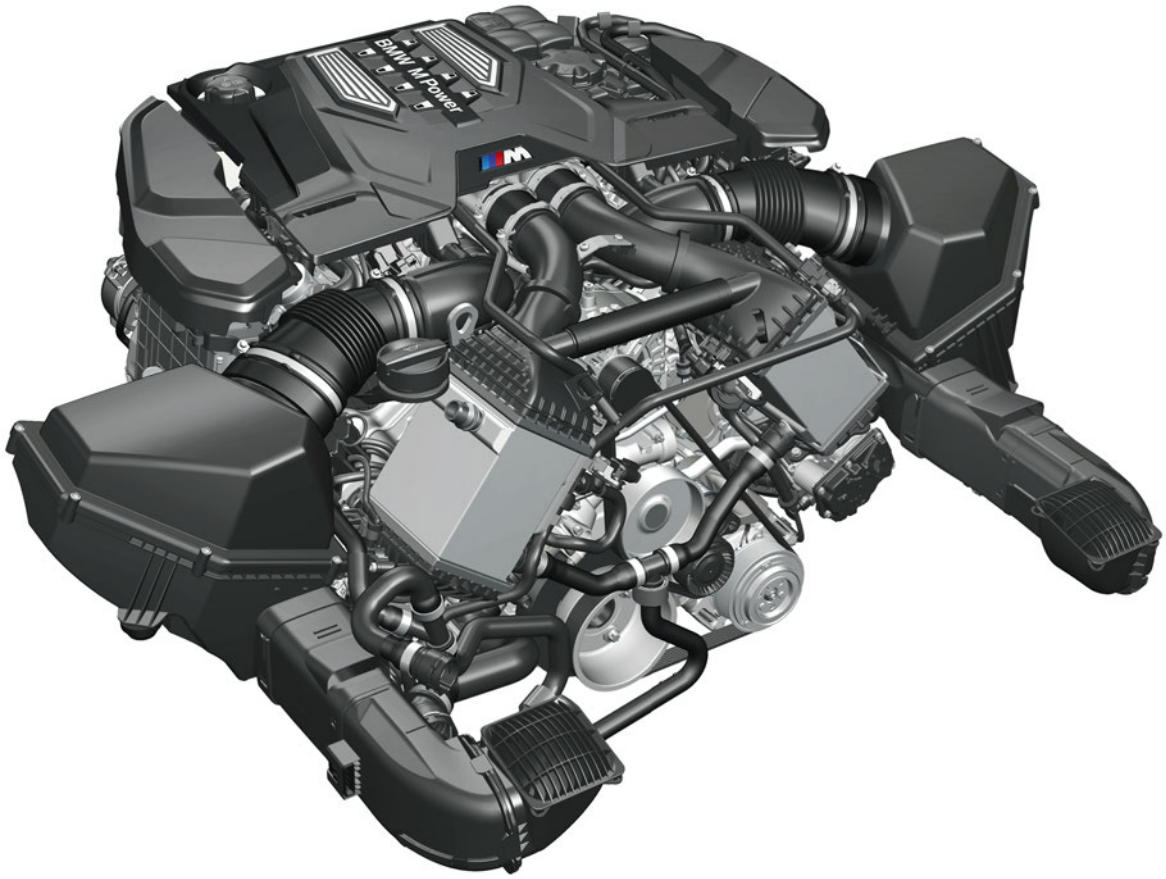
4. Powertrain.

4.1. M TwinPower turbo engine S63B44T4

The S63B44T4 engine is described in a separate Product Information.



F91/F92, S63B44T4 engine

Further information on the S63TU4 engine can be found in the product information "ST1916 S63TU4 Engine".

4.2. Engine mounts F91/F92 Competition

The engine mounts of the F91/F92 Competition have an optimized characteristic curve with an increased spring rate of 900 N/mm (basic F91/F92 580 N/mm). This provides a noticeably more direct connection of the drivetrain to the vehicle structures and delivers an even more spontaneous and precise turn-in ability on the part of the F91/F92 Competition.

Furthermore, the new engine mounts in the F91/F92 Competition increase the drive experience in that the engine acoustics in the vehicle interior are perceived more directly and unfiltered.

F91/F92 Complete Vehicle.
4. Powertrain.

4.3. Exhaust system

4.3.1. Overview of available exhaust systems

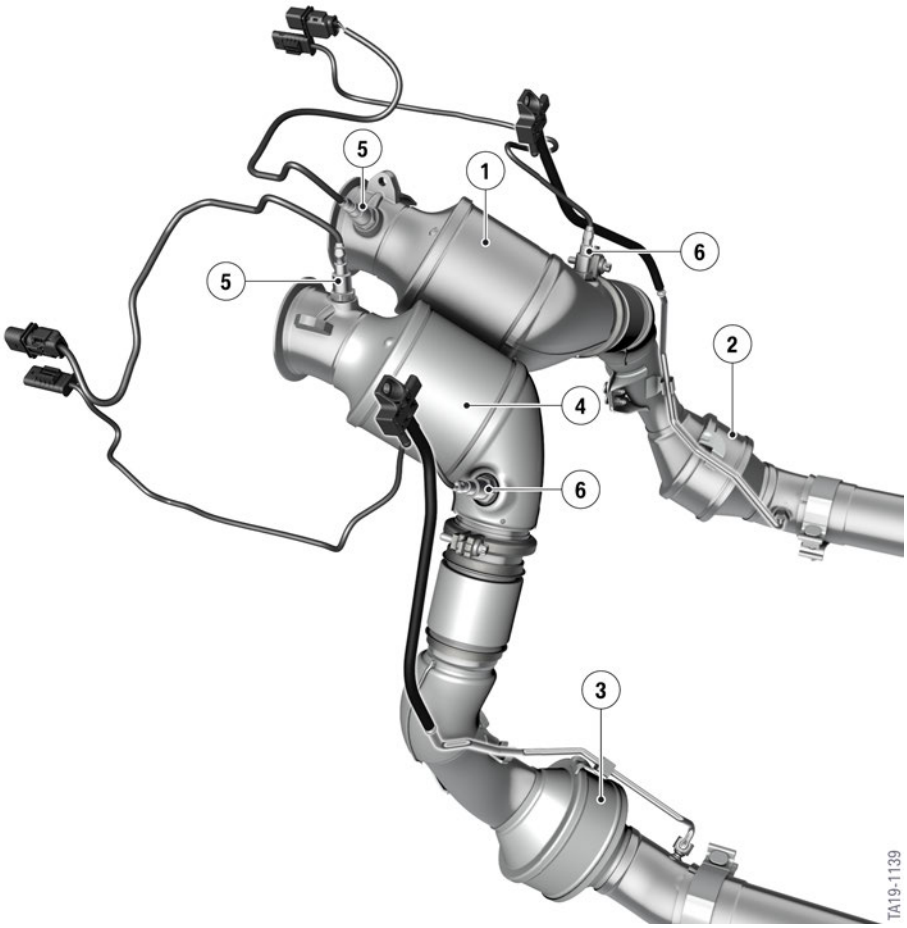
Standard exhaust system	European version	US version
Upstream catalytic converter	●	●
Underbody catalytic converter	●	●
Gasoline particulate filter	●	
Front oxygen sensor	●	●
Monitoring oxygen sensor	●	●
Differential pressure sensor, gasoline particulate filter	●	
Temperature sensor upstream of gasoline particulate filter		
Temperature sensor downstream of gasoline particulate filter		
Exhaust flap	●	●
Chrome-plated tailpipe trims	●	●
M Sport exhaust system		
Continuous exhaust flap	●	●
Black chrome-plated tailpipe trim	●	●

4.3.2. Catalytic converter

The S63B44T4 engine in the F91/F92 has two catalytic converters per cylinder bank, each with one ceramic monolith.

F91/F92 Complete Vehicle.

4. Powertrain.



F91/F92, catalytic converters

Index	Explanation
1	Catalytic converter (upper), bank 1
2	Catalytic converter (lower), bank 1
3	Catalytic converter (lower), bank 2
4	Catalytic converter (upper), bank 2
5	Lambda oxygen sensor LSU 5.2
6	Monitoring oxygen sensor LSF Xfour

Lambda oxygen sensor upstream of catalytic converter

The oxygen sensor (LSU 5.2) from Bosch is used as a control sensor before the catalytic converter. The function is comparable to the oxygen sensor (LSU AVD) and therefore is not described in detail here. This oxygen sensor was used in the S63B44T4 engine for the first time.

The oxygen sensor before catalytic converter (LSU 5.2) is characterized by the following advantages:

- High signal running, especially in charged operation due to lower M dynamic pressure dependence
- Increased durability thanks to reduced pump voltage
- Increased accuracy
- Rapid operating readiness < 7 s
- Higher heater output at 10 W
- Increased temperature compatibility (300 h)
- Improved system connector with better contact properties.

The LSU 5.2 has an extended measuring range. It is thus possible to measure precisely from oxygen sensor 0.65 and higher. The new oxygen sensor is operational earlier, meaning exact measured values are available after only 7 s.

The measuring dynamics of the sensor is higher, so it is possible to determine the air/fuel ratio in each cylinder separately and thus also control it. As a result, a homogeneous exhaust flow can be adjusted, the emission levels lowered and the long-term emission behavior optimized.

Monitoring oxygen sensor downstream of catalytic converter

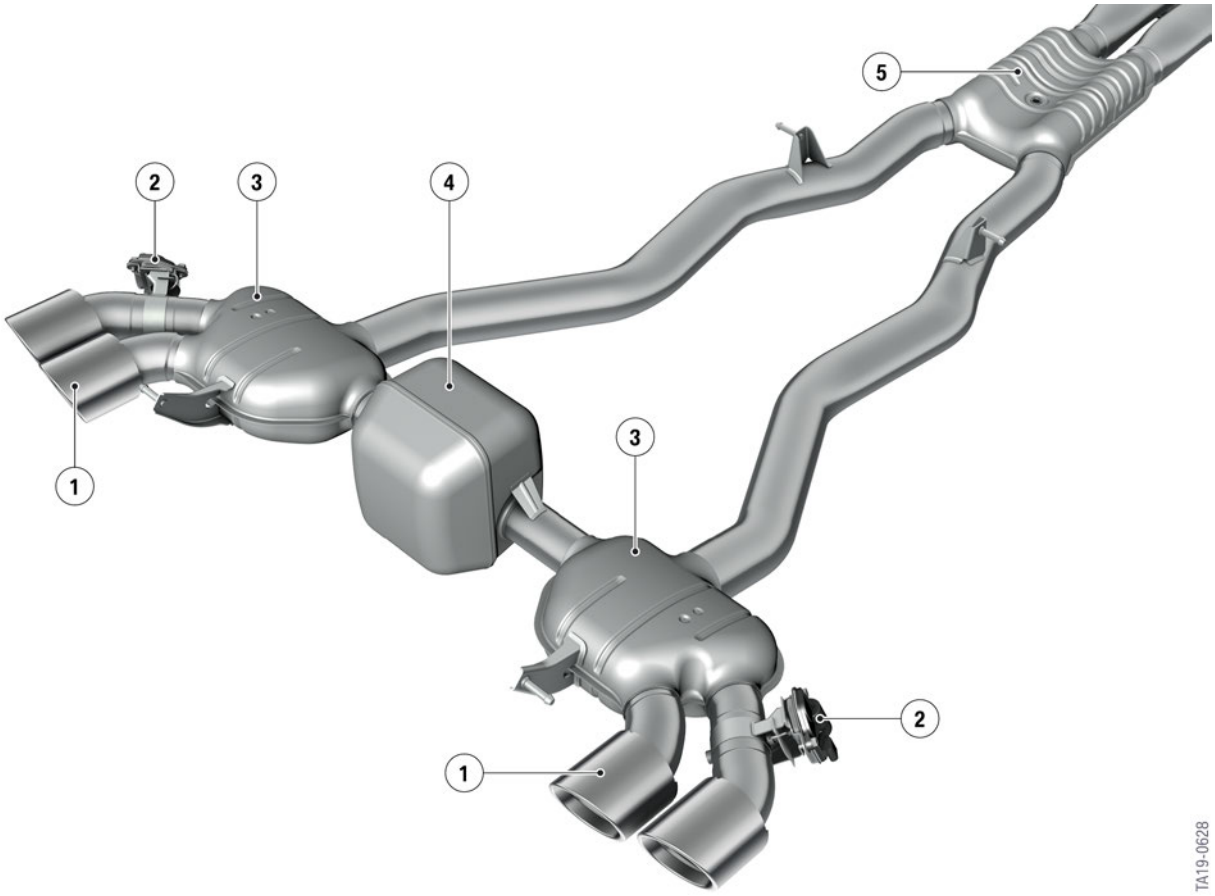
The oxygen sensor after the catalytic converter is also called a monitoring sensor. The monitoring sensor LSF Xfour from Bosch is used which is the successor sensor to the LSF 4.2.

The LSF Xfour needs the DME 8.8 for signal evaluation and is characterized by the following properties:

- In order to achieve faster response characteristics after the engine has started (halved compared with the LSF 4.2), a heater with a greater degree of regulation has been integrated into the LSF Xfour.
- This improves signal stability.
- Less space is required for installation.
- Thanks to the high temperature resistance and optimal thermoshock protection, the resistance to condensation in the exhaust system following a cold start has been improved.

4.3.3. Exhaust system

- Vacuum operated exhaust flaps replaced by electrical exhaust flaps
- M-specific startup sound on engine starting
- Sporty and unmistakable feedback of the exhaust sound to the vehicle occupants.



F91/F92, exhaust system

Index	Explanation
1	Twin tailpipe
2	Electrical exhaust flaps controller
3	Rear silencer
4	Resonator
5	Center silencer

The production exhaust system of the F91/F92 features 100 mm diameter chrome-plated tailpipe trims as a visual identifying feature.

4.3.4. M Sport exhaust system

An M Sport exhaust system is available as standard equipment (SA 1MA) on the F91/F92 Competition models only as of market introduction.

The design of the M Sport exhaust system only differs from the production exhaust system in the internal structure of the center silencer and rear silencer. In the internal structure of the center and rear silencer the perforated baffles to the individual damper chambers are influenced by the number of

overflow holes. This design change has made it possible to give the F91/F92 with the M Sport exhaust system above all, at high loads and engine revs an even more distinctly powerful, and richer sound that is more akin to motorsport applications. This again enhances the driving experience of the F91/F92.

A further adaptation of the interior sound in the F91/F92 with the sport exhaust system is made possible by a different Active Sound Design (ASD) tuning via the Receiver Audio Module (RAM).

The M Sport exhaust system of the F91/F92 features 100 mm diameter black chrome-plated tailpipe trims as a visual identifying feature.

4.3.5. Electrically controlled exhaust flaps

Electrically controlled exhaust flap(s)

The exhaust flap is integrated into the rear silencer in the outer exhaust tailpipes. The exhaust flap is operated by an electric motor with integrated gears and electronics. The electrical controller for the exhaust flap has the following connections:

- Voltage supply (+)
- Ground (-)
- Actuation wire (signal line)

The exhaust flaps furthermore help to suppress frequencies that are perceived as unpleasant and thereby improve driving comfort. At high engine speeds and high engine loads, the exhaust gas counterpressure can be reduced by opening the exhaust flap.

The exhaust flap is activated (using pulse width modulation) by the Digital Motor Electronics (DME). The input variables are:

- Engine speed
- Engine load
- Driving speed

The exhaust flap does not have an intermediate setting; it is either fully opened or closed. The flap moves towards the respective mechanical end stop using pulse-width modulated signals (PWM signals). If faults are detected or the actuation stops, or after the engine has been shut off, the preferred position is the closed position.

Electrical exhaust flap	S63B44T4 engine
Installation location	right and left
PWM signal open	10% duty cycle
PWM signal closed	90% duty cycle

In contrast with the exhaust flaps on the standard exhaust system, the exhaust flaps of the M Sport exhaust system do have intermediate positions. Therefore, it is possible for the exhaust flaps to be continuously variably adjusted to any position. On vehicles with the M Sport exhaust system the exhaust flap is fully open in SPORT mode and after the engine has been shut off.

A further, more distinctive adaptation of the interior sound in the F91/F92 with M Sport exhaust system is made possible by a different Active Sound Design (ASD) tuning via the Receiver Audio Module (RAM).

The electrical controller of the exhaust flap can be replaced separately. The controller can be moved into an installation position using the ISTA diagnosis system.

The exhaust sound of the F91/F92 is geared towards the F90, but is much more pronounced. The exhaust flaps are actuated in accordance with demand and can be set via the function of the SETUP button in the Central Information Display (CID) to **"EFFICIENT"**, **"SPORT"** and **"SPORT+"**.

The position of the exhaust flaps can additionally be influenced by means of the sound button in the center console switch cluster. Because no default value is stored in the "EFFICIENT" engine dynamics control for the engine start sound that would lower the noise level, it is possible that this would have an unfavorable effect on the sound produced by the vehicle in residential areas. For this reason, the exhaust flaps can be influenced and closed independently of the engine dynamics control setting to EFFICIENT, SPORT or SPORT+ via the sound button. By pressing the sound button, the sound produced can quickly be changed to a quieter exhaust sound without influencing the engine dynamics control settings.

The sound button is connected with the Body Domain Controller BDC via a LIN bus.

Please note that the outer exhaust flaps on the S63B44T4 engine may be closed when idling.
As such, no emission measurement can be performed at these exhaust tailpipes.

4.4. Cooling

4.4.1. System overview

The engine and charge air cooling both have separate cooling circuits.

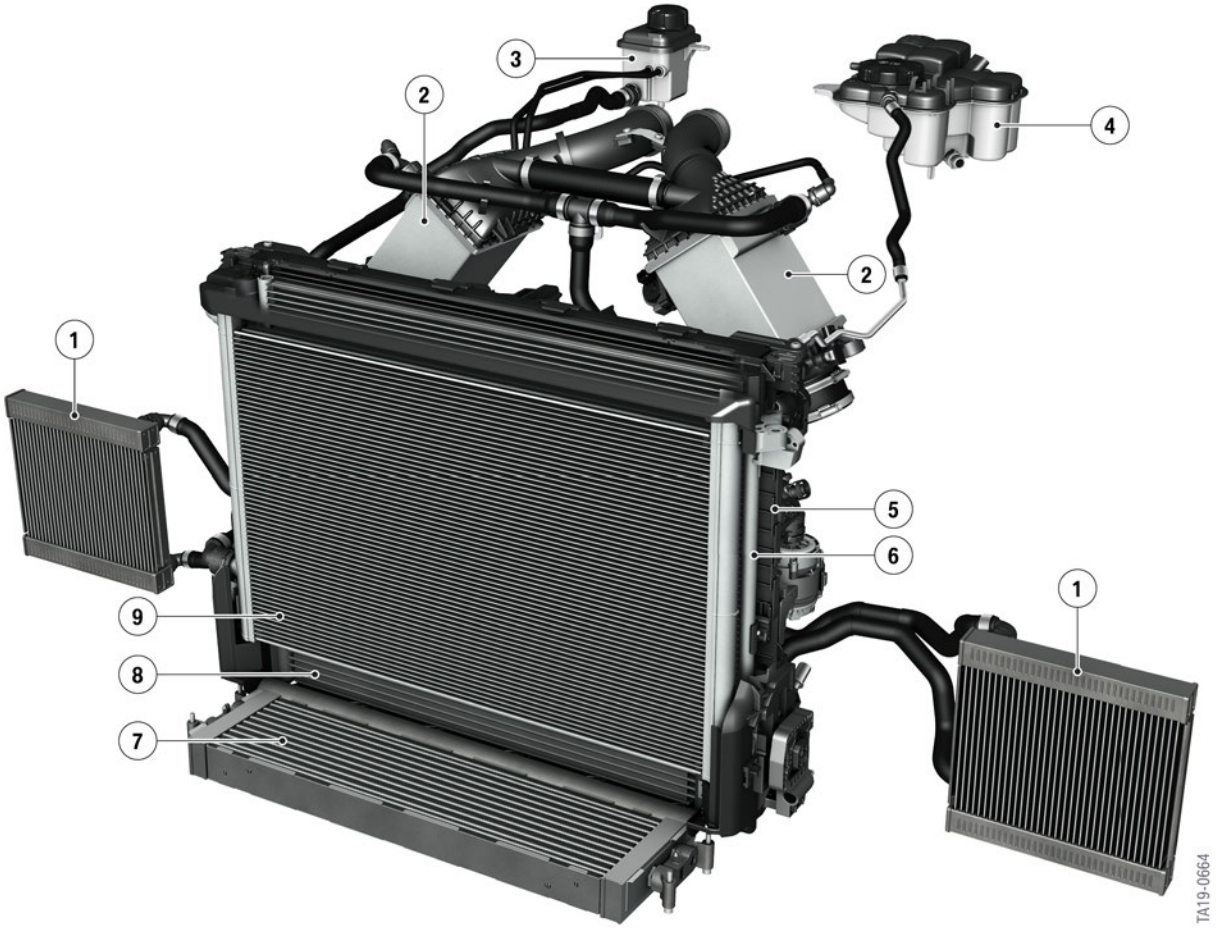
Differences in cooling between F90 and F91/F92:

- Deletion of the external low-temperature charge air cooler on the right
- Additional external radiator on the right.

In order to ensure the cooling power of the cooling system in the S63B44T4 engine even in extreme racetrack applications, the external low-temperature charge air cooler on the right is deleted.
An additional external radiator is installed in its place.

F91/F92 Complete Vehicle.

4. Powertrain.



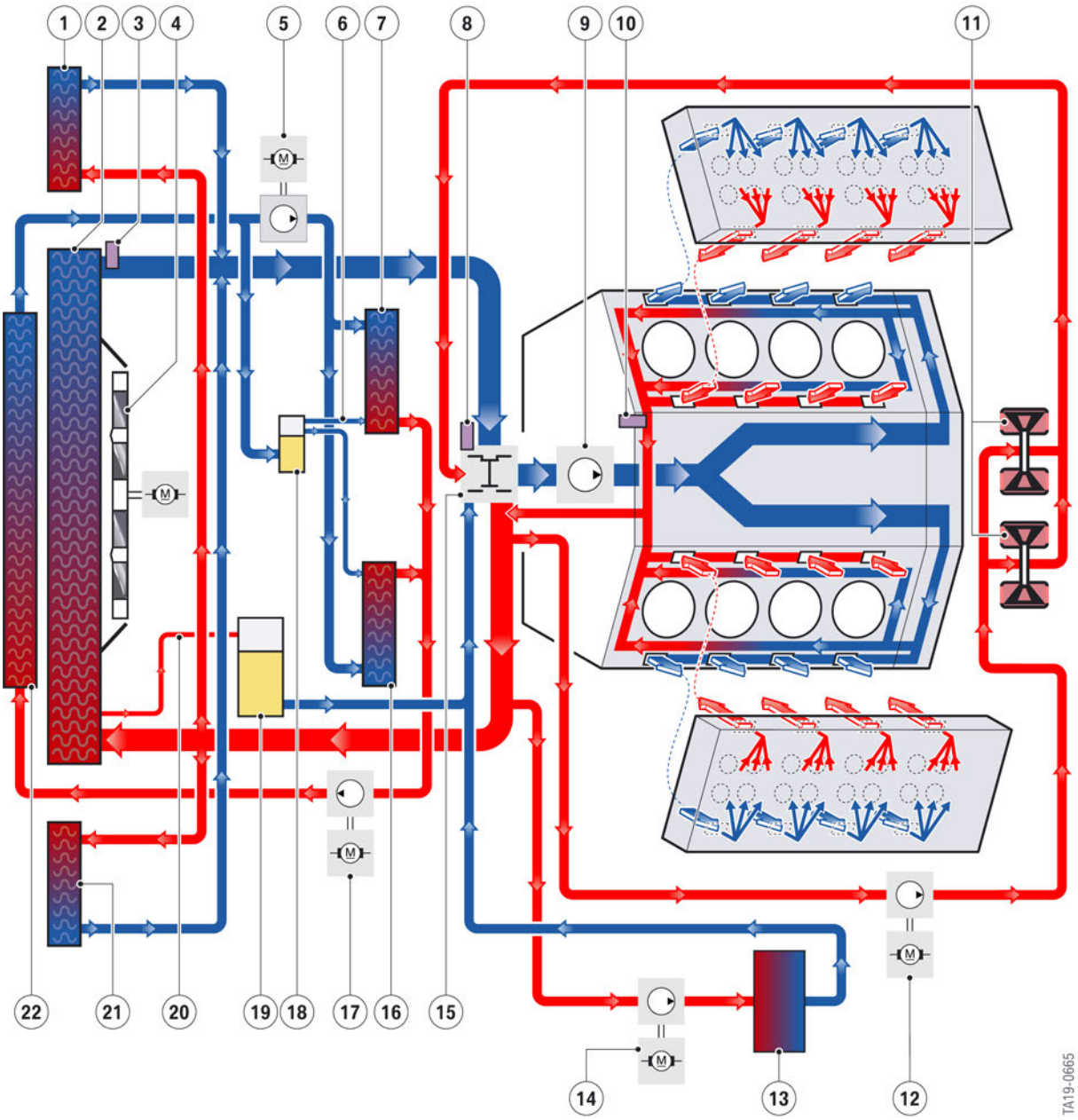
F91/F92, radiator/cooler assembly from front

Index	Explanation
1	External radiator
2	Indirect charge air cooler
3	Expansion tank, low-temperature circuit
4	Expansion tank, high-temperature circuit
5	Radiator, engine
6	Low-temperature cooler, charge air
7	Engine oil cooler
8	Transmission oil cooler
9	Air conditioning condenser

The above-mentioned changes are carried over as of production date 07/2019 in the F90 for the S63B44T4 engine as well.

F91/F92 Complete Vehicle.

4. Powertrain.



It is absolutely essential to observe the latest information and specifications of the documents with regard to the cooling system filling capacities in the Integrated Service Technical Application (ISTA).

F91/F92, complete cooling system without oil cooling, schematic

Index	Explanation
1	Auxiliary radiator, engine
2	Radiator, engine
3	Coolant temperature sensor at radiator outlet
4	Electric fan 1 kW
5	Electric coolant pump, low-temperature circuit, charge air 1
6	Ventilation line, low-temperature circuit
7	Indirect charge air cooler, bank 1
8	Heater, map thermostat
9	Mechanical coolant pump
10	Coolant temperature sensor
11	Exhaust turbocharger
12	Electric coolant pump, exhaust turbocharger
13	Heat exchanger for heating system
14	Electric coolant pump, heating, vehicle interior
15	Data-map thermostat
16	Indirect charge air cooler, bank 2
17	Electric coolant pump, low-temperature circuit, charge air 2
18	Coolant expansion tank, low-temperature circuit, charge air
19	Coolant expansion tank, engine
20	Ventilation line
21	Auxiliary radiator, engine
22	Low-temperature cooler, charge air

4.4.2. Engine with exhaust turbocharger

The engine cooling system is an independent coolant circuit known as the "**high-temperature circuit**". It comprises the conventional engine cooling and cooling of the turbochargers. The vehicle interior heating is also supplied by the coolant circuit of the engine cooling system.

The conventional coolant pump is driven via a belt and cannot be used for cooling the exhaust turbocharger after the engine has shut down. For this reason there is an electric coolant pump, which works at a power of 20 W, for this separate coolant circuit. But also during engine operation the electric coolant pump is switched on taking into account the following factors:

- Coolant temperature at the engine outlet
- Engine oil temperature
- Injected fuel quantity

Using these values the heat input into the engine is calculated. The run-on period of the electric coolant pump can last up to 30 min. To improve the cooling effect, the electric fan is activated and can run for up to a maximum of 11 minutes. (For further information, please also refer to the chapter "BMW Remote Software Upgrade".)

4.4.3. Charge air cooling

For charge air cooling, the system again makes use of so-called "**indirect**" charge air cooling, which is cooled by a separate coolant circuit, the so-called "**low-temperature circuit**".

Compared with the F90 only 1 low-temperature cooler is used in the F91/F92 for the charge air. One low-temperature charge air cooler is located directly at the front of the vehicle as the first component of the radiator assembly. The low-temperature charge air cooler is supplied with coolant via an independent cooling system with 2 electric coolant pumps.

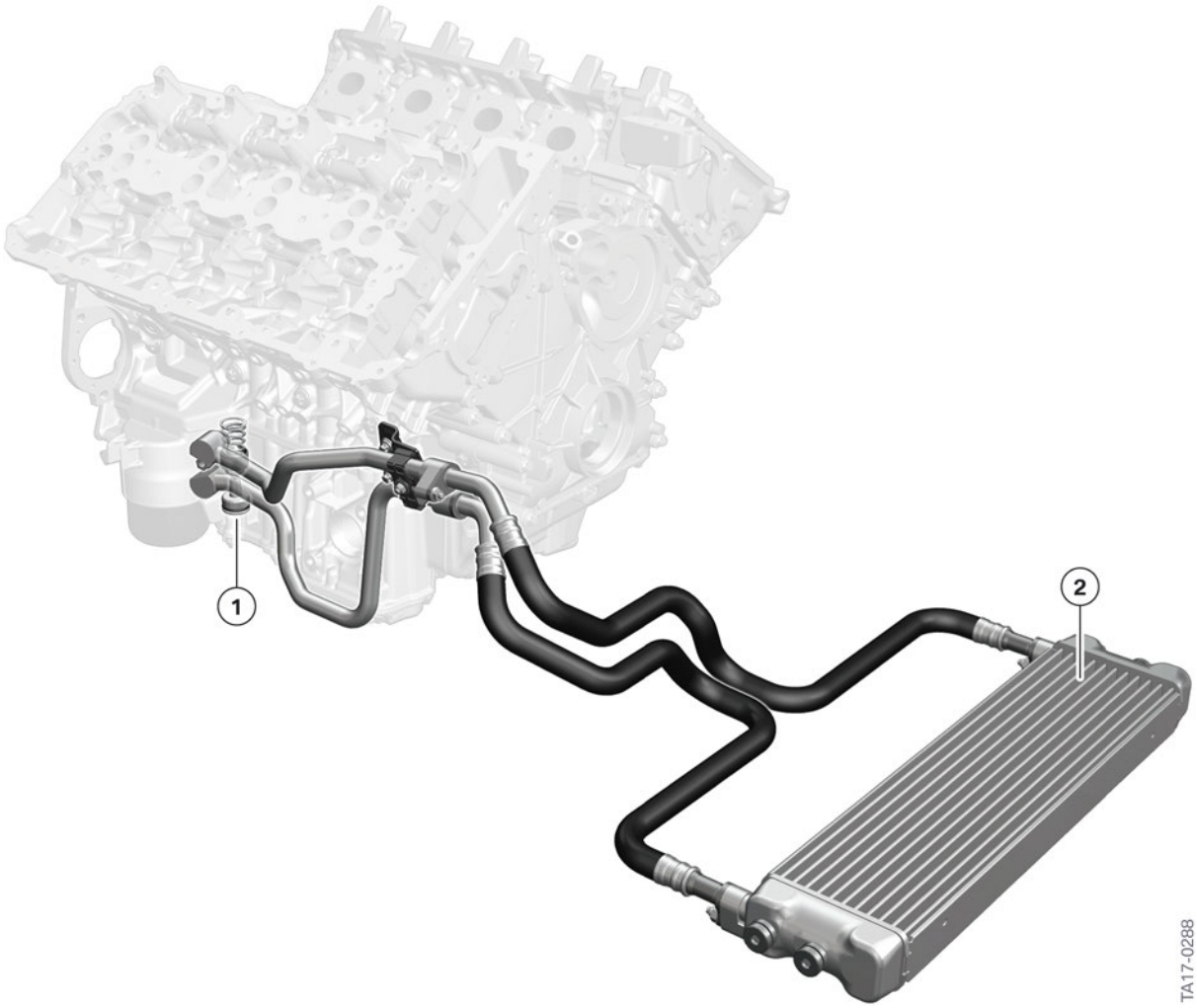
Both 50 W pumps have self-diagnosis and dry-running protection, which can lead to fault code entries in the DME. If the pump speed increases (indicating low or no coolant) for 15 minutes over a period, the auxiliary coolant pumps are switched off and a fault code is stored in the DME. The expansion tank does not have a coolant level switch and does not automatically detect when the fluid level is too low.

If the electric coolant pump is removed but being reused, it is important to ensure that it is set down still filled with coolant. Drying out may cause the bearing positions to stick. The outcome of this is that the electric coolant pump may possibly not start, which in turn may result in engine damage.

Before installing, turn the pump impeller manually to ensure that it moves freely.

4.4.4. Engine oil cooling

The S63B44T4 engine has an air-coolant heat exchanger for cooling the engine oil which is built-in flat in front of the cooling module. To make possible quick heating-up of the engine oil, a thermostat is integrated in the oil sump upper section. The thermostat releases the flow to the engine oil cooler as of an engine oil temperature of 100 °C (212 °F) and is fully open at an engine oil temperature of 145 °C (293 °F).



S63B44T4 engine, engine oil cooling

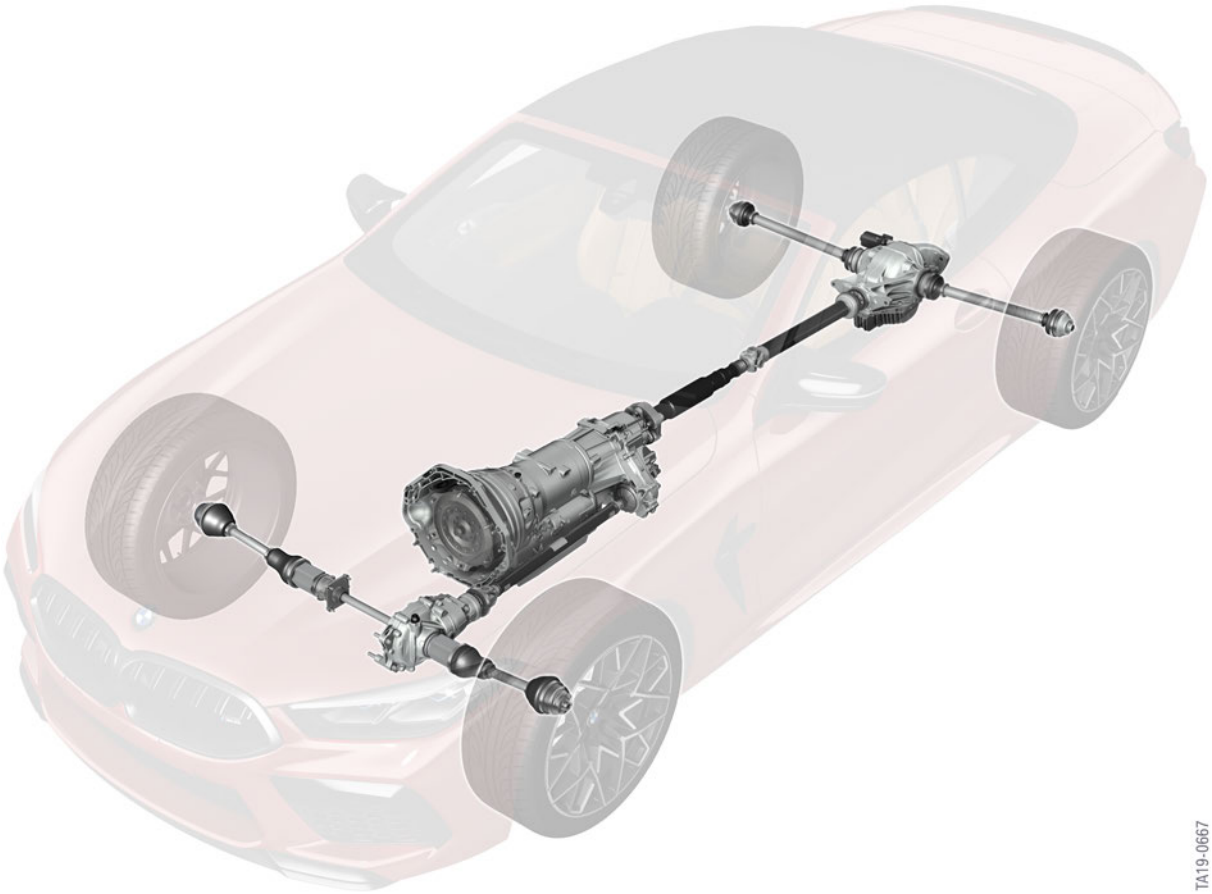
Index	Explanation
1	Thermostat
2	Upstream engine oil cooler

4.4.5. Cooling power limits

If under extreme conditions such as for example in countries with high outside temperatures and the cooling power reaching its limits on the racetrack under race conditions, the cooling power of the vehicle air conditioning is reduced as the very first measure. Reducing the cooling power for the air conditioning ensures that there is sufficient cooling power available for the engine and charge air cooling. If the cooling power for the engine and charge air cooling still cannot be achieved even after the cooling power of the air conditioning has been eliminated, the engine performance and engine speed are gradually reduced before the CC message is displayed. In this way, constant and rapid lap times over a lengthy period can be achieved on the racetrack even at high ambient temperatures. The customer is alerted by a Check Control message if the cooling power of the engine or charge

air cooling reaches its limits. In the event of a customer complaint relating to the cooling power of the vehicle's air conditioning system, it is necessary to take these cooling limit conditions into consideration before starting troubleshooting on the cooling system and on the air conditioning.

4.5. M automatic transmission/M GWS



F91 Drivetrain

4.5.1. M automatic transmission

The M automatic transmission with Drivelogic with the designation GM8HP76Z is used in the F91/F92. This is referred to in the following as M8HP76.

With the M8HP76 M Sport Steptronic transmission, which is based on the BMW AG 8HPTU2 gearbox, customers benefit from significantly improved gear shift responsiveness and even further optimized control of the converter lock-up clutch.

This has been made possible by the further development of converter technology to effectively dampen rotational irregularities in the drivetrain with a turbine torsional vibration damper. As a result, the operating ranges in which the converter lock-up clutch has to be controlled are reduced even further because the converter lock-up clutch is fully engaged in the vast majority of driving situations. This provides for an even more direct connection of the M8HP76 transmission to the complete drivetrain, resulting in an even sportier driving experience and reduced fuel consumption.

F91/F92 Complete Vehicle.
4. Powertrain.

The power transmission capability of the torque converter has been adapted to the increased torque of the S63B44T4 engine.

In the F91/F92, as in the F90, the **"Idle coasting"** function known from the BMW AG vehicles is not used. However, the M8HP76 supports, as known from the BMW AG vehicles, the **“ConnectedShift”** function.

Transmission ratios, comparison of F90 - F91/F92

	F90	F91/F92
Transmission designation	M8HP75 (ZF)	M8HP76 (ZF)
Steering axis inclination	7.8	7.8
Maximum engine speed [rpm]	7200	7200
Torque [Nm]	760	760
Ratio [:1] 1st gear	5.000	5.000
Ratio [:1] 2nd gear	3.200	3.200
Ratio [:1] 3rd gear	2.143	2.143
Ratio [:1] 4th gear	1.720	1.720
Ratio [:1] 5th gear	1.313	1.313
Ratio [:1] 6th gear	1.000	1.000
Ratio [:1] 7th gear	0.823	0.823
Ratio [:1] 8th gear	0.640	0.640
Ratio [:1] reverse gear	3.478	3.478

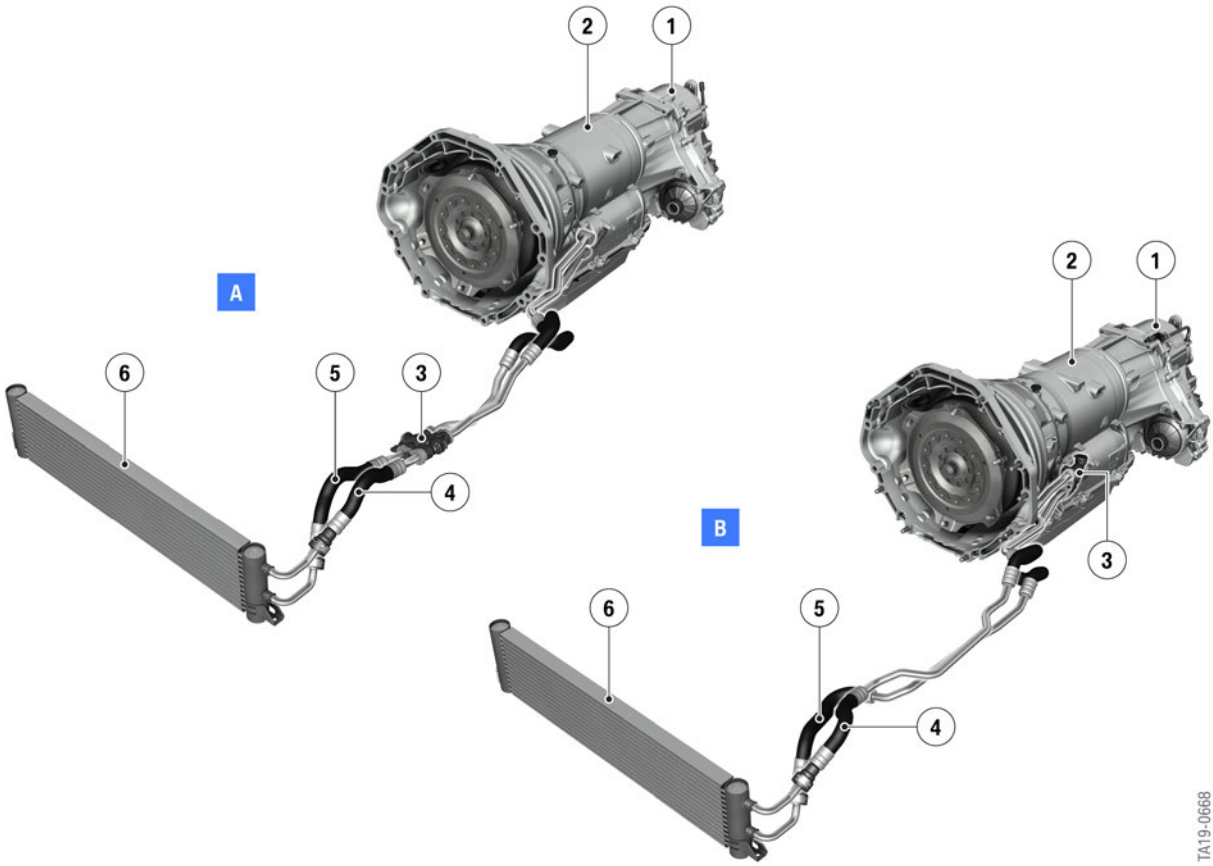
Transmission oil cooling

The plastic transmission oil sump has been replaced by an aluminum version with larger cooling fins and the opening point of the transmission oil thermostats has been lowered, improving the cooling of the M8HP76 transmission.

A transmission oil cooler with a thermostat is used to cool the M8HP76 on the F91/F92. This additional transmission oil cooler, which is designed as a plate heat exchanger, is an oil-to-air heat exchanger and is installed vertically in front of the radiator assembly.

F91/F92 Complete Vehicle.

4. Powertrain.



F91/F92, transmission oil cooling

Index	Explanation
A	Installation location, thermostat F90
B	Installation location, thermostat F91/F92
1	Transfer box
2	M automatic transmission
3	Thermostat
4	Transmission oil return
5	Transmission oil feed
6	Transmission oil cooler (oil-to-air heat exchanger)

In some of the outside lines and hoses that carry transmission oil to the additional transmission oil cooler, the cross-section has been optimized. This results in a greater oil flow rate, translating into more efficient cooling of the M automatic transmission.

The thermostat has been routed in the F91/F92 from the lines carrying transmission oil to the transmission housing. The thermostat of the transmission oil cooler opens at 76 °C (168 °F) and is fully open at 96 °C (205 °F).

4.5.2. M gear selector lever/M GWS

The M automatic transmission is operated using the M gear selector lever (M GWS) or the shift paddles on the steering wheel.

The M-specific shift pattern, as used for the M double-clutch transmissions, was retained for the M gear selector switch.

F91/F92, M gear selector switch

Index	Explanation
1	Drivelogic button
2	Parking lock button
3	Gear display (with M-specific shift pattern)

It is possible to choose and change between an automatic **"D mode"** and a sequential **"manual mode"**. In each mode there are 3 driving programs, which can be selected and activated with the **“Drivelogic switch”**.

Drivelogic

A rocker switch is used on the F91/F92 for changing the transmission mode up or down.

After each change between the manual mode and Drive mode, the last selected driving program is active.

After each engine start driving program 1 is active in Drive mode.

D mode/Drive mode

This mode is automatic, all forward gears are shifted automatically. Kickdown is triggered by depressing the accelerator pedal beyond the pressure point.

Three driving programs are available for selection:

1: Efficient driving - Comfort shifting time

2: Fast driving - Sport shifting time

3: Sporty driving - Sport Plus shifting time.

Manual mode/Sequential mode

The gears can be manually shifted by means of shift paddles on the steering wheel **"+** or **–"** or the gear selector lever **"forward** and **back"** at the matching driving speed and engine revs. The selected gear is maintained even when the engine speed limitation is reached, but an automatic downshift is performed when the vehicle drops below the gear-specific minimum driving speed.

When the manual mode is selected for the first time after terminal change (engine restart), the last Drivelogic stage used is active.

Three driving programs are also available here for selection:

1: Comfortable, smooth gearshifts in all driving conditions

2: Sporty, fast gearshifts, light gearshift jolts permitted at higher engine loads and speeds

3: Maximum sporty shift speed and gearshifts and the prerequisite for activation of Launch Control

To use the highest, i.e. the third driving program, M DSCi does not have to be deactivated.

4.5.3. Launch Control

During the first 3100 mile run-in distance, the Launch Control must not be used.

The Launch Control is active from the factory. Activation of the Launch Control is no longer restricted by the 1200 mile running-in check.

Premature wear occurs as a result of the high load on the vehicle components when using Launch Control.

Launch Control

Function: Launch Control enables optimal acceleration when driving off on a non-skid roadway.

Sequence	Precondition/Action
1.	The vehicle must be stationary, the engine running and at operating temperature (approximately 7 mile warm-up journey).
2.	Dynamic Stability Control (DSC) is deactivated. (4WD)
3.	The manual mode and the third Drivelogic driving program are selected.
4.	The brake pedal is gently pressed with the left foot and held.

Sequence	Precondition/Action
5.	The accelerator pedal is depressed fully and held in this position.
6.	In the M instrument cluster a flag symbol must appear (if not, check notes and steps 1-5).
7.	An optimum engine speed for pulling away is adjusted.
8.	The left foot is taken off the brake pedal within 5 seconds.

Effect

- Launch Control automatically shifts up using the shortest possible gearshift times and performance-optimized shift points as long as the customer keeps the accelerator pedal fully depressed.
- The start flag in the instrument cluster remains active.

Repeated Launch Control starts are possible as long as the transmission oil temperature satisfies the preconditions for this.

Automatic deactivation

- The customer releases (even if only briefly) the accelerator pedal from full-throttle during acceleration.

A manual intervention in the automatic upshift, for example via the gearshift paddles on the steering wheel or the gear selector lever, does not interrupt the Launch Control process.

If one of these preheating/precooling conditions is breached, it is not possible to activate the Launch Control.

Also at excessive transmission oil temperature (e.g. repeat Launch Control or race-like start), activation is blocked up until an acceptable temperature threshold is reached.

The start flag goes out with every deactivation and the automatic forced upshift is cancelled.

Premature wear occurs as a result of the high load of the vehicle with use of the launch control.

4.5.4. Wheelspin start (smoky burnout)

During the first 3100 mile run-in distance, wheelspin start (smoky burnout) must not be used.

Premature wear occurs as a result of the high load on the vehicle components when using the wheelspin start function.

Preheating/Precooling

Sequence	Precondition/Action
1.	The vehicle must be stationary with the engine running at idle speed and at operating temperature (approximately 7 mile warm-up journey).
2.	Deactivate Dynamic Stability Control (DSC) (2WD).
3.	Select manual or automated mode.
4.	Fully depress the accelerator pedal and hold in position.

Effect

- The vehicle accelerates with maximum power and with corresponding wheel slip, depending on the surface.
- In sequential mode the customer must shift up manually so that they do not drive against the rev limiter.
- In the case of automated upshifts, the M automatic transmission carries out the upshifts independently.

4.5.5. Transmission emergency release

A mechanical emergency transmission release is available and can be accessed through the vehicle underbody. In addition, an electronic emergency gearbox release is implemented as it is in automatic transmissions of the BMW AG vehicles. For towing away, please observe the information in the Owner's Manual of the vehicle.

Release is possible if the starter motor can crank the engine. Apply the parking brake before manual release of the parking lock to prevent the vehicle from rolling away.

Sequence	Precondition/Action
1.	Engage selector lever position N.
2.	Press and hold the brake.
3.	Press the start/stop button (the starter motor must start up audibly).
4.	Keep the start/stop button pressed.
5.	With your free hand, press the selector lever into selector lever position N and keep it there until selector lever position N appears in the instrument cluster.
6.	A CC message is displayed in the instrument cluster and in the CID.
7.	Release the start/stop button and the selector lever.
8.	Release the brake as soon as the starter motor stops.

Maneuver the vehicle out of the danger area and then secure to prevent it from rolling away.
Further information can be found in the Owner's Manual for the vehicle.

4.5.6. Service information

Transmission oil circuit

For work required on the oil circuit of the automatic transmission, for example after an accident, or if the oil circuit has to be opened due to a repair, maximum cleanliness must be observed. This includes:

- Thorough cleaning of the outer oil circuit areas before disassembly of the components or opening the oil circuit.
- Immediate closure of openings and lines after disassembly without delay and using clean original plugs. Do not use unsealed components or replacement parts of the oil circuit without checking for cleanliness and where possible competent repair.
- The work bay in which an automatic transmission is opened up must be absolutely clean and protected from dirt contamination, including during work interruptions, e.g. by means of an adequate, clean and lint-free cover.

Long-term oil filling

Currently, as with the F90 with M automatic transmission, for the F91/F92 with M automatic transmission a transmission oil change is **not** scheduled at 1200 mi (running-in check) or with every third engine oil change.

Transmission oil recommendations and capacities can be found in the current documentation of the BMW workshop information system.

4.6. Differential

4.6.1. Active M differential

The active M differential on the rear axle is an integral part of the M xDrive.

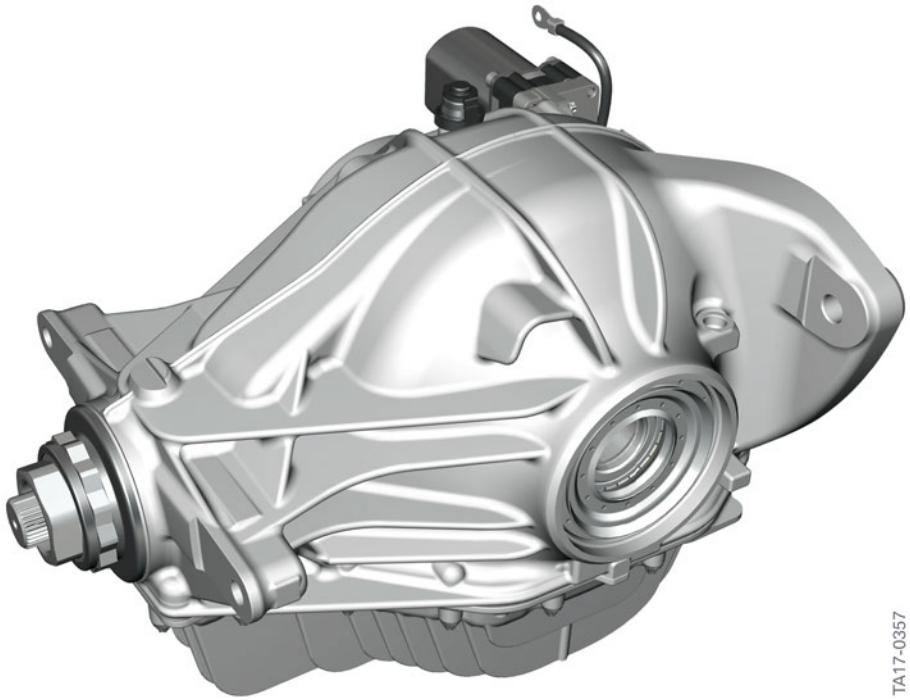
The active M differential in the F91/F92 is a carry-over from the F90.

The M rear axle differential, size HAG 225 (crown wheel Ø 225 mm), is used with a M rear axle differential lock. The system designation is "M regulated rear differential lock" and accordingly the control unit designation is M GHAS.

The gear ratio of the rear axle differential HAG 225 is 3.154:1.

This M rear axle differential II can be recognized by an aluminum oil sump mounted from below and an electric motor which is visible from the outside.

The HAG 225 weighs 95 lbs.



F91/F92, M GHAS external view

Demand-controlled lock

The lock is a demand-controlled rear axle differential lock which is active in the following situations:

- Pulling away
- Differential speed at the rear axle for straight-ahead driving under load due to various traction levels, left/right
- M dynamic cornering
- Power oversteer (drifting)
- Stabilization in coasting/decelerating

Traction, handling and driving stability are optimized by adjusting a defined differential speed or differential torque at the rear axle.

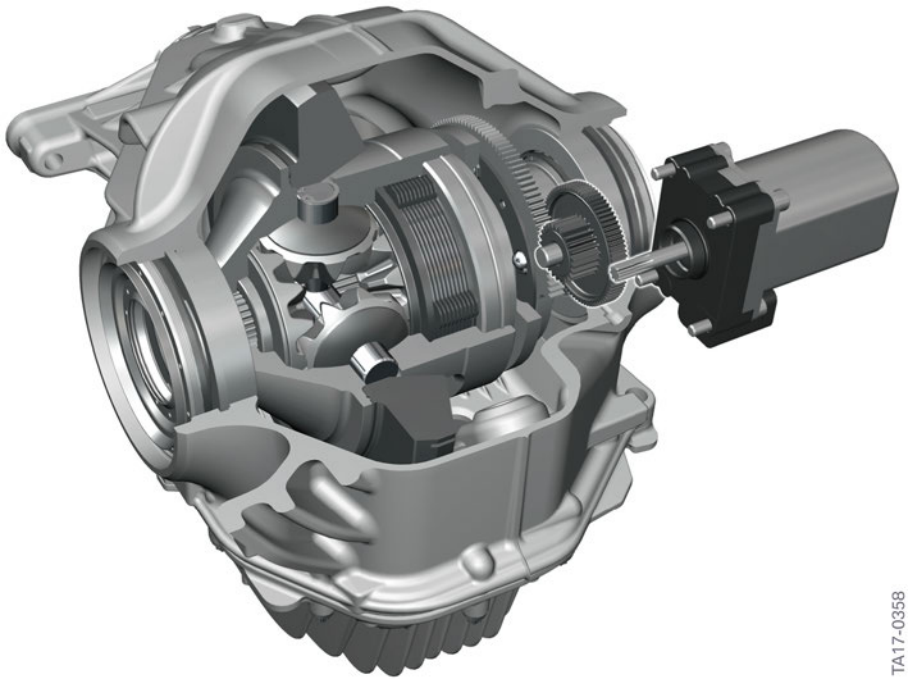
The regulated M rear axle differential lock works with a position-controlled electric motor and a ball ramp.

4.6.2. Structure/Function

The lock-up torque is generated by a multidisc clutch. The necessary pressure is applied to the multidisc clutch by the position-controlled DC 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).

F91/F92 Complete Vehicle.

4. Powertrain.



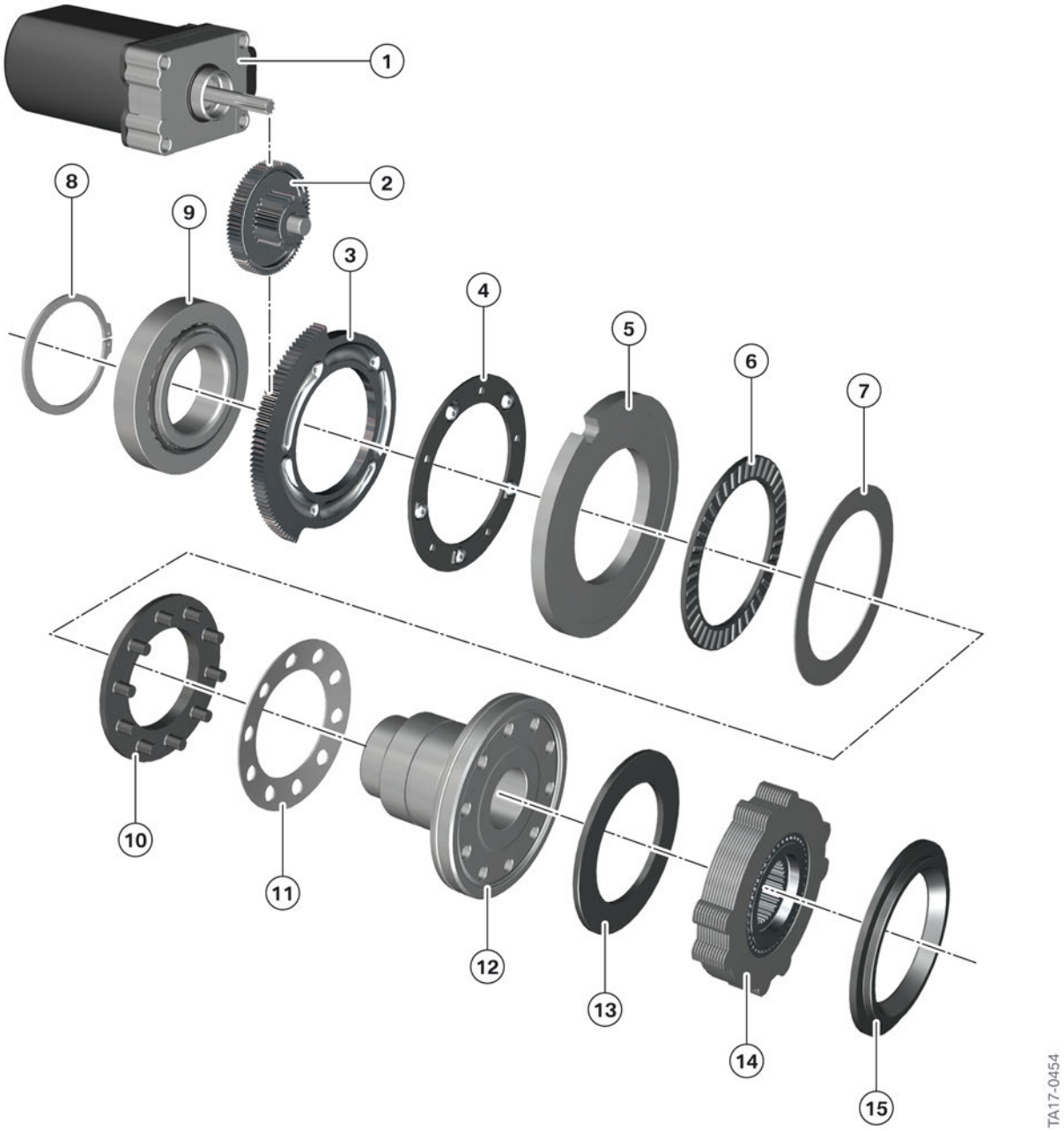
F91/F92, sectional view of rear differential

System components:

- Wiring harness
- Regulated differential lock control unit M GHAS
- Electric motor and transmission gearing
- Lock

F91/F92 Complete Vehicle.

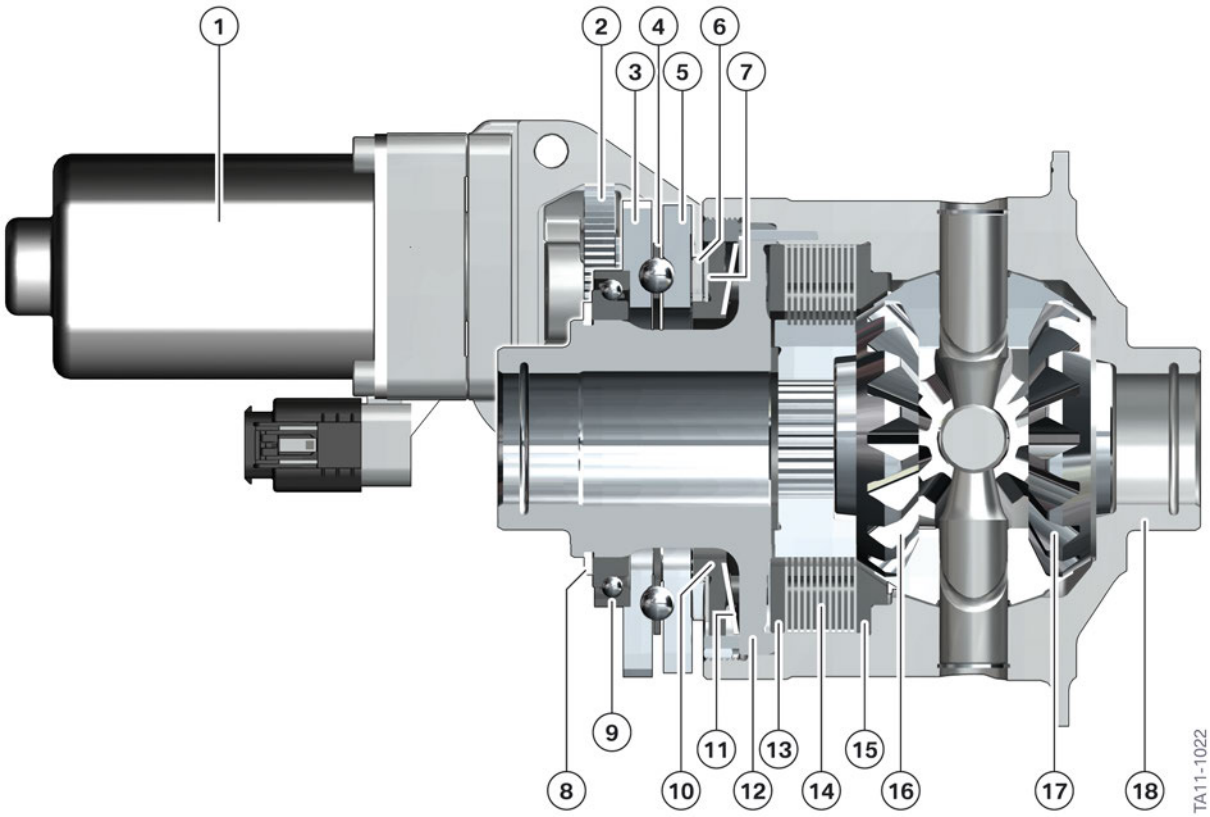
4. Powertrain.



F91/F92, components of internal differential lock: Exploded diagram

Index	Explanation
1	Electric motor
2	Intermediate gear
3	Ball ramp with cut gears for adjusting discs and first ball ramp half
4	Balls/Rounded washer
5	Fixed pressure disc with the second ball ramp half
6	Axial needle bearing

Index	Explanation
7	Axial bearing thrust washer
8	Snap ring (ball bearing mount)
9	Ball bearing between inner output hub and differential housing
10	Disc spring thrust ring
11	Disc spring
12	Inner output hub (connected with inner discs)
13	Pressure plate
14	Multidisc clutch
15	Counter pressure plate



F91/F92, sectional view of parking lock differential

Index	Explanation
1	Electric motor
2	Intermediate gear
3	Ball ramp with cut gears for adjusting discs and first ball ramp half
4	Balls/Rounded washer
5	Fixed pressure disc with the second ball ramp half

Index	Explanation
6	Axial needle bearing
7	Axial bearing thrust washer
8	Snap ring (ball bearing mount)
9	Ball bearing between inner output hub and differential housing
10	Disc spring thrust ring
11	Disc spring
12	Inner output hub (connected with inner discs)
13	Pressure plate
14	Multidisc clutch
15	Counter pressure plate
16	First bevel gear
17	Second bevel gear
18	Differential housing (connected with outer discs)

The electric motor (1) is screwed on to the housing and the pressure disc fixed to the second ball ramp half (5) in the housing. The movable components of the ball ramp (2, 3 and 4) generate the necessary axial displacement of the pressure disc (5). These components are not subject to the differential gear rotation and are disconnected from the rotating components by an axial needle bearing (6).

The components with the index 6 to 18 are part of the differential gear and rotate proportional to the rear axle gear wheel speeds.

The lock acts between the inner output hub (12) and the differential housing (18) and counteracts a difference in speed between the output bevel gears (16 and 17). The disc spring (11) opens the lock when the motor is not supplied with current.

4.6.3. System information

The M DSCi control unit monitors the dynamic handling characteristic parameters from other control units on the FlexRay data bus and determines the locking torque to be applied. The M DSCi control unit can also request separate and higher-level locking interventions to stabilize the vehicle both when the M DSCi is activated and deactivated.

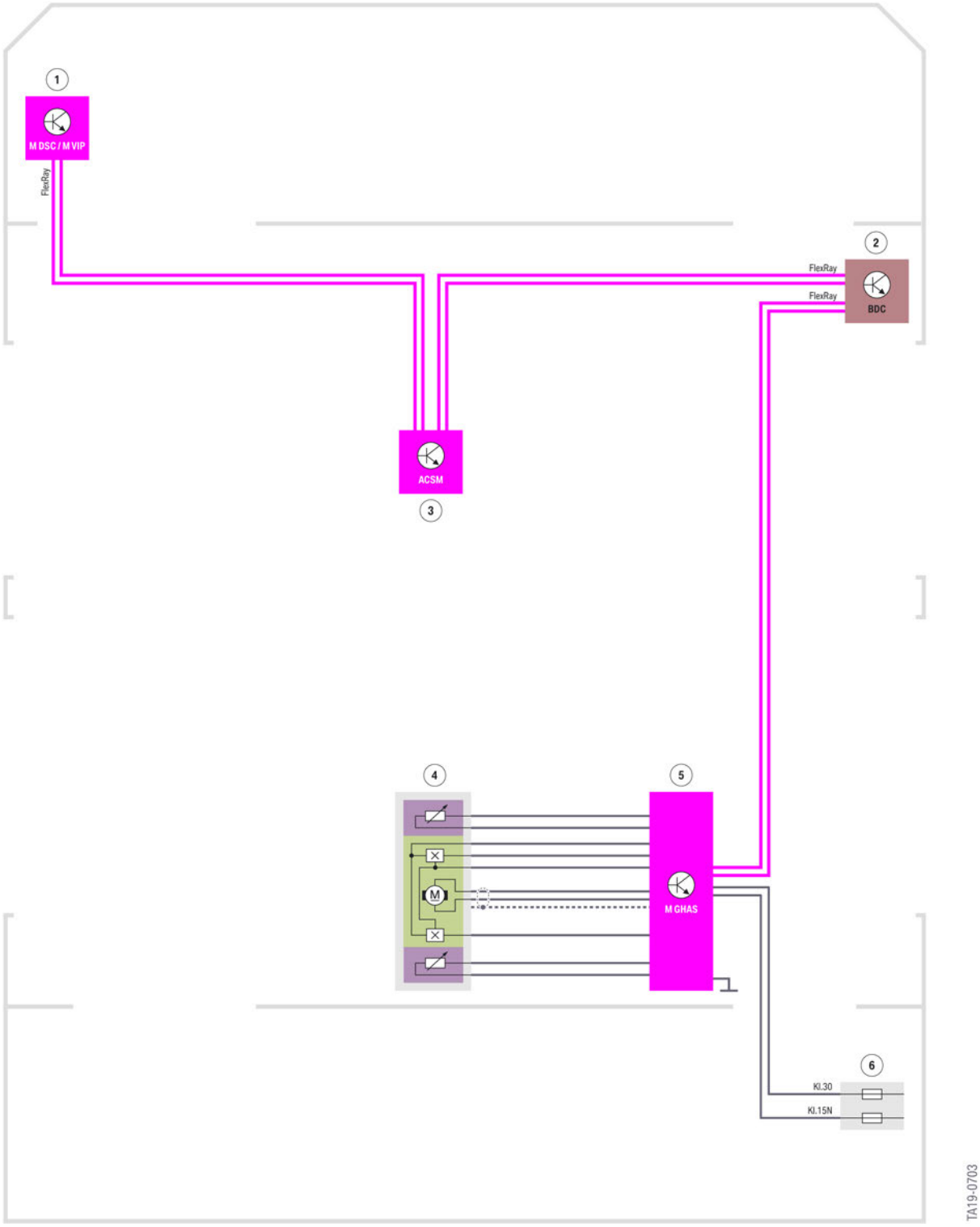
The position-regulated direct current motor is activated directly by the power electronics of the M GHAS control unit with a pulse-width-modulated signal. The frequency is approximately 4 kHz and the maximum current is 30 A.

Two hall-effect sensors are used to determine the position and the direction of rotation of the electric motor.

F91/F92 Complete Vehicle.

4. Powertrain.

System wiring diagram



F91/F92, M GHAS system wiring diagram

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	Body Domain Controller (BDC)
3	Crash Safety Module (ACSM)
4	Components of the regulated M rear axle differential lock
5	Regulated M rear axle differential lock (M GHAS)
6	Power distribution box, rear

Interfaces

The M GHAS control unit works with the following control units and includes the following information:

Control unit	Bus system	Information
BDC	FlexRay	- Terminal status - Vehicle identification number (for encoding) - Vehicle condition (power management and fault memory block, e.g. in the event of voltage drop by engine start)
DME	FlexRay	- "Engine running" signal
M DSCi	FlexRay	- Wheel speed - Target transverse torque distribution - Stabilization status - Braking value - Tolerance adjustment of wheel (adjustment of different wheel circumferences) - Driving speed
ACSM	FlexRay	- Lateral acceleration - Yaw speed - Road longitudinal inclination - Steering angle

Electric motor location determination

Two hall-effect sensors are installed inside the motor for determining the position of the electric motor.

For determining the characteristic curve of the locking torque over the motor position, a recalibration is regularly carried out to compensate for clutch wear.

To calculate the clutch locking torque for a certain position of the servomotor a reference run is performed after the engine is turned off, at the same time it uses this reference run to determine clutch wear. During this reference run the motor is subjected to a defined amount of current. The locking torque of 0 Nm is assigned to the resulting position.

Temperature monitoring

A total of 3 temperature sensors are installed. The temperature of the control unit (driver output stage), the temperature of the electric motor and the transmission oil temperature are monitored.

The temperature thresholds are:

- Control unit 185 °F
- Electric motor 320 °F
- Oil temperature 374 °F

4.6.4. Service information

- When replacing the M GHAS control unit, encoding (activation of vehicle-related characteristic curve) followed by calibration are necessary and then the fault memory must be deleted.
- After the replacement of the entire M rear axle differential a calibration must be performed and then the fault memory must be deleted.
- If the electric motor, the electric motor and intermediate gearing or the oil temperature sensor is replaced, deleting the fault memory is all that is required.

The final drive oil is currently replaced at 1200 miles (running-in check) and at every third engine oil change.

Because the disc material was changed to include carbon content in the multidisc set, a different rear axle transmission oil is now used. The factory filling is with Fuchs Titan 5037B.

Rear axle differential box oil recommendations and capacities can be found in the current documentation of the BMW workshop information systems.

If, due to a fault, the M GHAS lockup function is switched off or fails, a blocked differential is automatically reopened as the lockup function is not self-locking. The customer is warned/informed and the following effects can be expected:

1. Reduced traction with a dynamic driving style and low traction levels, especially with different traction levels, left/right.

2. Possible reduction of stability in dynamic driving situations.

4.6.5. Front axle differential

The front axle differential VAG175AL already deployed in the G12 is also used here.

Technical data

Technical data	Front axle differential 175AL
Oil volume	0.6 l
Oil filling in factory	Fuchs Titan EG3846
Oil filling in BMW Service	Castrol SAF-XO
Maximum input torque	1300 Nm
Possible ratios	3.15
Weight including oil filling	32 lbs

Front axle differential oil recommendations and capacities can be found in the current documentation of the BMW workshop information system.

4.7. Drive shafts and output shafts

4.7.1. Front drive shaft

The front drive shaft was been carried over from the G12 for the F91/F92.

4.7.2. Rear drive shaft

The drive shaft of the F91/F92 is a steel drive shaft. The dimensions and strength of the drive shaft, the center bearing, the flange connecting to the flexible disc on the transfer box and the flange connecting to the rear axle differential have been adapted to the higher torque of the F91/F92. The drive shaft in the F91/F92 is shorter when compared with the F90, since the F91/F92 has a shorter wheelbase than the F90.

The maximum permissible deflection angle of the drive shaft must not be exceeded when working on the drive shaft center bearing. The instructions in the current repair instructions in ISTA absolutely must be followed.

It is important to follow the procedures in the current repair instructions in ISTA regarding inserted and screwed drive shafts on the rear axle differential.

4.7.3. Front output shafts

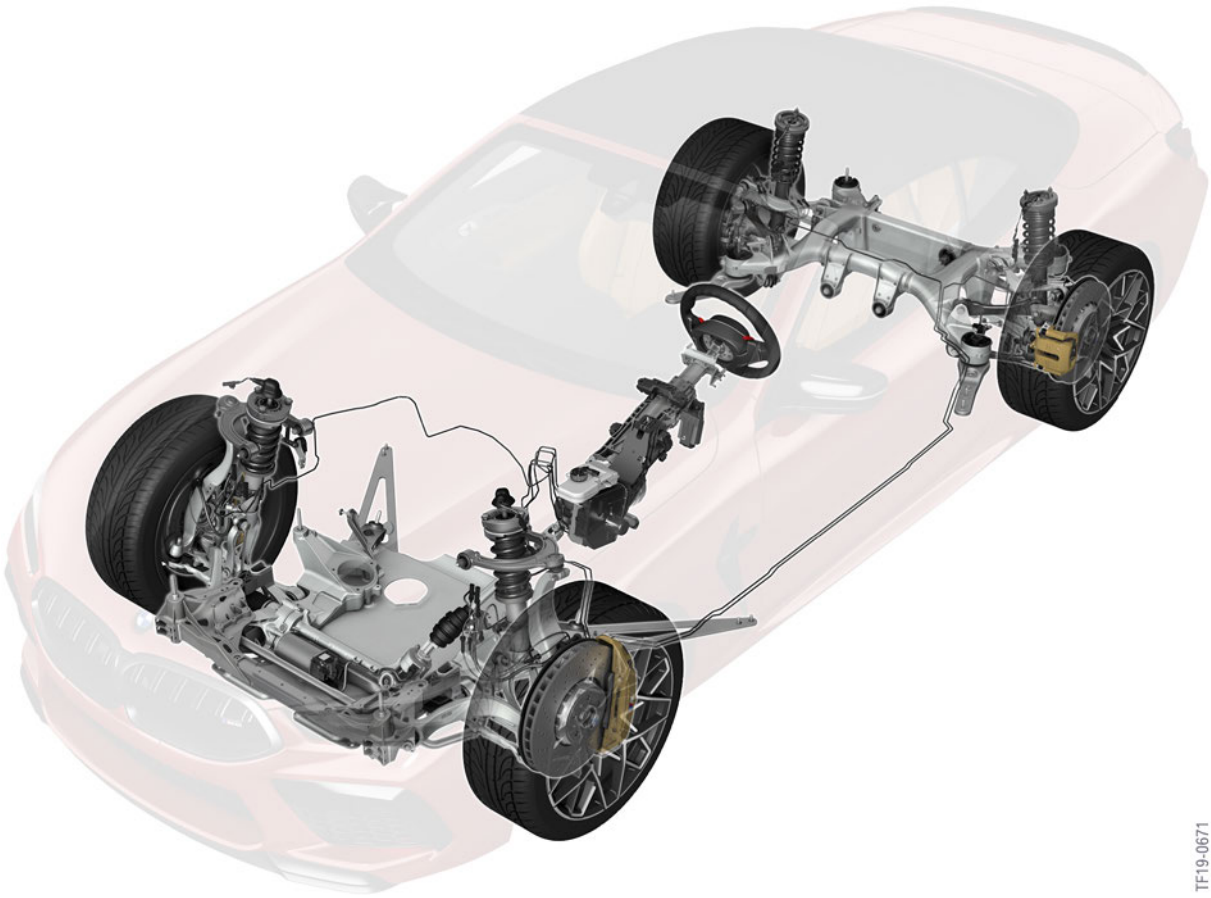
The front output shafts have been adopted from the F90.

4.7.4. Rear output shafts

The rear output shafts have been adapted in terms of their length, design and strength to the increased torque of the F91/F92.

F91/F92 Complete Vehicle.

5. Chassis.



F91, chassis complete

The chassis is based on the technology of the G14/G15, whereby almost all components are again new and specific to M or have been adapted and carried over from the F90.

Designation	Unit	G14/G15 M850i xDrive	F91/F92 M8
Wheelbase/Turning circle	[mm/m]	2822/11.9	2827/12.2
Front track width	[mm]	1627	1627
Rear track width	[mm]	1642	1632
Front axle		Double-wishbone axle	Double-wishbone axle
Steering		Electronic Power Steering (EPS)	M Electronic Power Steering (M EPS)
Average overall ratio		16.3:1	14.3:1
Rear axle		HA5 Rear axle	HA5 Rear axle
Final drive ratio		2.813	3.154

F91/F92 Complete Vehicle.

5. Chassis.

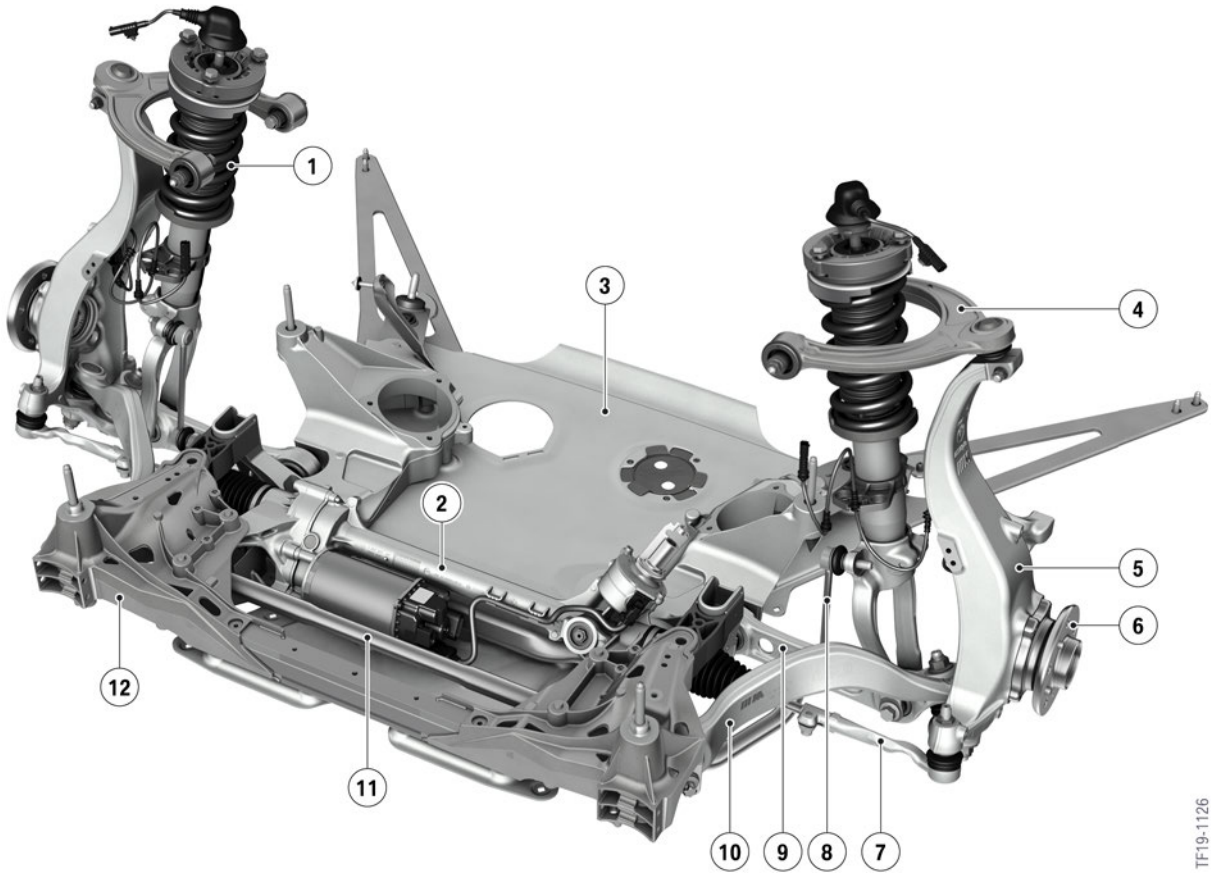
5.1. F91/F92 differences compared with the F90

Vehicle component	Changes compared with the F90	Customer benefit
Ride height	Lowered by 10 mm	Lower wheel load transfer, which favors safer turn-in ability during dynamic cornering. Earlier tendency to understeer or oversteer is reduced. The vehicle can be driven in an even more dynamic and sporty style.
Spring rates, front and rear	Stiffer springs	Better support of body and steering response, vehicle's roll tendencies are improved. In this way the vehicle body movements are minimized during dynamic handling. The vehicle can be driven in an even more dynamic and sporty style.
Anti-roll bar spring rate	Front axle more roll-sensitive (-10 %) rear axle more roll-resistant (+ 10 %)	More rear-biased rolling moment distribution. The rear area of the vehicle's inside cornering wheel is made tighter by the support of the anti-roll bar, which makes the handling even more rear-biased when cornering. Sportier and more agile handling even when accelerating out of bends.
Anti-roll bar mounts	Front axle and rear axle rubber mounts stiffened	The anti-roll bar is mounted more stiffly in the rubber mounts, delivering a more direct anti-roll bar effect response compared with softer mounts. The vehicle can be driven in an even more dynamic and sporty style.
Auxiliary springs	Auxiliary springs shortened	Lower wheel load variations by means of reduced body acceleration. Lower wheel load variation results in increased driving safety and driving stability.
Hydraulic shock absorber setting at front and rear	Adaptation to modified spring rates, auxiliary springs and anti-roll bar	Lower wheel load variations by means of reduced body acceleration. Lower wheel load variation results in increased driving safety and driving stability.
Software logic shock absorber setting M VDP	"COMFORT": optimized connection "SPORT": Focus on Nürburgring "SPORT+": Focus on GP circuits	Adaptation of the characteristic shock absorber curves via the EDC shock absorbers. This results in increased sportiness.
Higher camber at front axle	Camber increase from -0° 54‘ to -1° 04‘ via lowered suspension	Increase in lateral force potential on the front axle. The vehicle can be driven in an even more dynamic and sporty style on bends.

Vehicle component	Changes compared with the F90	Customer benefit
Track width enlargement on the rear axle	Track width enlargement from 1594 mm to 1632 mm	Increase in lateral force potential. The vehicle exhibits an even greater high-speed stability.
Wheelbase	Reduction from 2982 mm to 2827 mm	Increase in vehicle agility and directness.
Tension strut/wishbone on front axle	F91/F92-specific elastomer material on the tension strut rubber mount and wishbone rubber mount	Optimization of wheel control precision on the front axle. Optimized rigidity in case of lateral force on the front axle. Increase in driving stability and directness.

5.2. Front axle

The front axle of the F91/F92 is based on the double-wishbone front axle of the G14/G15.



F91/F92, double-wishbone front axle

Index	Explanation
1	M spring strut with support bearing
2	M Servotronic (EPS)
3	M stiffening plate
4	M wishbone, top
5	M swivel bearing
6	M wheel hub
7	M track rod
8	M anti-roll bar link
9	M wishbone, bottom
10	M tension strut
11	M anti-roll bar
12	Front axle support (carry-over from G14/G15)

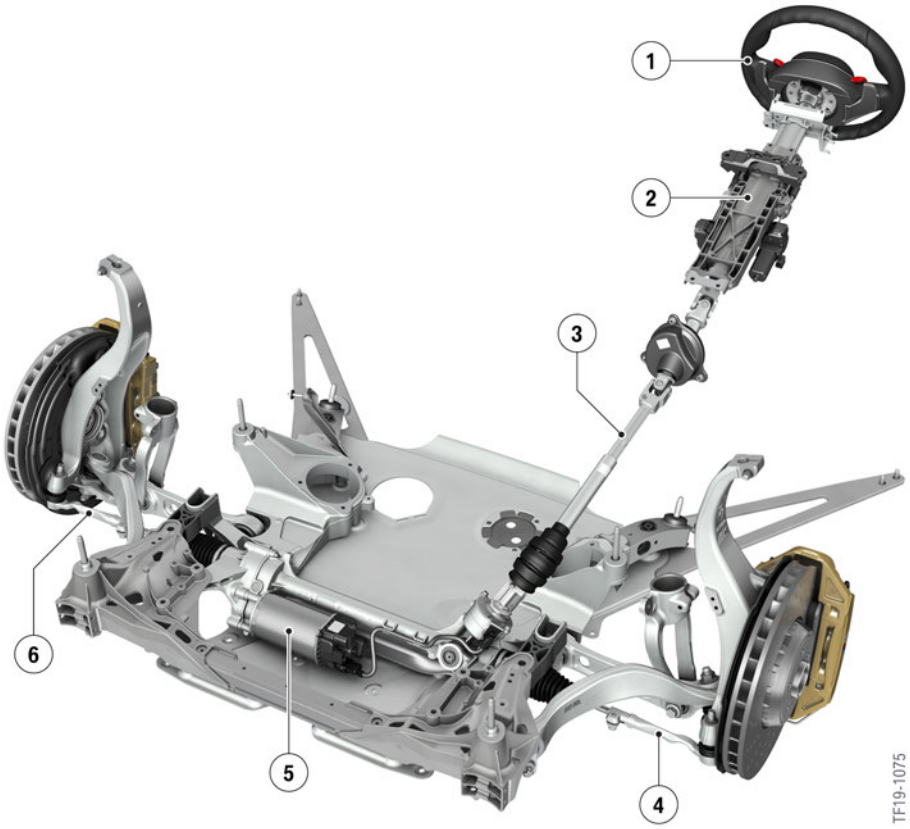
5.2.1. Steering

Within the framework of the EfficientDynamics measures for the F91/F92, the steering used is a rack-and-pinion steering with electrical steering wheel support "M Servotronic" based on an EPS and is a carry-over from the F90.

For power assistance during steering an electric motor is housed parallel to the rack at the steering gear housing, the power transmission is effected via a ball screw.

F91/F92 Complete Vehicle.

5. Chassis.



F91/F92, steering

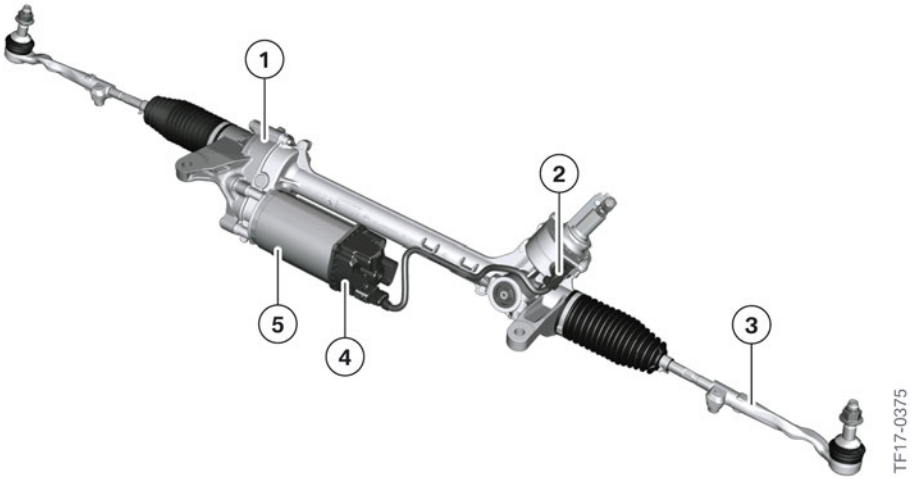
Index	Explanation
1	M steering wheel
2	Adjustable steering column
3	Steering column
4	Track rod, left
5	M Servotronic (EPS)
6	Track rod, right

The M Servotronic (EPS) is an independent development for the F90. All the components of the M Servotronic (EPS) have been developed specifically for the F90 and carried over in the F91/F92. With this measure the development of the steering was able to be coordinated to the typical M properties. Special attention was paid to the typical M features:

- Direct steering sensation
- Driving condition feedback
- M dynamic driving in the limit range

F91/F92 Complete Vehicle.

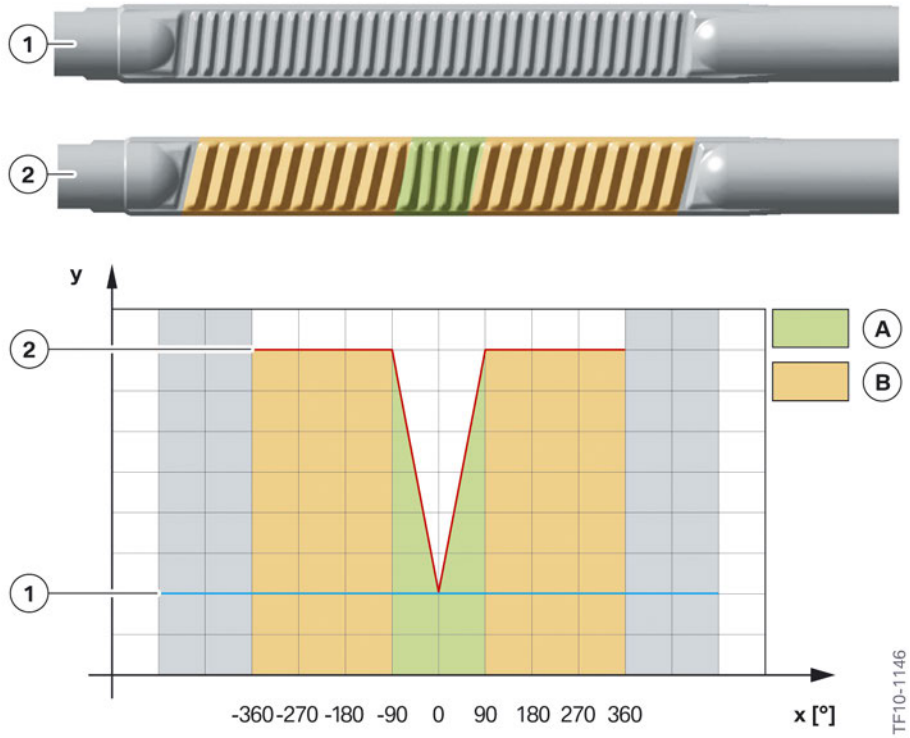
5. Chassis.



F91/F92, M Servotronic (EPS)

Index	Explanation
1	Reduction gear
2	Steering-torque sensor
3	Track rod
4	Control unit, M Servotronic (EPS)
5	Electric motor with rotor position sensor

The ratio of the M Servotronic (EPS) has been carried over in the F91/F92 from the F90 (F90 14.3:1 — G14/G15 16.3:1), of particular note is the fact that after 1/8 of a turn of the steering wheel the rack ratio increases by 8%.



F91/F92, comparison of M Servotronic (EPS) steering gear ratios

Index	Explanation
1	Rack, basic version G14/G15 (constant gear geometry)
2	Rack, variable sport steering F91/F92 (variable gear geometry)
A	More indirect steering gear ratio (variable sport steering)
B	More direct steering gear ratio (variable sport steering)
x	Steering wheel angle
y	Rack travel

The system supplier of M Servotronic (EPS) is Bosch.

5.2.2. M Servotronic

The Servotronic function familiar from conventional hydraulic power-steering systems is also used on the M Servotronic (EPS) and is available as standard on the F91/F92. It is a M Servotronic, which functions according to the same operating principle as in production vehicles. The difference in the M Servotronic of the F91/F92 is that this can be selected in 2 stages (in the F90 in 3-stages); in contrast to the F90 in the F91/F92 the Servotronic Settings menu is accessed in the Central Information Display (CID) via a SETUP button in the center console. The driver can switch between "COMFORT" and "SPORT" via the SETUP button. The program selection can also be preconfigured in the Head Unit High 3 (HU-H 3) and selected using the M1/M2 buttons on the steering wheel. Here the corresponding characteristic curve is activated and in Sport setting the power steering support is also noticeably reduced.

Program description, M Servotronic:

- “COMFORT”: Focus on light and comfortable steering torques with perfect feedback from the road surface at the same time.
- "SPORT": Increase in the steering force and perceptibly more feedback for sporty M dynamic driving, both for every day use and at the driving limit.

5.2.3. Steering angle sensor

The information on the steering angle in the F91/F92 is not monitored by the Electronic Power Steering (EPS) and not via a separate sensor on the steering wheel and instead is calculated based on the motor position angle of the EPS motor in relation to the steering wheel.

The EPS delivers the position of the rack via FlexRay to the M Dynamic Stability Control integrated (M DSCi). During this process, the EPS calculates the absolute position of the rack based on the current motor position of the EPS motor and the number of complete revolutions performed by the motor starting from the zero position (straight-ahead driving).

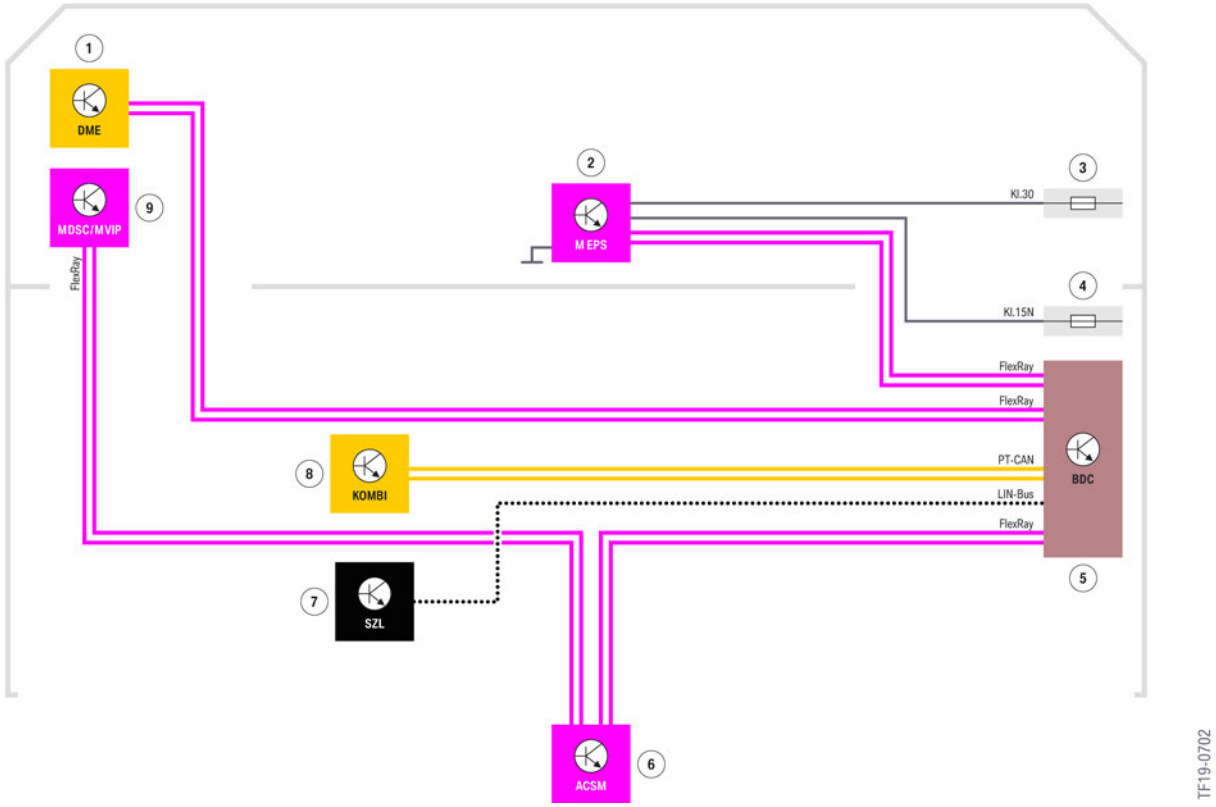
Taking this position as the starting point, M Dynamic Stability Control integrated (M DSCi) determines the wheel-specific steering angle among other things using the stored ratio parameters (rack to wheel-specific steering angle) and transmits this via FlexRay. This wheel-specific steering angle is used by M Dynamic Stability Control integrated (M DSCi) among other things as a reference variable for internal control functions.

In cases where the absolute value is not available from the EPS (loss of terminal 30, programming process), the absolute value is determined between M Dynamic Stability Control integrated (M DSCi) and EPS using a calibration function in which the steering wheel is turned from end stop to end stop (e.g. straight-ahead position -> left -> right -> straight-ahead position).

F91/F92 Complete Vehicle.

5. Chassis.

5.2.4. System wiring diagram, M Servotronic



F91/F92, system wiring diagram, EPS

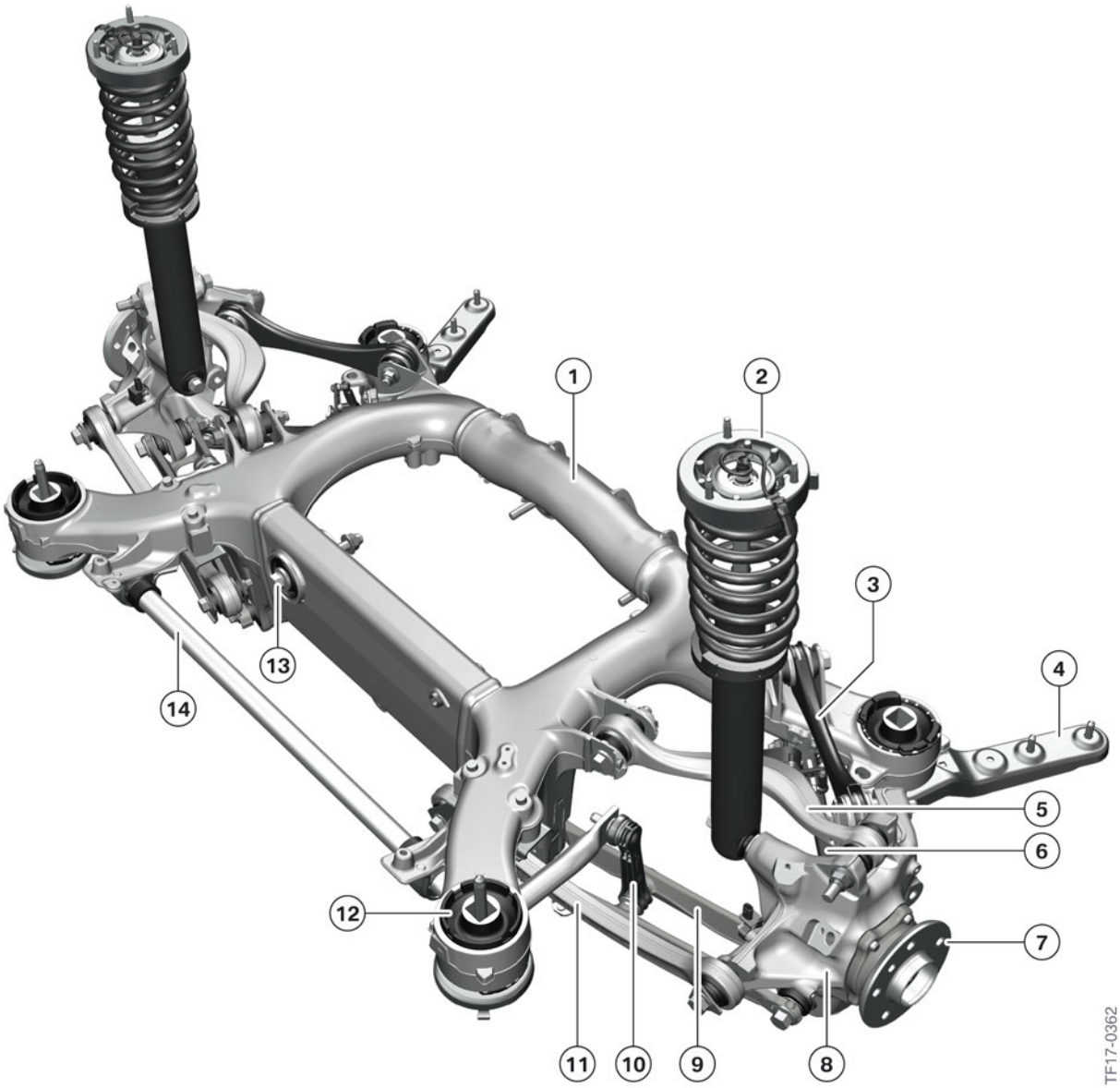
Index	Explanation
1	Digital Motor Electronics (DME)
2	M Servotronic (EPS)
3	Power distribution box, engine compartment
4	Power distribution box, front
5	Body Domain Controller (BDC)
6	Crash Safety Module (ACSM)
7	Steering column switch cluster (SZL)
8	Instrument cluster (KOMBI)
9	M Dynamic Stability Control integrated (M DSCi)

F91/F92 Complete Vehicle.

5. Chassis.

5.3. Rear axle

The five-link rear axle is largely a carry-over from the F90 and is based on the rear axle of the G14/G15. The F91/F92 rear axle support is bolted to the body with M-specific hard rubber mounts.



F91/F92, rear suspension

Index	Explanation
1	Rear axle support (carry-over from G14/G15)
2	M spring strut with M support bearing
3	Control arm (carry-over from G14/G15)
4	Compression strut (carry-over from G14/G15)

Index	Explanation
5	Wishbone (carry-over from G14/G15)
6	Trailing arm (carry-over from G14/G15)
7	M wheel hub
8	M wheel carrier
9	M camber control arm
10	Anti-roll bar link (carry-over from G14/G15)
11	M track control arm
12	M rear axle support mounting (with hard rubber mount)
13	M rear axle housing mounting
14	M anti-roll bar

5.4. F91/F92 difference, Competition model

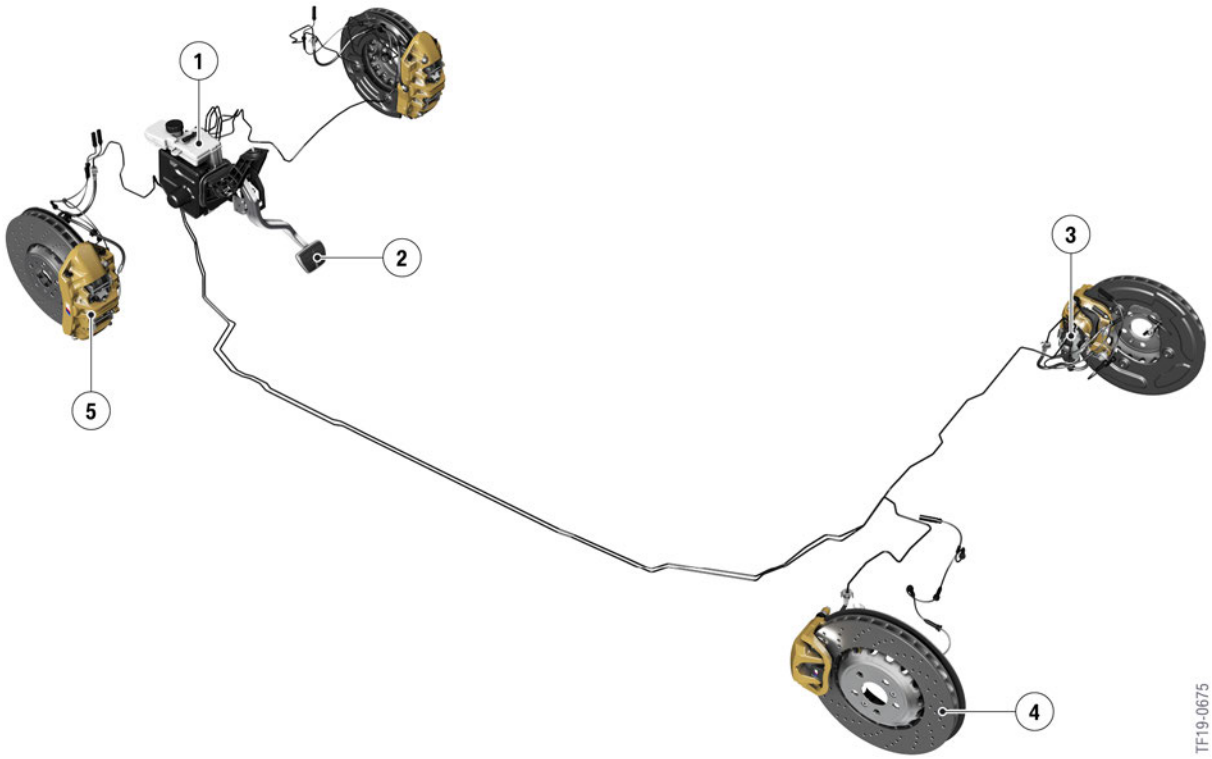
Vehicle component	Changes to the basic F91/ F92	Customer benefit
Software logic shock absorber setting M VDP	“COMFORT": optimized connection "SPORT": Focus on Nürburgring "SPORT+": Focus on GP circuits	Adaptation of the characteristic shock absorber curves via the EDC shock absorbers. This results in further increased sportiness compared with the basic model.
Engine mount	Stiffer engine mount with 900 N/mm instead of 580 N/ mm	• Additional sportiness • More spontaneous engine response
Higher camber at front axle	Camber increase from -1° 04‘ to -1° 20‘	Increase in lateral force potential on the front axle. The vehicle experiences even more improved vehicle balance during dynamic cornering compared with the basic model.
Track control arm on the rear axle	Ball joint instead of rubber mount	Even more precise wheel control on the rear axle compared with the basic model. Optimized rigidity in case of lateral force on the front axle. Increase in driving stability and directness.

F91/F92 Complete Vehicle.

5. Chassis.

5.5. Brakes and wheels/tires

5.5.1. Brakes



F91/F92, brake system

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	Brake pedal
3	Rear single-piston floating caliper with actuator for the electromechanical parking brake
4	Rear brake disc
5	Front six-piston fixed caliper

M compound brake

The M compound brake offers even greater braking power than the sport brake offered in the G14/G15 BMW M850i. In a direct comparison it also offers:

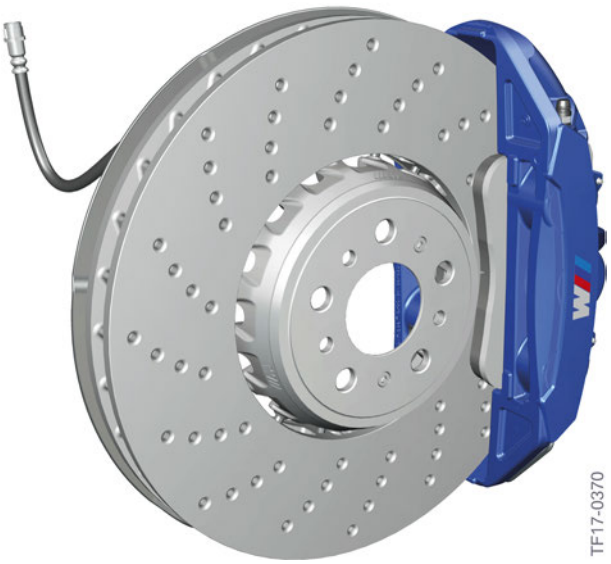
F91/F92 Complete Vehicle.

5. Chassis.

- Reduction in the vehicle weight, resulting in improved agility and dynamics, accelerating ability and fuel consumption
- Reduction in the rotating mass, resulting in improved accelerating ability, response and handling
- Increased fading stability and greater thermal resistance
- Series launch of copper-free brake pads with the F91/F92
- Cross-drilled disc ring, sports-style look, optimized response characteristics in the wet
- Consistent realization of intelligent lightweight construction
- Technology transfer from M Sport
- Unique, authentic M design.

Designation	Unit	G14/G15 M850i	F91/F92 M8
Front brakes		4-piston fixed caliper	6 pistons, fixed caliper
Brake disc, front	[mm]	374 x 36	395 x 36
Rear brakes		1 piston, floating caliper	1 piston, floating caliper
Brake disc, rear	[mm]	345 x 24	380 x 28
Parking brake		electro-mechanical	electro-mechanical

The front brake is a carry-over from the F90. It is a large-sized, cross-drilled M compound brake disc combined with a six-piston fixed caliper. The brake disc diameter is 21 mm larger than that of the G14/G15 M850i. The exterior of all brake calipers is blue metallic in color with the M logo.



F91/F92, front brake

The rear cross-drilled M compound brake disc is 35 mm larger in diameter than the G14/G15 BMW M850i.

F91/F92 Complete Vehicle.

5. Chassis.

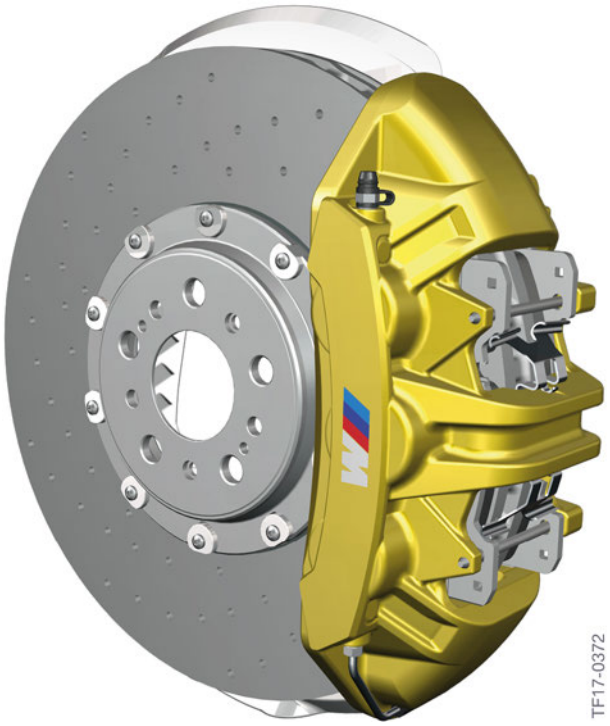
M carbon ceramic brake

The M carbon ceramic brake is available from the series launch of the new F91/F92. The M carbon ceramic brake is a carry-over from the F90 and can be ordered as optional equipment SA 2NK.

The M carbon ceramic brake system is also called the C/SiC brake system.

Depending on the situation, this offers a further increase in braking power as compared to the M compound brake. In a direct comparison it also offers:

- Even more direct/spontaneous use of brake force
- Maximum heat resistance even with continuous sporty operation
- Higher fading stability
- With the F91/F92 series launch of copper-free brake pads
- Significantly reduced wear
- 15.4 lb weight reduction of rotating wheel masses
- Increased suitability for winter driving conditions thanks to corrosion resistance.



F91/F92, M carbon ceramic brake, front axle

As a visible distinguishing feature to the M Compound brake system the brake calipers are painted in gold with a colored M logo.

The brake discs are manufactured by Brembo SGL Carbon Ceramic Brakes GmbH.

Designation	Unit	F91/F92 M8
Front brakes		6 pistons, fixed caliper
Brake disc, front	[mm]	400 x 38
Rear brakes		1 piston, floating caliper
Brake disc, rear	[mm]	380 x 28
Parking brake		electro-mechanical

Further information on the M Carbon ceramic brake can be found in the Product Information "ST1302 M Carbon Ceramic Brake System".

Brake noise

- Humming of the BMW M compound brake disc at high speeds
- Squeaking brakes shortly before coming to a stop
- Screeching in the event of wet, cold BMW M carbon ceramic brakes
- Cracking noises from the area of the BMW M compound brake discs when hot

Explain to the customer at this point that such noises occurring temporarily or in specific situations are inherent in the design and do not represent a quality problem. They are a consequence of the special performance of the brakes and do not pose any danger or risk of damage.

Point out that the customer can use his/her braking technique to help prevent the noises occurring or ensure they quickly disappear again. For example, after washing the vehicle it is important to dry the brakes out by braking (braking a few times from 30 mph to 0 is sufficient). Or that the brakes can have a tendency to squeak if they go through long periods when they are only exposed to light braking, which is why braking hard a few times can help out (= higher brake temperature). After driving the vehicle very hard and subjecting the braking system to high loads (high brake disc temperatures) the driver should try to make sure that the brakes are able to cool down while the vehicle is moving and not to keep the brakes on the first time the vehicle comes to a stop. As a result of the increased material transfer from the brake pads to the disc after very hard driving, a humming noise can occur which disappears again after a short time.

Brake dust

Brake dust is the consequence of a high-performance brake system. The BMW M models are high-performance vehicles which are designed for fast and dynamic driving and embody a racing pedigree. The specially designed brakes provide the high braking performance required by the vehicle and in so doing generate larger amounts of dust due to the greater levels of friction. The brake dust tells the customer that his/her BMW M vehicle has been driven in an appropriate manner. What is important is to ensure that it is regularly removed by washing the vehicle, as otherwise it will eat into the surface of the wheel.

F91/F92 Complete Vehicle.

5. Chassis.

For necessary service work the current information and specifications in the documents in the Integrated Service Technical Application (ISTA) must be observed in each case.

5.5.2. Wheels/Tires

F91/F92, range of wheels

Index	Explanation
1	20" M double-spoke bi-color wheel standard equipment (810M)
2	20" M double-spoke black wheel optional equipment (810M)
3	20" M Star-spoke bi-color wheel optional equipment (811M)
4	20" M Star-spoke bi-color wheel standard equipment (813M) (Competition Package)

The following wheel/tire combinations are offered:

Standard equipment

Designation	F91/F92 BMW M8
LM EH2+ rims front (cast) styling 810M M double-spoke bi-color, diamond-polished and diamond-milled	9.5 J x 20
LM EH2+ rims rear (cast) styling 810M M double-spoke bi-color, diamond-polished and diamond-milled	10.5 J x 20
Standard tires, front	275/35 ZR20
Standard tires, rear	285/35 ZR20
RSC tires with emergency running properties	No

F91/F92 Complete Vehicle.

5. Chassis.

Standard equipment Competition Package

Designation	F91/F92 BMW M8 Competition
LM EH2+ rims front (forged) styling 813M Jet black plain, clear coat translucent shadow diamond-polished and diamond-milled	9.5 J x 20
LM EH2+ rims rear (forged) styling 813M Jet black plain, clear coat translucent shadow diamond-polished and diamond-milled	10.5 J x 20
Standard tires, front	275/35 ZR20
Standard tires, rear	285/35 ZR20
RSC tires with emergency running properties	No

Optional equipment

Designation	F91/F92 BMW M8
LM EH2+ rims front (cast) styling 810M M double-spoke Jet black plain	9.5 J x 20
LM EH2+ rims rear (cast) styling 810M M double-spoke Jet black plain	10.5 J x 20
LM EH2+ rims front (cast) styling 811M M double-spoke bi-color, diamond-polished and diamond-milled	9.5 J x 20
LM EH2+ rims rear (cast) styling 811M M double-spoke bi-color, diamond-polished and diamond-milled	10.5 J x 20
Front tires	275/35 ZR 20
Rear tires	285/35 ZR 20

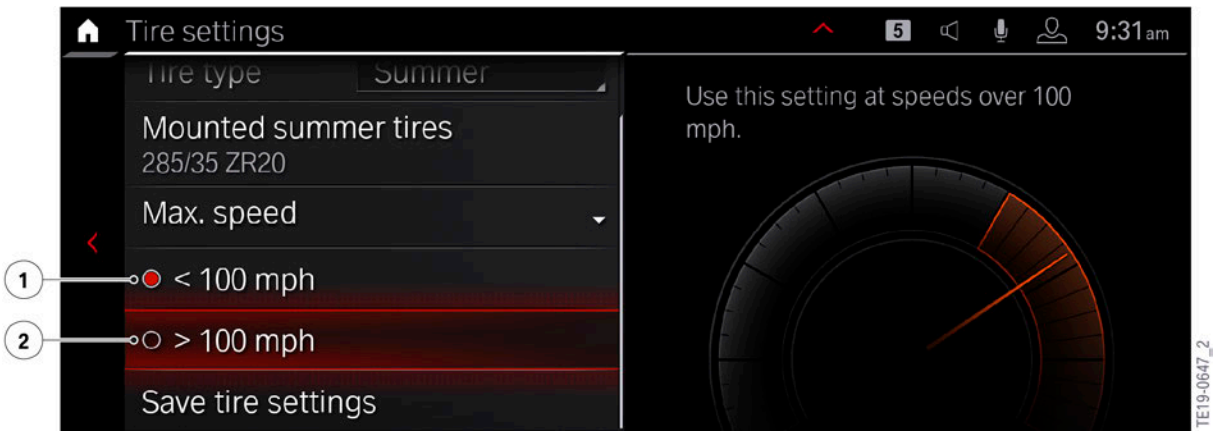
The components of the above-listed wheel/tire combinations have been developed specially for the F91/F92. This can be recognized by the star on the outer side of the tire, among other things.

Electronic tire pressure specification

Function adaptations to the electronic tire pressure specification increase comfort and traction potential in the F91/F92.

The changes make it possible to offer the customer an additional, speed-monitored tire inflation pressure level as follows:

- Tire inflation pressure level "< 100 mph" - up to 100 mph
- Tire inflation pressure level "> 100 mph" - up to the maximum speed



F91/F92, electronic tire pressure specification

Index	Explanation
1	< 100 mph
2	> 100 mph

When the respective maximum speed status is selected, the tire pressure setpoint values to be set are displayed for the customer.

The tire inflation pressure level "< 100 mph" can be driven up to a maximum speed of 100 mph. If the tire inflation pressure level is not adjusted for the "> 100 mph" range by the customer, the customer - if a speed of 100 mph is exceeded - receives a Check Control message with the prompt to adjust the tire inflation pressure.

The Check Control message is output in 2 priorities:

Priority	Check Control message	Information
1	High speed. Increase tire pressure.	None
2	High speed. Increase tire pressure.	Increase tire pressure. Increase tire pressures for journeys in the high-speed range. Correctly adjust the load status for the speed range under "Tire pressure control (TPM)". See Owner's Manual for further information.

F91/F92 Complete Vehicle.

5. Chassis.

5.6. Driving dynamics systems

The M-specific coordination of the driving dynamics (longitudinal, transverse and vertical) was accomplished on the Nürburgring Nordschleife. The main criteria were handling and the lap times.

5.6.1. Vertical Dynamics Management

The EDC function integrated in the M vertical dynamic platform (M VDP) controls the adjustable dampers.

The handling can be further shifted in the direction of individual driving dynamics via the SETUP button in the center console. The program selection can also be preconfigured in the Head Unit High 3 (HU-H 3) and selected using the corresponding M1/M2 buttons on the steering wheel.

Adaptive M suspension (EDC)

There are no external EDC control valves as seen on the G14/G15 shock absorbers but instead typical M-only internal control valves. The shock absorbers have been developed with the supplier ZF Sachs and the system adapted to the F91/F92.

The EDC works with infinitely variable valves in the absorbers. The hydraulic oil flow is controlled via electromagnetic control valves. The infinitely variable control principle was introduced in the E65 and has consistently been further developed.

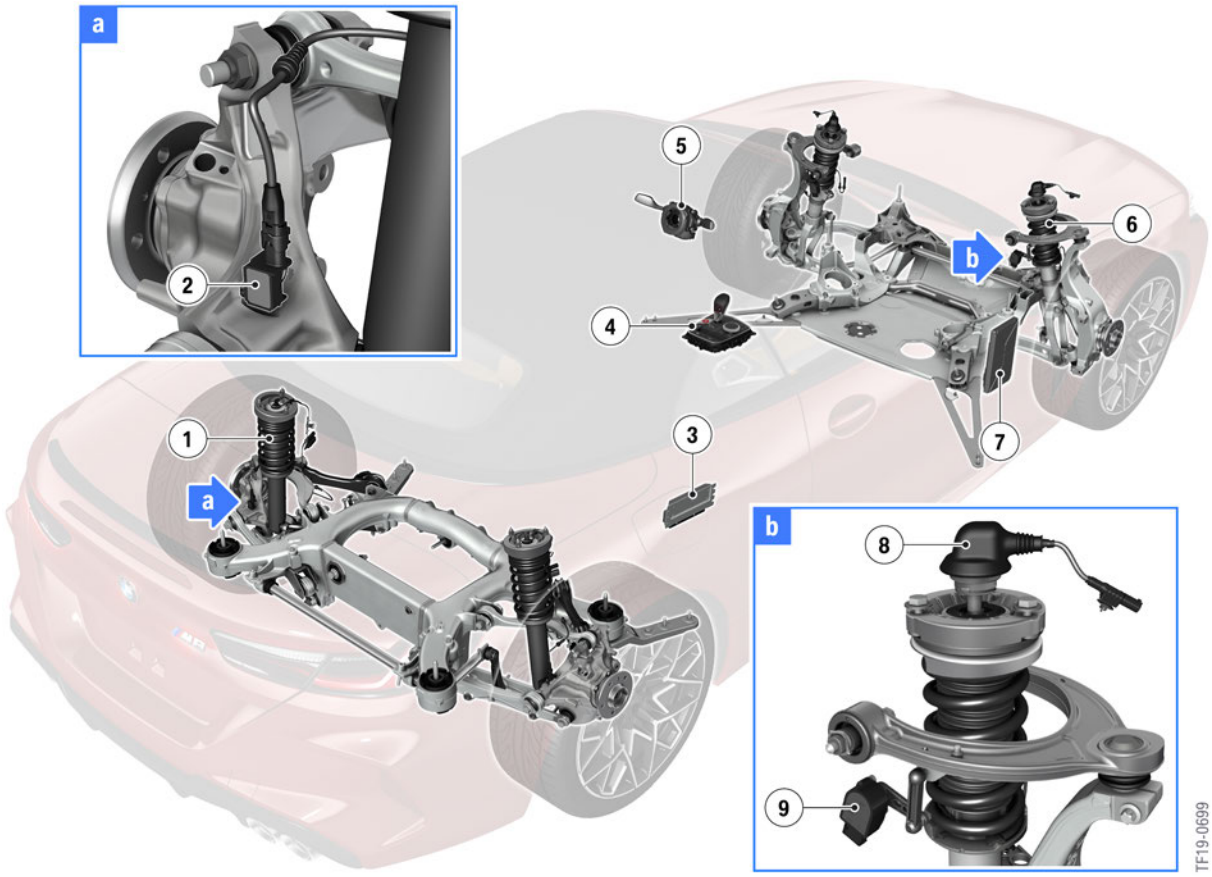
The following variables, among others, were programmed into the corresponding control variables in the M vertical dynamic platform (M VDP): vertical acceleration, wheel speeds (M DSCi), steering angle change (M EPS), angle change rate (ACSM) and damper piston speed.

In addition, the ride height between the wheel suspension and body is used as a control, reference and load variable and is read off of the ride height sensors. Two sensors each are installed at the front and rear. They are potentiometer based and their signal is made available to the M vertical dynamic platform (M VDP).

F91/F92 Complete Vehicle.

5. Chassis.

System overview



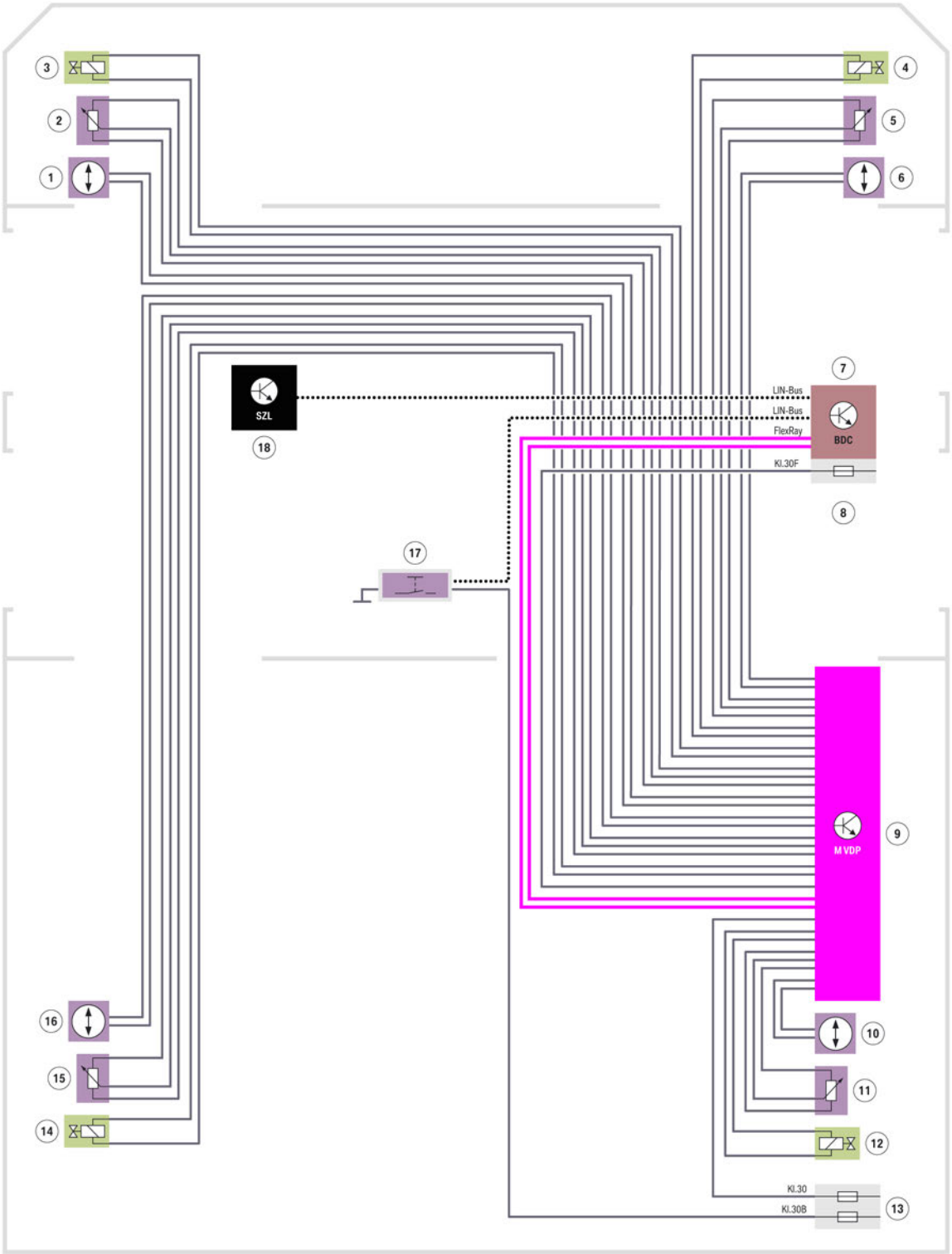
F91, EDC system overview

Index	Explanation
1	Electronic adjustable damper, rear
2	Rear left vertical acceleration sensor
3	M vertical dynamic platform (M VDP)
4	SETUP button
5	Steering column switch cluster (SZL)
6	Electronic adjustable damper, front
7	Body Domain Controller (BDC)
8	Electrical connection, EDC valve
9	Ride height sensor, front right

F91/F92 Complete Vehicle.

5. Chassis.

System wiring diagram



F91/F92, EDC system wiring diagram

F91/F92 Complete Vehicle.
5. Chassis.

Index	Explanation
1	Vertical acceleration sensor, front left
2	Ride height sensor, front left
3	EDC control valve, front left
4	EDC control valve, front right
5	Ride height sensor, front right
6	Front right vertical acceleration sensor
7	Body Domain Controller (BDC)
8	Power distribution box, front
9	M vertical dynamic platform (M VDP)
10	Rear right vertical acceleration sensor
11	Ride height sensor, rear right
12	EDC control valve, rear right
13	Power distribution box, rear
14	EDC control valve, rear left
15	Ride height sensor, rear left
16	Rear left vertical acceleration sensor
17	SETUP button
18	Steering column switch cluster (SZL)

System function

The Electronic Damper Control (EDC) is a variable, electronically controlled shock absorber adjustment system that controls the vertical dynamics. The front axle damper and rear axle damper can be controlled independently of each other. The EDC adapts the damping forces of the shock absorber more or less instantly to the changing road or driving conditions.

The EDC consists of the following components:

- 4 continuously variable shock absorbers with coupled rebound/compression stage adjustment
- M VDP control unit
- 2 vertical acceleration sensors on the front axle (swivel bearing) for determining the wheel movement
- 2 vertical acceleration sensors on the rear axle (wheel bearing) for determining the wheel movement
- 4 ride height sensors
- Body Domain Controller (BDC) as gateway.

The sensors in the vehicle permanently measure the following:

- Body and vertical acceleration
- Current lateral/longitudinal acceleration
- Vehicle speed
- Steering wheel position.

Based on this measured data, the M VDP control unit calculates the control commands to be sent to the electromagnetic valves in the shock absorbers for each individual wheel according to the road profile and driving situation. This means that the damping forces will always be applied according to requirements.

This improves ride comfort and also increases driving dynamics.

This is expressed as follows:

- Improved suitability for long-distance journeys
- Enhanced body stability and agility
- Improves driving safety by minimizing wheel load fluctuations and reducing the stopping distance.

Adaptive M suspension (EDC) button option

The SETUP button is connected via the LIN bus to the Body Domain Controller (BDC). The Body Domain Controller BDC forwards this information via the FlexRay bus to M VDP.

The Dynamic Damper Control on the F91/F92 offers the options "Comfort", "Sport" and "Sport+". All three programs feature M dynamic control on the F91/F92.

Note:

In the first E90/E92 M3 models, the EDC had the 3 options, "Comfort", "Normal" and "Sport", where the "Sport" option there was no M dynamic control, but the dampers were set very hard. This is primarily suited for a cone slalom on an even surface. However, the fastest possible times on normal roads cannot be achieved with the "Sport" option. The E93 M3 was dynamically controlled in "Sport" mode on standard production models upwards, and all proceeding models including the F91/F92 are dynamically controlled in "Sport+" mode.

SETUP button, program description, EDC:

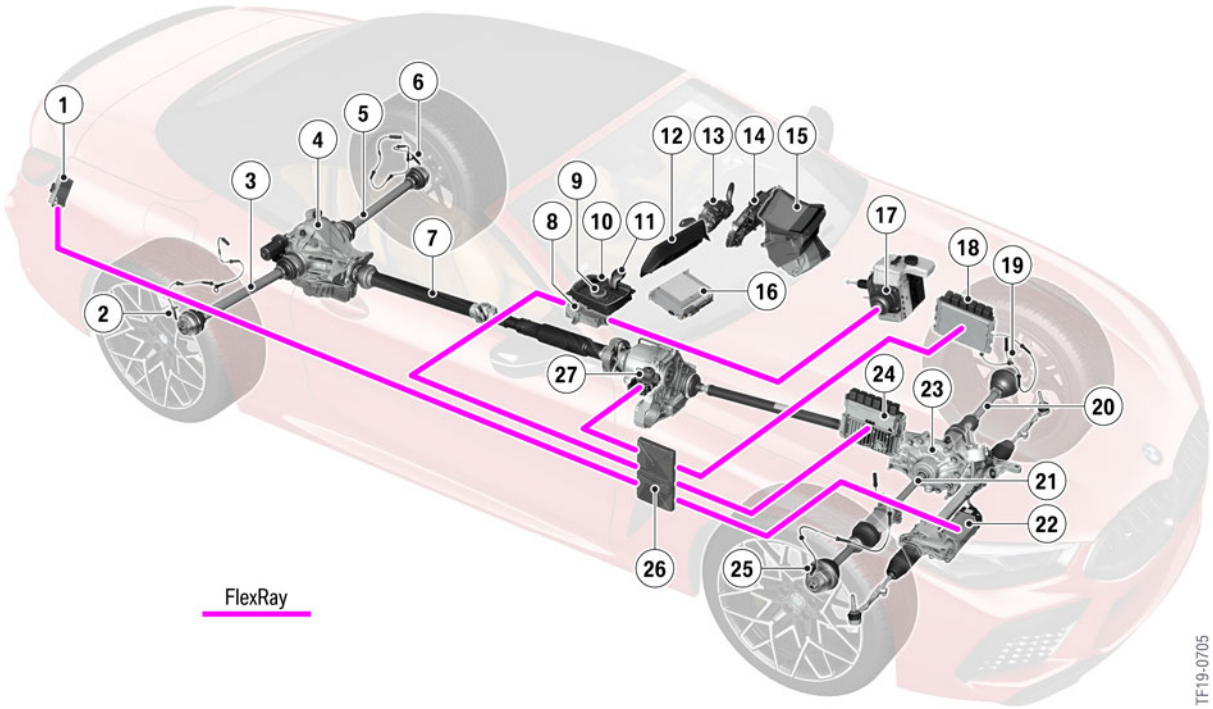
- "COMFORT" emphasizes the comfortable configuration in the F91/F92 in order to satisfy any comfort requirements a BMW M8 customer may have. The basic damper hardness is comfortable without forfeiting safe handling in an emergency (such as during rapid evasive maneuvers).
- “SPORT" supports a demanding M dynamic and sporty driving style with increased basic damper stiffness and sufficient remaining comfort (for example on country roads or bumpy racetracks such as the Nürburgring Nordschleife).
- "SPORT+" on the F91/F92 now also means that M dynamic control comes into effect with the basic damper stiffness being further increased relative to "Normal". It may therefore also be the best selection for the fastest times on different route profiles on very even surfaces, unlike a route profile similar to a "cone-lined slalom".

5.6.2. M Dynamic Stability Control integrated (M DSCi)

The main functions of Dynamic Stability Control integrated (DSCi) are the same as those in the G14/ G15.

Further information on Dynamic Stability Control integrated (DSCi) and its function can be found in the product information "ST1852 Dynamic Stability Control integrated (DSCi)".

M Dynamic Stability Control integrated (M DSCi) represents the longitudinally dynamic system network in the F91/F92. This control unit coordinates the interaction between the M Servotronic, engine control, M VTG and the regulated M rear axle differential lock (M GHAS).



F91, longitudinal dynamics system overview

F91/F92 Complete Vehicle.

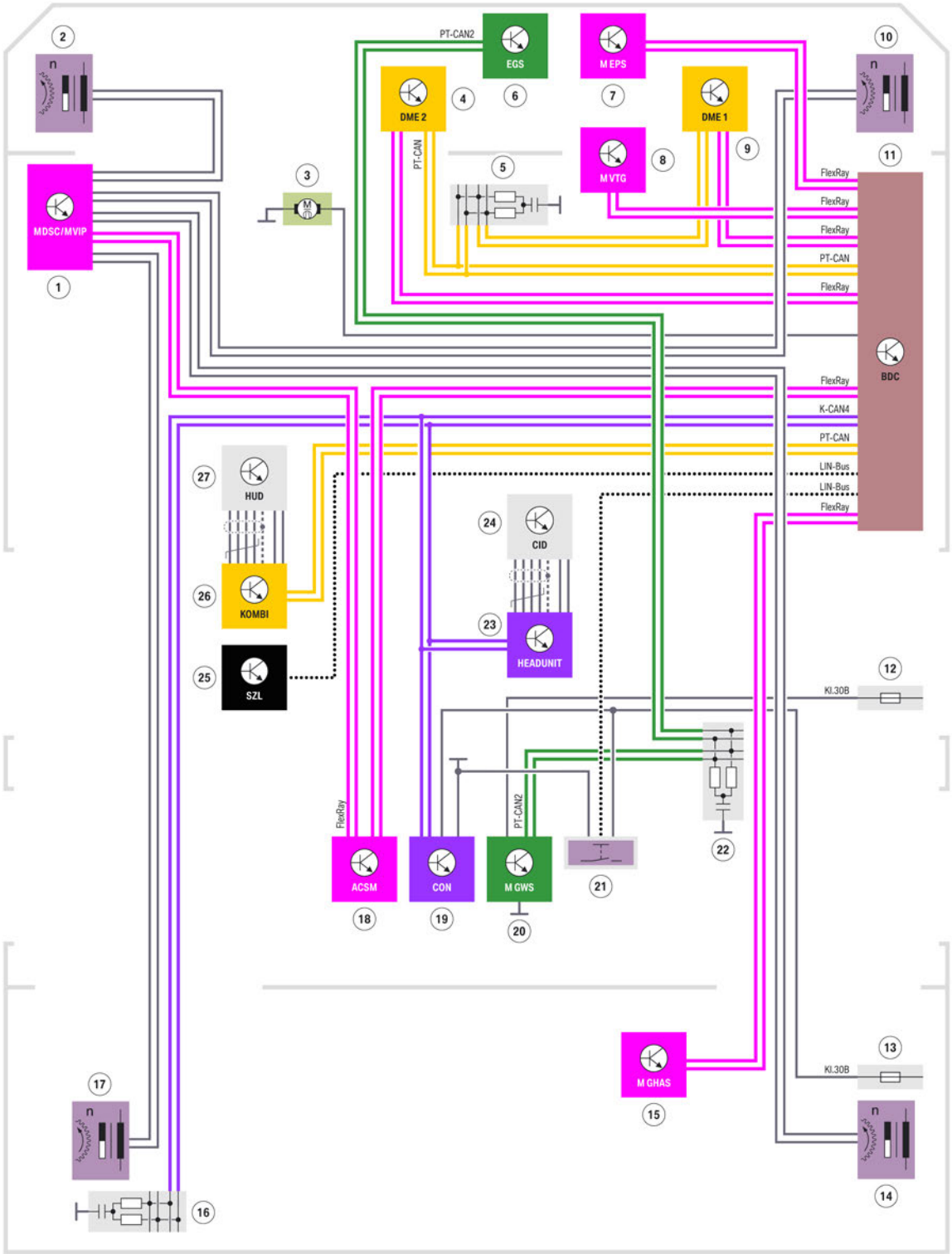
5. Chassis.

Index	Explanation
1	Regulated M rear axle differential lock (M GHAS)
2	Wheel speed sensor, rear right
3	Output shaft, rear left
4	M rear axle differential lock
5	Output shaft, rear left
6	Wheel speed sensor, rear left
7	Drive shaft
8	Crash Safety Module (ACSM)
9	Controller (CON)
10	SETUP button
11	M gear selector switch (M GWS)
12	Central Information Display (CID)
13	Steering column switch cluster (SZL)
14	Instrument cluster KOMBI (M-specific)
15	Head-up Display (HUD) (M-specific)
16	Head Unit High 3 (HU-H 3) (M-specific)
17	M Dynamic Stability Control integrated (M DSCi)
18	Digital Motor Electronics 2 (DME 2)
19	Wheel speed sensor, front left
20	Output shaft, front left
21	Output shaft, front right
22	M Servotronic (M EPS)
23	Front axle differential
24	Digital Motor Electronics 1 (DME 1)
25	Wheel speed sensor, front right
26	Body Domain Controller (BDC)
27	M transfer box (M VTG)

F91/F92 Complete Vehicle.

5. Chassis.

System wiring diagram



F91/F92, longitudinal dynamics system wiring diagram

F91/F92 Complete Vehicle.

5. Chassis.

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	Wheel speed sensor, front left
3	Auxiliary coolant pump, heating
4	Digital Motor Electronics 2 (DME 2)
5	PT-CAN terminating resistor
6	Electronic transmission control (EGS)
7	M Servotronic (M EPS)
8	M transfer box (M VTG)
9	Digital Motor Electronics 1 (DME 1)
10	Wheel speed sensor, front right
11	Body Domain Controller (BDC)
12	Power distribution box, front
13	Power distribution box, rear
14	Wheel speed sensor, rear right
15	Regulated M rear axle differential lock (M GHAS)
16	K-CAN4 terminating resistor
17	Wheel speed sensor, rear left
18	Crash Safety Module (ACSM)
19	Controller (CON)
20	M gear selector switch (M GWS)
21	SETUP button
22	PT-CAN2 terminating resistor
23	Head Unit High 3 (HU-H 3) (M-specific)
24	Central Information Display (CID)
25	Steering column switch cluster (SZL)
26	Instrument cluster KOMBI (M-specific)
27	Head-up Display (HUD) (M-specific)

5.6.3. Integrated actuation (longitudinal transverse dynamics)

What is known as integrated actuation is used on the F91/F92. The integrated actuation in M DSCi comprises DSC, which is responsible for the longitudinal dynamics, and a virtual integration platform control unit (VIP) integrated in the DSC control unit. This means that the current customer request is distributed to the appropriate actuator via this M DSCi control unit. That results in the following benefits when driving the F91/F92:

- Excellent traction, especially on low traction surfaces
- M-specific agility and playfully intuitive control of the vehicle
- Superiority in every day use
- Depending on the customer request, variable functions of the M xDrive possible

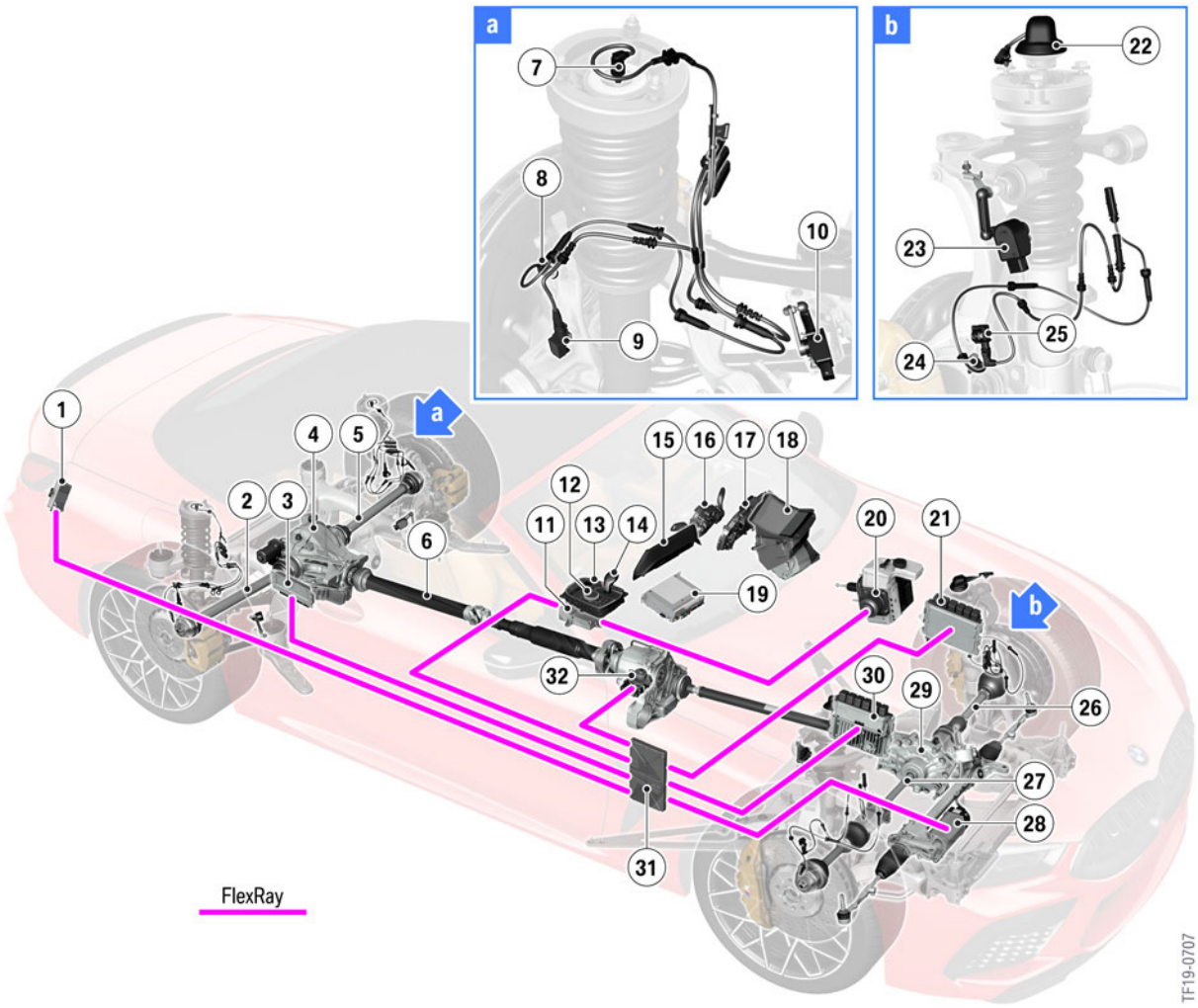
Depending on the customer request, the following actuator and following control units are used:

- M Servotronic (M EPS)
- M VDP Electronic Damper Control (EDC)
- M regulated M rear axle differential lock (M GHAS)
- M Dynamic Stability Control integrated (M DSCi)
- M transfer box (M VTG)
- Digital Motor Electronics (DME)

The virtual integration platform control unit (VIP) is not a separate control unit, but is integrated in M DSCi. It therefore cannot be replaced separately.

F91/F92 Complete Vehicle.

5. Chassis.



F91, system overview, integrated actuation

Index	Explanation
1	Regulated M rear axle differential lock (M GHAS)
2	Output shaft, rear left
3	M vertical dynamic platform (M VDP)
4	M rear axle differential lock
5	Output shaft, rear left
6	Drive shaft
7	Electrical connection, EDC valve, rear
8	Wheel speed sensors, rear
9	Vertical acceleration sensor, rear
10	Ride height sensors, rear
11	Crash Safety Module (ACSM)

F91/F92 Complete Vehicle.

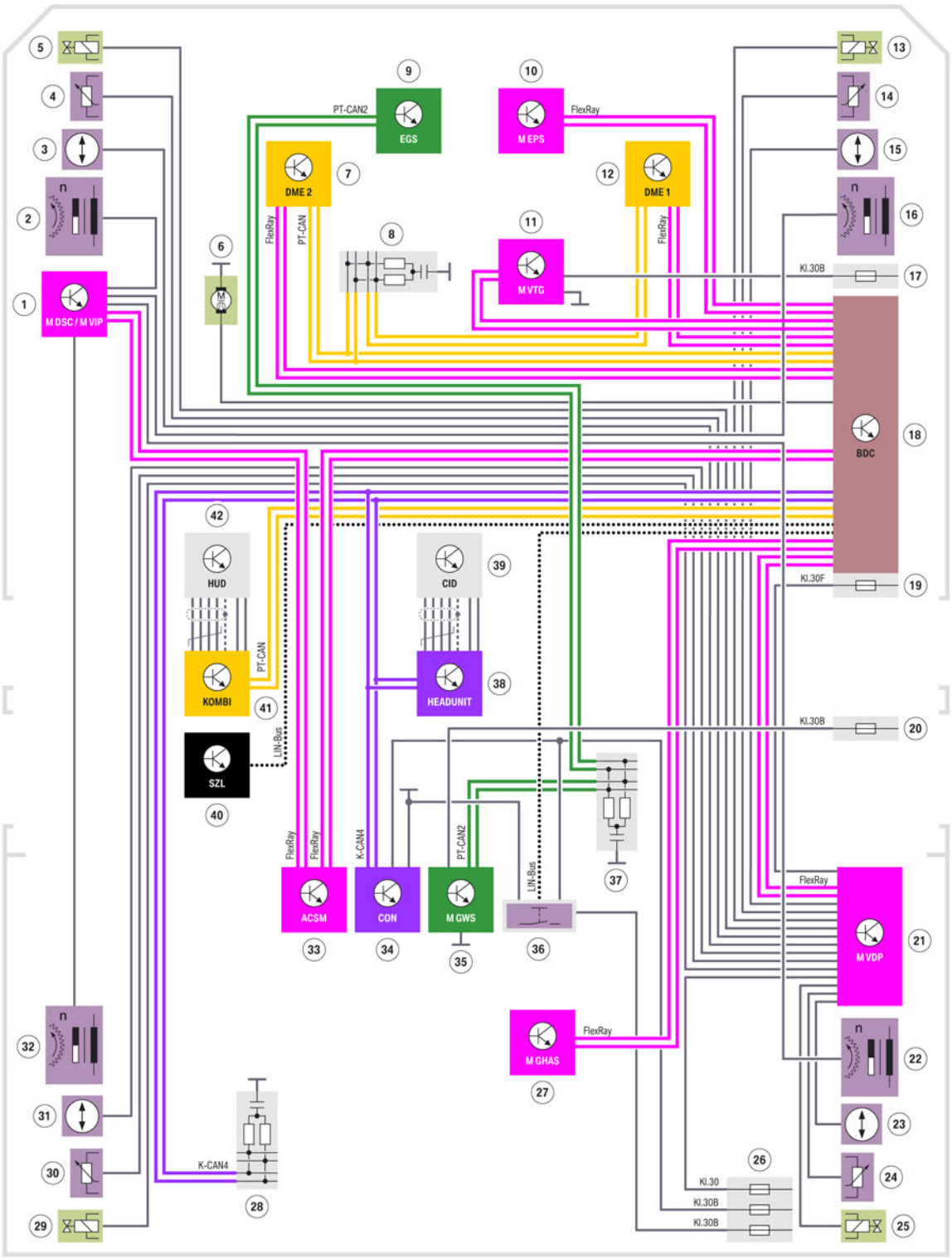
5. Chassis.

Index	Explanation
12	Controller (CON)
13	SETUP button
14	M gear selector switch (M GWS)
15	Central Information Display (CID)
16	Steering column switch cluster (SZL)
17	Instrument cluster KOMBI (M-specific)
18	Head-up Display (HUD) (M-specific)
19	Head Unit High 3 (HU-H 3) (M-specific)
20	M Dynamic Stability Control integrated (M DSCi)
21	Digital Motor Electronics 2 (DME 2)
22	Electrical connection, EDC valve, front
23	Ride height sensors, front
24	Wheel speed sensors, front
25	Vertical acceleration sensor, front
26	Output shaft, front left
27	Output shaft, front right
28	M Servotronic (M EPS)
29	Front axle differential
30	Digital Motor Electronics 1 (DME 1)
31	Body Domain Controller (BDC)
32	M transfer box (M VTG)

F91/F92 Complete Vehicle.

5. Chassis.

System wiring diagram



F91/F92, integrated actuation system wiring diagram (simplified)

F91/F92 Complete Vehicle.

5. Chassis.

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	Wheel speed sensor, front left
3	Vertical acceleration sensor, front left
4	Ride height sensor, front left
5	EDC control valve, front left
6	Auxiliary coolant pump, heating
7	Digital Motor Electronics 2 (DME 2)
8	PT-CAN terminating resistor
9	Electronic transmission control (EGS)
10	M Servotronic (M EPS)
11	M transfer box (M VTG)
12	Digital Motor Electronics 1 (DME 1)
13	EDC control valve, front right
14	Ride height sensor, front right
15	Front right vertical acceleration sensor
16	Wheel speed sensor, front right
17	Fuse 30B (power distribution box, front)
18	Body Domain Controller (BDC)
19	Fuse 30F (power distribution box, front)
20	Fuse 30B (power distribution box, front)
21	M vertical dynamic platform (M VDP)
22	Wheel speed sensor, rear right
23	Rear right vertical acceleration sensor
24	Ride height sensor, rear right
25	EDC control valve, rear right
26	Power distribution box, rear
27	Regulated M rear axle differential lock (M GHAS)
28	K-CAN4 terminating resistor
29	EDC control valve, rear left
30	Ride height sensor, rear left
31	Rear left vertical acceleration sensor
32	Wheel speed sensor, rear left
33	Crash Safety Module (ACSM)
34	Controller (CON)
35	M gear selector switch (M GWS)

Index	Explanation
36	SETUP button
37	PT-CAN2 terminating resistor
38	Head Unit High 3 (HU-H 3) (M-specific)
39	Central Information Display (CID)
40	Steering column switch cluster (SZL)
41	Instrument cluster KOMBI (M-specific)
42	Head-up Display (HUD) (M-specific)

5.6.4. M Dynamic Mode and DSC OFF

In M Dynamic Mode (MDM) the control threshold of the brake interventions is raised and the engine power reduction by ASC is applied significantly later. This enables customer-oriented dynamic and sporty handling. "DSC OFF" is described separately in a later chapter.

5.6.5. M brake

The use of M Dynamic Stability Control integrated (M DSCi) enables the customer to select 2 different ranges of adjustment for the brake in the F91/F92.

In “COMFORT" and in "SPORT" different ratios are created between the vehicle deceleration and the pedal force noticeable to the driver and the brake pedal travel. In this way, the driver can decide between a comfort-oriented perception of the braking process and a particularly direct and spontaneous feedback to deceleration requests.

SETUP button, program description, brake:

M compound brake

- **"Low speed"**
  At low speeds an approximately equal deceleration is set for up to 1/5th of the brake pedal travel in COMFORT and SPORT. The benefit of this is that the customer can meter the brake more sensitively at low speeds.
  In the middle range of the brake pedal travel (2/5th - 4/5th) the deceleration in SPORT is increased in comparison with COMFORT. The benefit of this increase is that the braking effect in SPORT increases with the same brake pedal travel. For the customer a fast-response brake is set in this range.
  At the end of the brake pedal travel (5/5th) the deceleration in SPORT decreases in comparison with COMFORT.

- **"High speed"**
  The responsiveness at higher speed is similar to the responsiveness at low speed. However, a greater deceleration corresponding to the speed is set with the same brake pedal travel.
  At high speeds an approximately equal deceleration is set for up to 1/5th of the brake pedal travel in COMFORT and SPORT. The benefit of this is that the customer can meter the brake more sensitively even at higher speeds.

In the middle range of the brake pedal travel (2/5th - 4/5th) the deceleration in SPORT is increased in comparison with COMFORT. The benefit of this increase is that the braking effect in SPORT increases at high speeds with the same brake pedal travel. For the customer a fast-response, sporty brake at high speeds is set in this range.
At the end of the brake pedal travel the deceleration in SPORT decreases in comparison with COMFORT. The benefit of this is that the customer must actively increase the pedal force. This underlines the sporty driving feel.

M carbon ceramic brake

Since the M carbon ceramic brake exhibits a different braking response from the M compound brake, the settings of the M brake do not have such a pronounced different effect.

- **"Low speed to high speed"**
  The deceleration with regard to the speed does not have an effect as a result of the physical braking response in the M carbon ceramic brake.
  An approximately equal deceleration is set for up to 1/6th of the brake pedal travel in COMFORT and SPORT. This benefit of this is that the customer can meter the brake sensitively in this range.
  In the remaining range of the brake pedal travel (2/6th - 6/6th) the deceleration in SPORT is increased in comparison with COMFORT. The benefit of this increase is that the braking effect in SPORT increases with the same brake pedal travel. For the customer a fast-response, sporty brake is set in this range.

An active setting cannot be made. In other words, the last setting remains active when the brake pedal is pressed. The switch to the new setting takes place only when the brake pedal is released. However, the customer receives immediate feedback via the CID.

F91/F92 Complete Vehicle.
6. General Vehicle Electronics.

6.1. Voltage supply

The voltage supply for the electrical system is provided in the F91/F92, as already in the F90, by an installed lithium-ion starter battery.

Further information on the voltage supply can be found in the product information "ST1703 F90 Complete Vehicle".

6.1.1. Service information

Charging

Use only BMW-recommended chargers to charge the lithium-ion starter battery during servicing.

Please observe the operating instructions of the charger manufacturer.

The maximum charging voltage of the lithium-ion starter battery of 14.4 V must not be exceeded. For this reason, use only BMW-recommended chargers for lithium-ion starter batteries.

For necessary adjustment work on the charger, the current information and specifications in the documents in the Integrated Service Technical Application (ISTA) must be observed in each case.

Identification

The lithium-ion starter battery is labelled with a corresponding sticker on the top of the battery: **"Li-ion 30"**.

Replacement

F90/F91/F92 Lithium-ion batteries do not look differently from F80/F82/F83 batteries. However due to different vehicle electrical systems of the F80/82/83 and the F90/F91/F92 and the resulting software differences of the battery supervision circuits (BUE), the F91/F92 lithium-ion starter batteries are not compatible with the F8x M3/M4, F90 M5 and vice versa. The batteries can be differentiated using the part numbers of the lithium-ion starter batteries.

Disposal

Please refer to all applicable state laws and the latest service information regarding the disposal of lithium-ion starter batteries.

General handling of lithium-ion starter battery

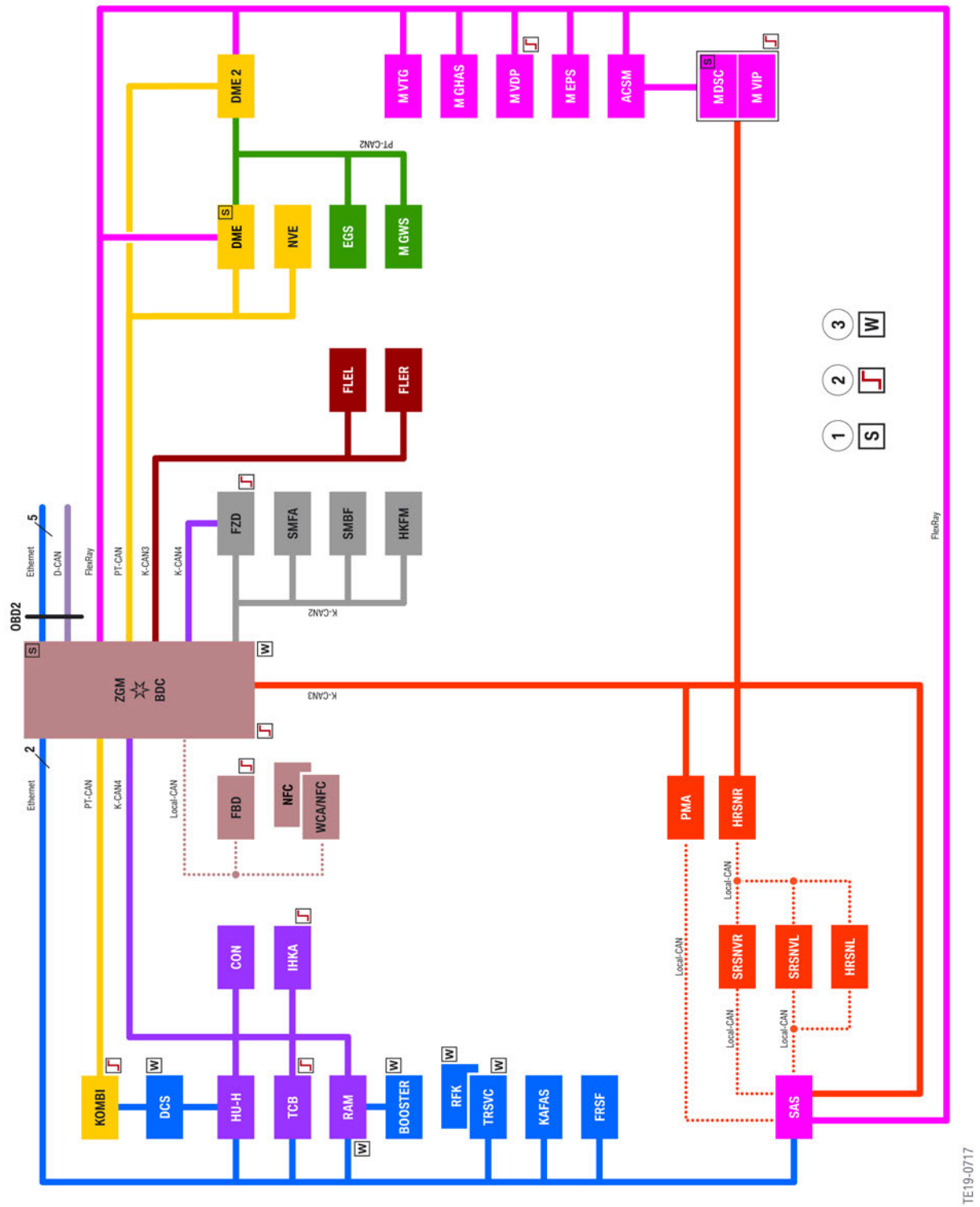
Instructions on the handling of lithium-ion starter battery are available in the safety data sheet.

When performing the necessary service work, it is always important to follow the current information and specifications in the documents in the workshop information system ISTA.

F91/F92 Complete Vehicle.

6. General Vehicle Electronics.

6.2. Bus overview



F92, data bus overview

F91/F92 Complete Vehicle.
6. General Vehicle Electronics.

Index	Explanation
1	Start-up node control units for starting and synchronizing the FlexRay bus system
2	Control units authorizedto perform wake-up function
3	Control units additionally connected to the wake-up line
ACSM	Advanced Crash Safety Module
BDC	Body Domain Controller
BOOSTER	Hi-fi amplifier
CON	Controller
DME	Digital Motor Electronics
DME2	Digital Engine Electronics 2
DCS	Driver Camera System
EGS	Electronic transmission control
FBD	Remote control receiver
FLEL	Frontal Light Electronics Left
FLER	Frontal Light Electronics Right
FRSF	Front radar sensor long range
FZD	Roof function center
HKFM	Tailgate function module
HRSNL	Rear radar sensor short range left
HRSNR	Rear radar sensor short range right
HU-H	Head Unit High 3 (HU-H 3)
IHKA	Integrated automatic heating / air conditioning
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (M-specific)
NFC	Near Field Communication
NVE	Night Vision Electronics
M DSC	M Dynamic Stability Control
M EPS	M Servotronic
M GHAS	Regulated M rear axle differential lock
M GWS	M gear selector lever
M VDP	M vertical dynamic platform
M VIP	M Virtual Integration Platform
M VTG	M transfer box
PMA	Parking Manoeuvring Assistant
RAM	Receiver Audio Module

Index	Explanation
RFK	Rear view camera
SAS	Optional equipment system
SMBF	Front passenger seat module
SMFA	Driver's seat module
SRSNVL	Side radar sensor short range front left
SRSNVR	Side radar sensor short range front right
TCB	Telematic Communication Box
TRSVC	Top rear side view camera
WCA	Wireless charging station
ZGM	Central gateway module

There are the following differences with regards to the G15:

FlexRay
The S63B44T4 engine is equipped exclusively with the DME variant DME 8.8.T.

The rear axle slip angle control (HSR) and electric active roll stabilization rear-front (EARSH-EARSV) control units are deleted since this optional equipment is not offered for the F91/F92. By means of the special M GmbH software application the control units for Electronic Power Steering (EPS), transfer box (VTG), Dynamic Stability Control integrated (DSCi), virtual integration platform control unit (VIP), regulated rear axle differential lock (GHAS) and vertical dynamic platform (VDP) become M Servotronic (M EPS), M transfer box (M VTG), M DSCi, M VIP, M GHAS and M vertical dynamic platform.

PT-CAN2
No PCU is installed since no auxiliary batteries are used in the F91/F92 as they are in the G14/G15. Through the special software and hardware application of the M GmbH, the gear selector switch GWS becomes M gear selector switch M GWS with Drivelogic button.

The following control unit, which is not shown above in the F92, is used in the F91:

K-CAN2
The convertible top module (CVM) in the F91 for controlling the convertible top functions.

6.3. On-board information

6.3.1. M menu

Configuration via the center console switch cluster:

The driver can use the SETUP button in the center console to individually adapt his/her vehicle with regard to driving dynamics systems via the Central Information Display (CID).

F91/F92, SETUP button

Index	Explanation
1	M MODE
2	SETUP button (direct entry into the M menu in the Head Unit High 3 (HU-H 3))
3	Sound pattern

It is possible to switch directly to the M menu in the Head Unit High 3 (HU-H 3) via the "SETUP" button in the center console.

Configuration via the Head Unit High 3 (HU-H 3):

The M menu can also be found in the Settings menu. The following settings can be made in the M menu:

- Engine
- Chassis
- Steering
- Brake
- M xDrive

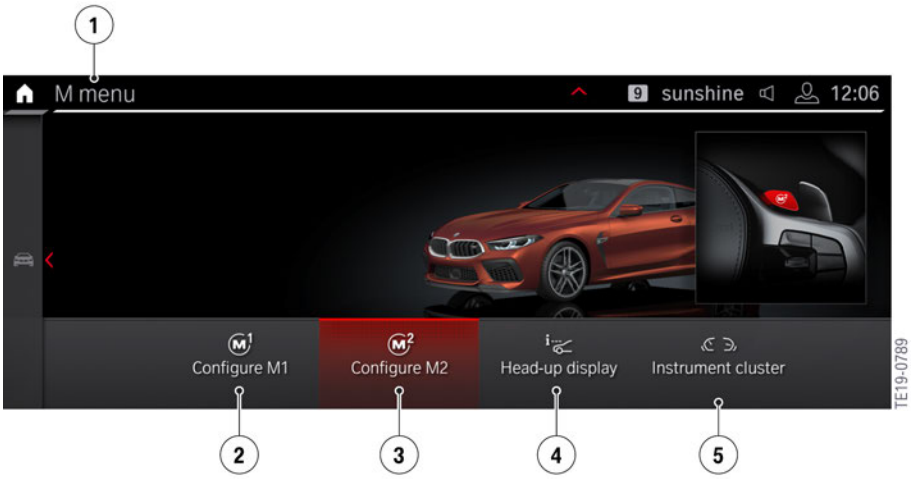
F91/F92, M menu HU

Index	Explanation
1	Engine (gearshift speed control)
2	Chassis
3	Steering
4	Brake
5	M xDrive

The respective configurations can also be displayed in a widget of the instrument cluster.

6.3.2. M1/M2

The customer's individual settings can be stored under Configure M1 and M2.



F91/F92, M menu

Index	Explanation
1	M menu
2	Configure M1
3	Configure M2
4	Head-up display
5	Instrument cluster

The settings made there are retrieved by pressing the corresponding button from the 2 available M buttons on the multifunction steering wheel.

F91/F92, M buttons

Index	Explanation
1	M1 button
2	M2 button

The activation of an M configuration is indicated by an M1 or M2 symbol in the instrument cluster.

The activated configuration can be changed at any time while driving. The M1 or M2 symbol in the instrument cluster goes out.

When Configure M1/M2 is opened and a system is adjusted while M1 or M2 is active, the M1/M2 symbol goes out. The reason for this is that the configuration to the active M1 or M2 has changed. Consequently, M1 or M2 is no longer active.

An efficient/comfortable configuration is set by default at the factory for the M1 button and a sporty configuration for the M2 button. This setting can be adjusted in the M menu to the customer's needs and also reset again to the factory setting. Each M button is individually configurable and the overall configuration is also assigned to the vehicle remote control being used.

F91/F92, Configure M (excerpt)

Index	Explanation
1	Steering
2	Brake
3	DSC
4	M xDrive
5	Automatic Start/Stop function
6	Sound Control

The following functions and configurations can be selected and set:

M Dynamic Stability Control, M DSC

- **ON**: Maximum possible driving stability with 4WD
- **MDM**: Reduced stabilizing interventions with 4WD Sport. Permits driving with a higher lateral and longitudinal acceleration on dry and wet roads
- **OFF**: Stability control switched off. ABS control remains active.

DSC OFF

"Configure DSC" is automatically displayed if DSC is deactivated. The customer can then configure M xDrive directly via the M menu in the Central Information Display (CID). In DSC OFF the customer can select 1 of 3 M xDrive settings:

4WD DSC OFF with traction-optimized all-wheel drive and neutral handling

4WD SPORT DSC OFF with sporty agile all-wheel drive

- Oversteering possible

2WD DSC OFF with pure rear wheel drive

- Unlimited oversteering possible

The selected M xDrive setting is displayed in the instrument cluster and can also be stored as part of the configurable M1/M2.

Engine dynamics control (gearshift speed control)

- **EFFICIENT**: Comfortable response (urban traffic, on snow), minimized consumption.
- **SPORT**: Dynamic, sports-style responsiveness
- **SPORT PLUS**: Precise and direct responsiveness with maximum dynamic response

Electronic Damper Control

- **COMFORT**: Comfort-optimized tuning.
- **SPORT**: Balanced
- **SPORT PLUS**: Thoroughly sports-style

M Servotronic

- **COMFORT**: Medium steering force, noticeable feedback
- **SPORT**: High steering force, significant feedback

M Brake

- **COMFORT**
- **SPORT**

Transmission

- Drivelogic program "S" switch position (bar) 1-3
- Drivelogic program "D" switch position (bar) 1-3

Sound pattern Active Sound Design (ASD) and exhaust flaps

- **COMFORT**
- **SPORT**

Automatic Start/Stop function (MSA)

- Activated
- Deactivated

Configuration quick save

The changed setting can also be permanently assigned to one of the two M buttons on the steering wheel. For this purpose, the corresponding M button on the steering wheel must be pressed and held down for a longer period until confirmed by an acoustic signal. The current configuration is assumed and overwrites the previously saved setting. This enables a quick adaptation or saving without calling up the M menu.

If the driver is not aware that holding down an M button overwrites the current configuration/setting, this may lead to a customer complaint.

Live adjustment

During the journey, the desired ideal tuning of the individual driving dynamics systems must be determined using the M menu and then, before “Residing OFF", one of the two M buttons on the steering wheel is pressed and held for a long period until the acoustic signal is heard.

ConnectedDrive countries: Set personalizations via the M1/M2 Setup are not the object of the personal driver profiles in the BMW ConnectedDrive account.

As a result, it is not possible to use these settings in other BMW vehicles as well.

Default settings

M1/M2 is automatically deactivated when the vehicle is exited and locked. As a result, on restart the default setting is called up again without M1 or M2 being active. This ensures that subsequent drivers are not confronted with a configuration of the vehicle which could potentially overextend their driving abilities.

The default settings are therefore configured for comfortable, safe and efficient. The customer can however at any time as desired activate his/her individual settings at M1/M2.

The following table shows the default settings when starting and the factory settings of M1/M2.

System	Control unit	Setting	Start	M1	M2
DSC	M DSCi	ON	X	X	
		MDM			X
		OFF			
M xDrive	M DSCi	4WD	X	X	
		4WD SPORT			X
		2WD			
Engine dynamics control	DME	EFFICIENT	X		
		SPORT		X	
		SPORT PLUS			X
Electronic Damper Control	M VDP	COMFORT	X		
		SPORT		X	
		SPORT PLUS			X
M Servotronic (M EPS)	M EPS	COMFORT	X	X	
		SPORT			X
M Brake	M DSCi	COMFORT	X	X	X
		SPORT			
Head-up Display	Instrument cluster	Standard view	X	X	
		M view			X
Transmission: D/S	EGS	D	X	X	
		Sequential			X
Transmission: Drivelogic	EGS	1	X		
		2		X	
		3			X
Sound pattern	DME	SPORT	X	X	X
		COMFORT			
Automatic Start/Stop	DME	Activated	X		
		Deactivated		X	X

6.3.3. M MODE

To offer the customer a motorsport experience which is contrary to the intervening driver assistance systems in the G14/G15, the F91/F92 offers the customer the option of using the M MODE to set his/her vehicle quickly to the following demands:

- ROAD-Start
- SPORT-Deliberate sporty driving
- TRACK-Racetrack driving

Two or three options are offered to the customer, depending on the optional equipment.

M MODE Matrix

M MODE	ROAD	SPORT	TRACK*
Driver assistance systems	Driver assistance systems similar to G14/G15	Reduced driver assistance systems (information but no direct active interventions)	All driver assistance systems OFF
Intelligent Safety	All ON similar to G14/ G15	Individual. Preassigned with: • Front collision warning ON • Rest OFF	All OFF
Driver information systems	All ON similar to G14/ G15	But: • no-overtaking indicator • Road sign recognition	All OFF
Displays	• M KOMBI = Basic • M HUD = Basic	• M KOMBI = M View • M HUD = M View	• M KOMBI = M View+ • M HUD = M View+
Others			• CID OFF • Entertainment mute • Deactivate hazard warning flashers after emergency braking OFF • Rear-end collision warning OFF • HUD distance information OFF • Evasion Assistant OFF

*Only in conjunction with Competition package SA 7MA.

The M MODE can be configured as follows:

- M MODE short press switches between ROAD and SPORT
- M MODE long press for entry into TRACK mode, additionally with confirmation via the Central Information Display (CID).

M MODE dependencies

System	Control unit	Characteristics	ROAD	SPORT	TRACK*
Instrument cluster	Instrument cluster	Standard	X		
		M View		X	
		M View+			X
HUD	Instrument cluster	Standard	X		
		M View		X	
		M View+			X
Intelligent Safety	BDC	All ON	X		
		Individual		X	
		All OFF			X
Driver assistance systems	SAS/M DSCi	approved	X		
		Switching-off		X	
		Switch-off & block			X
Hazard warning flashers after emergency braking	BDC	not prevented	X	X	
		prevented			X
Rear-end collision warning	HRSNL/ HRSNR	not prevented	X	X	
		prevented			X
Entertainment	HU-H	No MUTE	X	X	
		MUTE			X
Central information display	HU-H	ON	X	X	
		OFF			X

*Only in conjunction with Competition package SA 7MA.

6.3.4. M instrument cluster

The M instrument cluster of the F91/F92 is based on the multifunctional instrument display (12.3" TFT display) of the G15 and is already known from the G12.

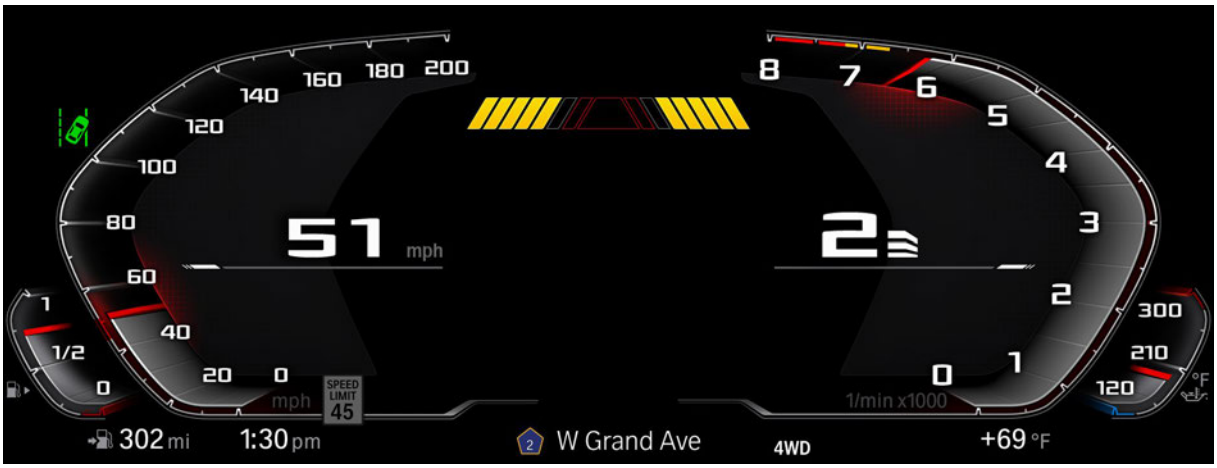
The following M-specific changes exist in comparison with the G15:

- Speed and engine speed display correspond to the drive concept (200 mph in 20 mph increments, 8000 rpm)
- Typical M red needles, lighting of the dial in white (also during the day without driving lights), BMW M8 model inscription when starting.

F91/F92 Complete Vehicle.
6. General Vehicle Electronics.

Two different views are made available to the customer:

Basic view

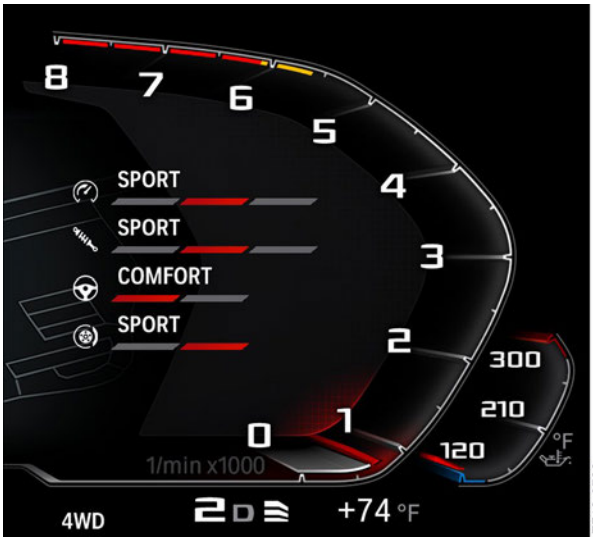


F91/F92, basic instrument cluster

M-specific displays:

- MDM M dynamic mode symbol in place of the DTC
- Additional digital speedometer in mph and km/h
- Display of all-wheel-drive mode
- M1
- M2
- Display of gear
- Display of Drivelogic (bar symbol such as a button)
- Shiftlight function inside the revolution counter (depending on the active M MODE)
- Temperature-dependent, variable engine-revolutions advance-warning field
- Oil temperature gauge in 90 °F increments.

The current configuration of the engine dynamics, damper control, brake and M Servotronic systems can be shown in a widget next to the revolution counter in the instrument cluster. The widgets cannot be activated in the display configuration menu via the Head Unit High 3 (HU-H 3). The customer can quickly switch between all the widgets only via the on-board computer button.



F91/F92, M configuration, instrument cluster display

The gear display and the Drivelogic display are then moved to an alternative position in the bottom right area of the instrument cluster.

M-specific display

F91/F92, instrument cluster M-specific

Only the essential information is displayed for the customer in the M-specific display:

- Sporty view with focus on driving, engine revs, Shiftlight function and gear display
- No driver assistance systems superimposed in the display
- No speed scale, speed only as a digital value
- Transition animation between basic view and M-specific display
- Display of “TRACK" lettering in Track mode

The following M-specific additional displays can be superimposed in the left and right areas of the instrument cluster:

Display	Information about	Content
	Engine	• Engine oil temperature • Boost pressure
	Tires	• Tire pressures • Tire pressure warnings • Tire air temperatures
	Centrifugal forces	• Longitudinal acceleration • Lateral acceleration • Secondary indicator

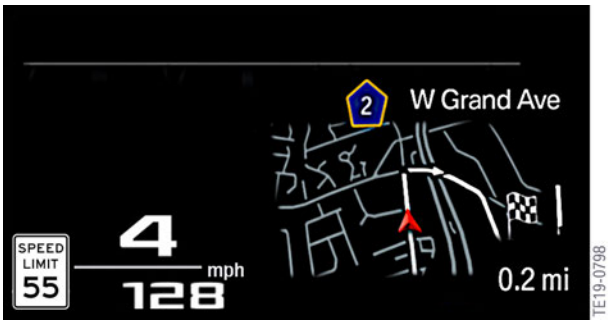
6.3.5. M Head-up Display

The multi-color Head-Up Display can switch into the M-specific display.

The following information/parameters can be shown:

- Shift point indicator by Shiftlight function
- Engine speed via speed bar and temperature-dependent engine-revolutions advance-warning field
- M font
- Transmission shift level
- Vehicle speed
- Road sign recognition
- No-overtaking display
- Navigation displays
- Driver assistance system not displayed
- Contents can be configured

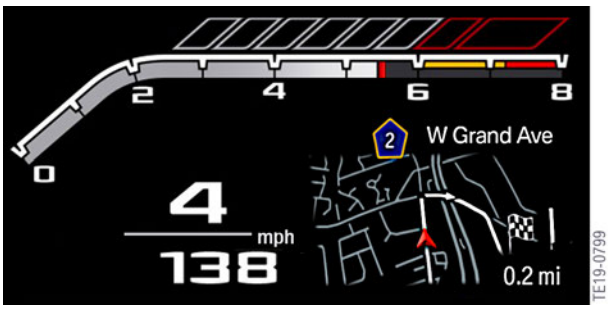
View ROAD



F91/F92, Head-up Display with navigation

If the Shiftlight function is activate in the HUD, it is not superimposed in the instrument cluster display (either in the HUD or in the instrument cluster, but not in both at the same time).

View SPORT



F91/F92, Head-up Display with Shiftlight function

The M-specific display is activated via the M MODE button (SPORT or TRACK). Activation via the M button on the steering wheel or by selection in the Head-up configuration menu.

6.3.6. Active Sound Design

Active Sound Design (ASD) is a subfunction of the Receiver Audio Module (RAM) and is described in the separate product information "ST1857 Infotainment 2018".

The ASD settings are coupled to the engine dynamics control settings:

- Engine dynamics Efficient = ASD Comfort
- Engine dynamics Sport = ASD Sport
- Engine dynamics Sport+ = ASD Sport+

6.4. BMW Remote Software Upgrade

The Remote Software Upgrade differs in vehicles with a V8 high-performance engine from vehicles with other engine versions. In a vehicle with a V8 high-performance engine the Remote Software Upgrade can only be started by the customer after the vehicle has been stationary for approximately 30 minutes.

The reason for this is that a Remote Software Upgrade can only be started when all the conditions for operation are satisfied:

- No electrical consumers active (e.g. lighting)
- Battery state of charge sufficient
- Outside temperature > 14 °F
- Vehicle safely parked off public roads
- Transmission position P selected
- Parking brake applied
- Doors, lids, windows and sliding/tilting sunroof closed
- Power-consuming devices removed, e.g. mobile phone
- Remote control is located in the vehicle to start the installation

Since in a V8 high-performance engine the electric fan can run on for up to 11 minutes and the electric coolant pump for turbocharger cooling can run on for up to 30 minutes in the "Park" operating state, the condition for operation "No electrical consumers active" is not satisfied.

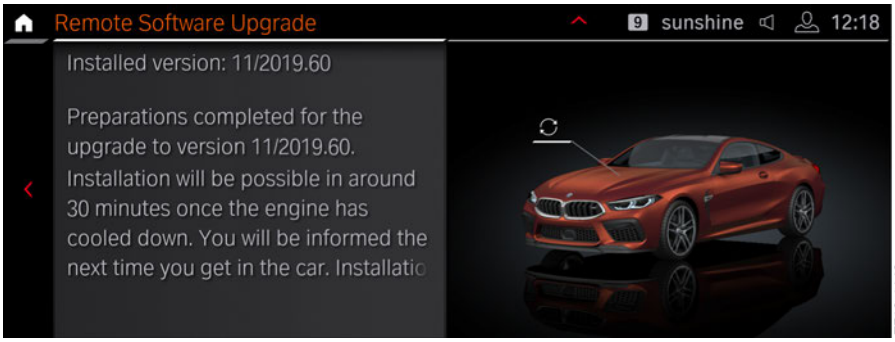
The following factors are reasons for a long run-on time in a V8 high-performance engine:

- Installation position of the exhaust turbocharger units in the hot V-space of the V8 high-performance engine.
- Therefore high temperatures in the turbocharger bearing seats and in the lines already caused after brief engine running by catalytic converter heating.
- Without the electric coolant pump run-on requirement the exhaust turbocharger when stationary is subject to a pronounced temperature increase, which could encourage oil coking in the turbocharger bearing seat.

The customer is therefore prompted by way of a message in the Central Information Display (CID) to start the Remote Software Upgrade only after a waiting period of around 30 minutes.

A further reminder to start the Remote Software Upgrade is issued to the customer the next time they get into the vehicle.

F91/F92 Complete Vehicle.
6. General Vehicle Electronics.



F91/F92, Remote Software Upgrade

The following should therefore be recommended in response to customer questions:

- It is not a malfunction.
- Wait for the engine to cool down and then start the Remote Software Upgrade.
- Do not start to engine before the Remote Software Upgrade so as to avoid re-introducing heat into the exhaust system.
- In the Head Unit High 3 (HU-H 3) proceed via "My Vehicle" > "Settings" > "General Settings" > "Software Update" to start the "BMW Remote Software Upgrade".