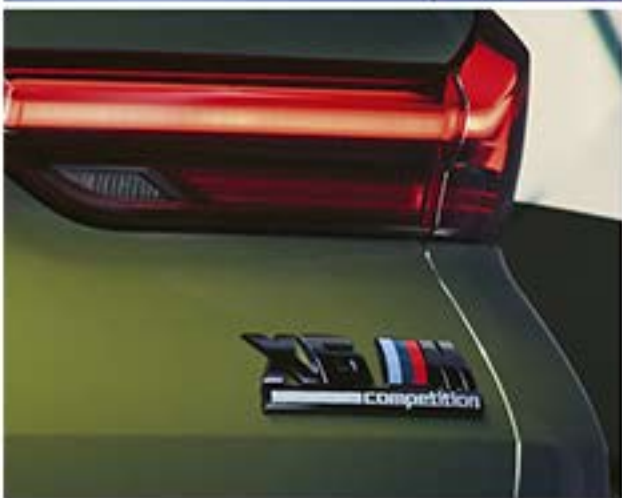


# Reference Manual



## F95/F96 COMPLETE VEHICLE



## Technical Training

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**Technical training.**  
Product information.

## **F95/F96 Complete Vehicle**



**BMW Service**

Edited for the U.S. market by:  
**BMW Group University**  
**Technical Training**

ST1919

3/1/2020

## General information

### Symbols used

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



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

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

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

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

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

This information is available by accessing TIS at [www.dealerspeed.net](http://www.dealerspeed.net).

### Additional sources of information

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

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

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# F95/F96 Complete Vehicle

## 1. Introduction.

BMW M GmbH presents the 3rd generation of its high-performance vehicles in the upper class segment of the Sports Activity Vehicles (SAV) and Sports Activity Coupes (SAC). In addition to their extravagant design and luxurious character, the new BMW X5 M and the new BMW X6 M, as well as the BMW X5 M Competition and BMW X6 M Competition models available for market introduction from April 2020, focus mainly with new optimum values for dynamics, agility and precision in the competitor environment.

The new BMW X5 M and BMW X6 M combine the DNA of an X vehicle with the High Performance concept of M GmbH. The heroic vehicles stand for "uncontested dominance" and therefore constitute the most extroverted characters in the entire BMW model portfolio. The vehicles differ in the exterior trim in all aspects with M-specific details in individual forms.

### 1.1. M history

In 1972 the then BMW Motorsport started out with the legendary M1. For over 47 years today's BMW M GmbH has been developing BMW M vehicles with a motorsport pedigree based on the standard production models.

#### 1.1.1. E70 M / E71 M

The typical M driving experience was also made to come alive for the first time in the Sports Activity Vehicle/Sports Activity Coupe segment in July 2009. The E70 M and E71 M were the first M vehicles with M TwinPower turbo engine, M Sport automatic transmission, xDrive, Dynamic Performance Control, Dynamic Drive and run-flat tires.



E70 M and E71 M

The E70 M was built until August 2013 and the E71 M until June 2014.



# F95/F96 Complete Vehicle

## 1. Introduction.

### 1.1.2. F85/F86

The BMW X5 M and the BMW X6 M start the 2nd generation as F85/F86. The maximum performance of the further developed V8 engine with M TwinPower turbo technology has increased 20 hp to 567 hp and the maximum torque has increased 70 Nm to 750 Nm. The models, which are equipped with an 8-speed M Steptronic transmission with Drivelogic as standard, go from zero to 60 mph in 4.0 seconds. They also achieve new optimum values in terms of transverse dynamics, steering precision and deceleration. Fuel consumption and CO2 emissions are approximately 20 percent less than with the predecessor models.



F85 and F86

The F85 and F86 were built from 2014 until 2018.

# F95/F96 Complete Vehicle

## 1. Introduction.

### 1.2. Vehicle profiles

#### 1.2.1. Vehicle profile F95



F95, BMW X5 M

- **Design and aerodynamics:** 5-door high-performance sports activity vehicle (SAV). M-specific characteristics in front, side and rear area. Clever aerodynamic design in front, side and rear area and vehicle underbody.
- **Engine/transmission/power transmission:** V8 high-performance engine. Efficient, with even more powerful and more spontaneous linear power development. 3 selectable engine dynamics control programs. M automatic transmission with Drivelogic. M all-wheel drive fully variable between front and rear axle or between rear and front axle electronically regulated M rear axle differential lock.
- **Engine sound:** Distinctly sporty character in the lower and upper engine speed and power ranges and a more emotive starting sound.
- **Steering:** Taut, direct and precise with M Servotronic. M leather steering wheel including M gearshift paddles and M Mode buttons.
- **Chassis and suspension/Chassis and suspension dynamics design:** M sports suspension, selectable driving dynamics program from comfortable to sporty in 3 stages. Optimal driving precision and adapted interplay of steering, suspension and damping action according to the selected program.

# F95/F96 Complete Vehicle

## 1. Introduction.

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

- **Seating comfort:** M multifunctional seat, electric, including illuminated M logo and high-quality upholstery in BMW Merino leather.
- **Ergonomics, interior equipment:** Extended Merino leather equipment, M instrument cluster, M Drive menu, M Head-Up Display with M theme on starting, M-specific decorative strips, M footrest and illuminated sill trims.
- **Vehicle electrical system:** Adaptive LED headlight. HiFi speaker system for maximum listening pleasure. Active Sound Design (ASD) for M-specific engine sound in the vehicle interior.
- **Display and operation:** Additional exclusive M MODE for rapid configuration of the vehicle to the individual customer experience. 2 programs are available: "ROAD" and "SPORT".
- **Driver assistance systems:** Availability of the driver assistance systems in the same scope as for the G05, with the exception of the Remote Control Parking SA 5DV, Active Guard Plus SA 5AQ, Active Cruise Control with Stop&Go function SA 5DF, as well as the Parking Assistant SA 5DM.

Further information about the driver assistance systems and their function can be found in the reference manual "ST1831 G05 Driver Assistance Systems" or "ST1858 Driver Assistance Systems 2018".

# F95/F96 Complete Vehicle

## 1. Introduction.

### 1.2.2. Vehicle profile F96



F96, BMW X6 M

- **Design and aerodynamics:** 5-door high-performance sports activity coupe (SAC). M-specific characteristics in front, side and rear area. Clever aerodynamic design in front, side and rear area and underbody with BMW X6 M specific rear spoiler.
- **Engine/transmission/power transmission:** V8 high-performance engine. Efficient, with even more powerful and more spontaneous linear power development. 3 selectable engine dynamics control programs. M automatic transmission with Drivelogic. M all-wheel drive fully variable between front and rear axle or between rear and front axle electronically regulated M rear axle differential lock.
- **Engine sound:** Distinctly sporty character in the lower and upper engine speed and power ranges and a more emotive starting sound.
- **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 mode buttons.
- **Chassis and suspension/Chassis and suspension dynamics design:** M sports suspension, selectable driving dynamics program 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. 2 additional modes in the M DSCi OFF mode; the following are available: all-wheel drive, all-wheel drive Sport.



# F95/F96 Complete Vehicle

## 1. Introduction.

- **Seating comfort:** M multifunctional seat, electric, including illuminated M logo and high-quality upholstery in BMW Merino leather and knee pads.
- **Ergonomics, interior equipment:** Extended Merino leather equipment, M instrument cluster, M Drive menu, M Head-Up Display with M theme on starting, M-specific decorative strips, M footrest and illuminated sill trims.
- **Vehicle electrical system:** Adaptive LED headlight. HiFi speaker system for maximum listening pleasure. Active Sound Design (ASD) for M-specific engine sound in the vehicle interior.
- **Display and operation:** Additional exclusive M MODE for rapid configuration of the vehicle to the individual customer experience. 2 programs are available: "ROAD" and "SPORT".
- **Driver assistance systems:** Availability of the driver assistance systems in the same scope as for the G05, with the exception of the Remote Control Parking SA 5DV, Active Guard Plus SA 5AQ, Active Cruise Control with Stop&Go function SA 5DF, as well as the parking function of the Parking Assistant SA 5DM.

Further information about the driver assistance systems and their function can be found in the reference manual "ST1831 G05 Driver Assistance Systems" or "ST1858 Driver Assistance Systems 2018".

### 1.2.3. Vehicle profile for F95 Competition model



F95, BMW X5 M Competition

TG14-1543

# F95/F96 Complete Vehicle

## 1. Introduction.

- **Design and aerodynamics:** The surround of the BMW M radiator grill, the typical M gills, the mirror hoods and the exclusive BMW X5 M roof spoiler are finished in high-gloss black as standard. The additional model designation on the rear with the X5 M "Competition" lettering ultimately distinguishes the external appearance of the Competition model from the BMW X5 M.
- **Engine:** V8 high-performance engine. The Competition engine has increased performance figures to 617 hp and makes the Competition model 0.1 second faster from 0-60 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.
- **Chassis and suspension/driving dynamics setup:** Adaptive M suspension with selectable driving dynamics programs in 3 stages with the emphasis on even more sportiness. The 21" wheels at the front and 22" wheels at the rear with 315/30 R22 tires at the rear and 295/35 R21 tires at the front underline the external styling of the Competition model.
- **Interior:** Merino full leather including headliner in Anthracite. Knee pads at the center console. Illuminated sill trims with the "Competition" lettering round off the interior equipment of the Competition model.
- **Display and operation:** In addition to the M modes "ROAD" and "SPORT", an exclusive M "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 various safety functions.

# F95/F96 Complete Vehicle

## 1. Introduction.

### 1.2.4. Vehicle profile for F96 Competition model



F96, BMW X6 M Competition

- **Design and aerodynamics:** The surround of the BMW M radiator grill, the typical M gills, the mirror hoods and the exclusive BMW X6 M rear spoiler are finished in high-gloss black as standard. The additional model designation on the rear with the X6 M "Competition" lettering ultimately distinguishes the external appearance of the Competition model from the BMW X6 M.
- **Engine:** V8 high-performance engine. The Competition engine has increased performance figures to 617 hp and makes the Competition model 0.1 second faster from 0-60 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.

# F95/F96 Complete Vehicle

## 1. Introduction.

- **Chassis and suspension/driving dynamics setup:** Adaptive M suspension with selectable driving dynamics programs in 3 stages with the emphasis on even more sportiness. The 21" wheels at the front and 22" wheels at the rear with 315/30 R22 tires at the rear and 295/35 R21 tires at the front underline the external styling of the Competition model.
- **Interior:** Merino full leather including headliner in Anthracite. Knee pads at the center console. Illuminated sill trims with the "Competition" lettering round off the interior equipment of the Competition model.
- **Display and operation:** In addition to the M modes "ROAD" and "SPORT", an exclusive M "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 various safety functions.



# F95/F96 Complete Vehicle

## 2. Technical Data.

### 2.1. Comparison of the F85 with the F95

Designation	Unit	F85 BMW X5 M	F95 BMW X5 M	F95 BMW X5 M Competition
Engine series		S63B44T2	S63B44T4	S63B44T4
Engine control		MEVD 17.2.H	DME 8.8T.0	DME 8.8T.0
Transmission type designation		M8HP75	M8HP76	M8HP76
Length	[mm]	4894	4953	4953
Width	[mm]	1985	2015	2015
Height	[mm]	1717	1749	1751
Number of seats		5	5	5
Luggage compartment volume	[l]	650-1870	650-1870	650-1870
Top-speed	[mph]	156*	155*/177**	155*/177**
Acceleration 0-60 mph	[s]	4.0	3.8	3.7
Nominal engine power at engine speed	[hp] [rpm]	567 6000-6500	600 6000	617 6000
Power-to-weight ratio (DIN)	[kg/kW]	5.4	5.2	5
Torque at speed	[Nm/lb-ft] [rpm]	750/553 2200-5000	750/553 1800-5690	750/553 1800-5860
<b>Aerodynamics</b>				
$c_x$ (drag coefficient value)		0.38	0.38-0.39	0.38-0.39
A (frontal area)	[m <sup>2</sup> ]	2.93	2.99	2.99
$c_x \times A$ (drag)	[m <sup>2</sup> ]	1.11	1.17	1.17
<b>Vehicle curb weight</b>				
US	[lbs]	5260	5286	5286
Payload	[lbs]	1170	1080	1080
Gross vehicle weight	[lbs]	6550	6615	6615
Permissible towed weight	[lbs]	6550	6615	6615
Fuel consumption	[l/100 km]	11.1	13.0-12.8	13.0-12.8
Approx. fuel tank capacity	[l/gal]	85/22.4	83/21.9	83/21.9
CO <sub>2</sub> emissions	[g/km]	258	296-291	296-291
Emission rating		ULEV 2	ULEV125	ULEV125

\* Electronically controlled

\*\* Electronically regulated in conjunction with M Drivers Package SA 7ME

# F95/F96 Complete Vehicle

## 2. Technical Data.

### 2.2. Comparison of the F86 with the F96

Designation	Unit	F86 BMW X6 M	F96 BMW X6 M	F96 BMW X6 M Competition
Engine series		S63B44T2	S63B44T4	S63B44T4
Engine control		MEVD 17.2.H	DME 8.8T.0	DME 8.8T.0
Transmission type designation		M8HP75	M8HP76	M8HP76
Length	[mm]	4923	4953	4953
Width	[mm]	1989	2019	2019
Height	[mm]	1689	1692	1693
Number of seats		5	5	5
Luggage compartment volume	[l]	550-1525	650-1870	650-1870
Top-speed	[mph]	156*	155*/177**	155*/177**
Acceleration 0-60 mph	[s]	4.0	3.8	3.7
Nominal engine power at engine speed	[hp] [rpm]	567 6000-6500	600 6000	617 6000
Power-to-weight ratio (DIN)	[kg/kW]	5.4	5.2	5
Torque at speed	[Nm/lb-ft] [rpm]	750/553 2200-5000	750/553 1800-5690	750/553 1800-5860
<b>Aerodynamics</b>				
c <sub>x</sub> (drag coefficient value)		0.37	0.38-0.39	0.38-0.39
A (frontal area)	[m <sup>2</sup> ]	2.89	2.99	2.99
c <sub>x</sub> x A (drag)	[m <sup>2</sup> ]	1.07	1.17	1.17
<b>Vehicle curb weight</b>				
US	[lbs]	5185	5286	5236
Payload	[lbs]	1170	1080	1080
Gross vehicle weight	[lbs]	6505	6615	6615
Permissible towed weight	[kg]	2950	6615	6615
Fuel consumption	[l/100 km]	11.1	13.0-12.8	13.0-12.8
Approx. fuel tank capacity	[l]	85	83/21.9	83/21.9
CO <sub>2</sub> emissions	[g/km]	258	296-291	296-291
Emission rating		ULEV 2	ULEV125	ULEV125

\* Electronically controlled

\*\* Electronically regulated in conjunction with M Drivers Package SA 7ME

# F95/F96 Complete Vehicle

## 3. Body.

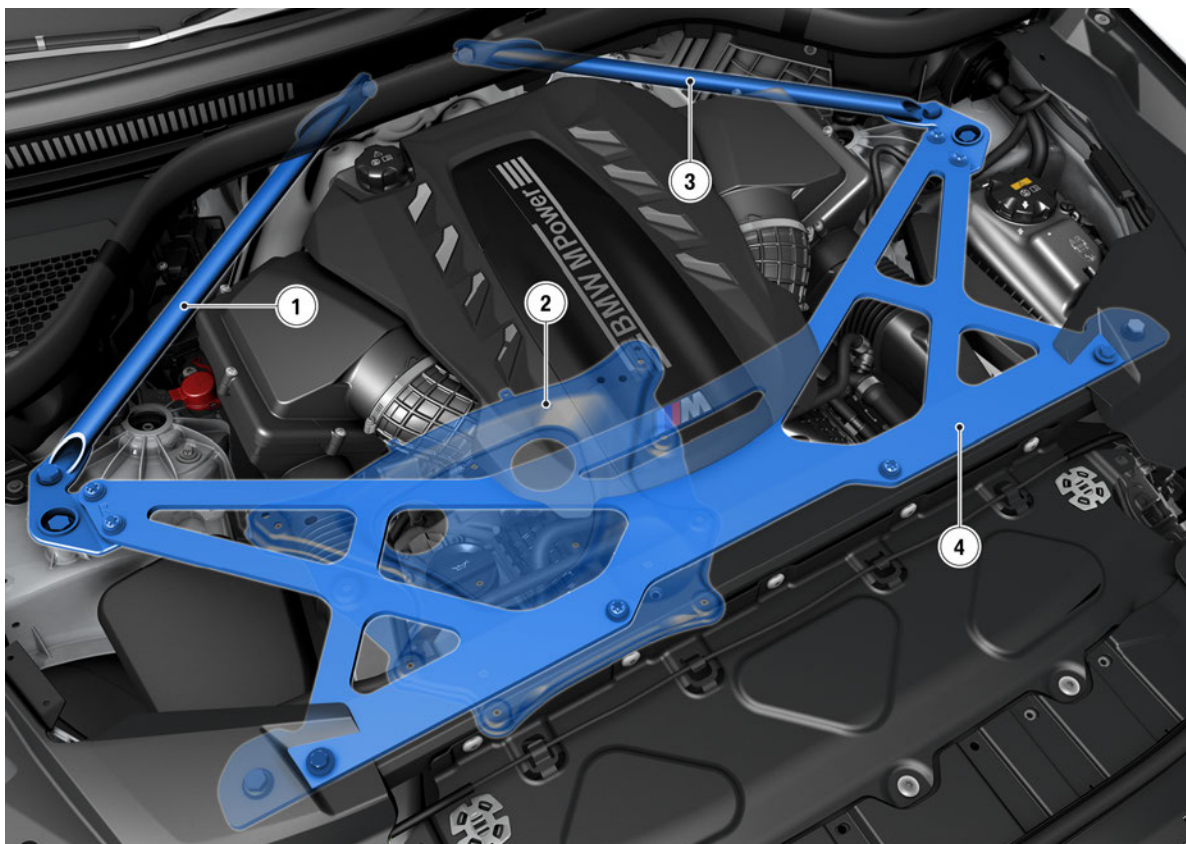
### 3.1. Rigidity

#### 3.1.1. Chassis and suspension components and rigidity concept

##### Front end area of F95/F96

The following identical measures on the F95 and F96 for attaching the chassis components and increasing the vehicle rigidity have been implemented in the front end area:

- Dome bulk head struts
- Combined dome-front-end strut
- Stiffening plate.



TG19-0905

F95/F96, stiffening measures in the forward area

Index	Explanation
1	Dome bulk head strut, right
2	Stiffening plate
3	Dome bulk head strut, left
4	Combined dome-front-end strut

# F95/F96 Complete Vehicle

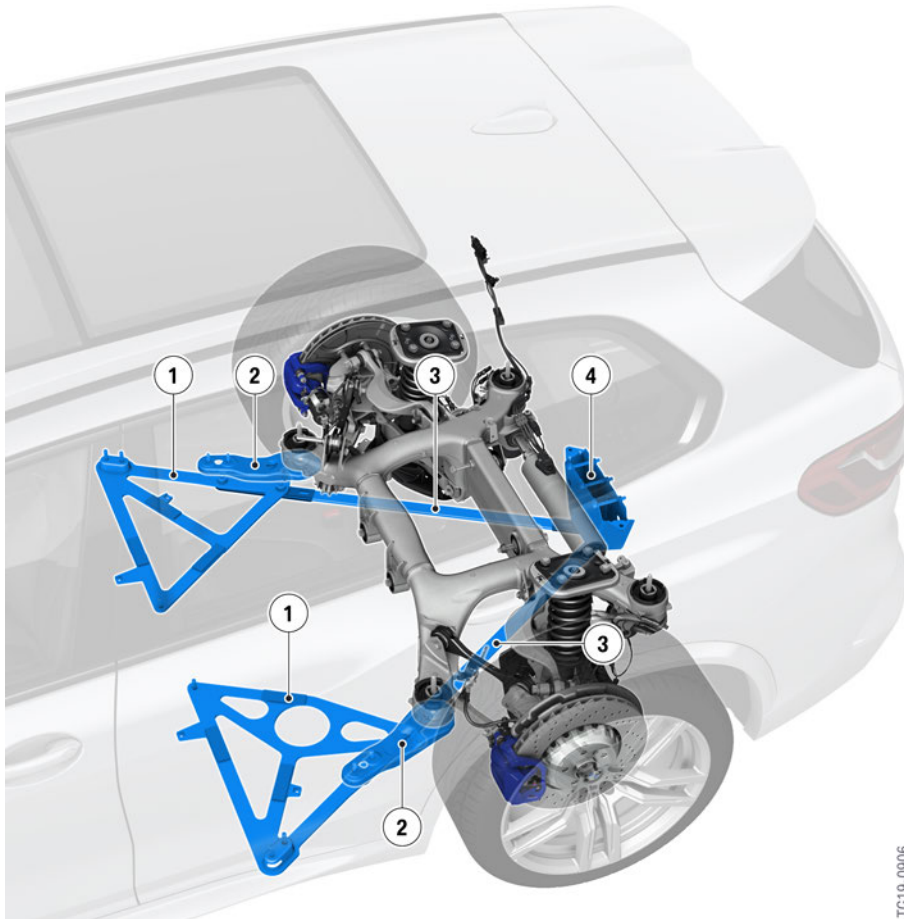
## 3. Body.

All other measures for stiffening the front end are the same as in the G05/G06 production vehicle.

### Rear area of the vehicle

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

- Strut block adopted from G05/G06
- Tension struts with connection to the strut block and to the rear door sill, front rear axle support
- Triangular struts with connection at door sill, rear axle support at the front and driveshaft tunnel.



F95/F96, stiffening measures in the rear area

Index	Explanation
1	Triangular struts
2	M front compression strut
3	Torsion struts
4	Strut block

# F95/F96 Complete Vehicle

## 3. Body.

### 3.2. Exterior trim

#### 3.2.1. Front F95

The BMW X5 M embodies a powerful presence. The large, dark air vents indicate the high air requirement and the enormous output of the up to 617 hp drive and lend the front a highly dynamic look.

#### Bumper, front

The one-piece M-specific bumper cover on the F95 has a distinct design and has M-specific flaps for reducing front-wheel lift. It is including the standard ultrasonic sensors for Park Distance Control (PDC) and the licence plate baseplate - painted to match the vehicle color. The grills are finished in high-gloss black. The standard Surround View with 3D view camera and the ultrasonic sensors for the Parking Assistant Plus are integrated similar to the G05/production vehicle at side front.

The F95/F96 is equipped with Adaptive Full LED Headlights as standard.



F95, front view (Competition model)

#### Radiator (kidney) grill

The frame and the double-rib kidney grill bars of the BMW M radiator grill have high-gloss black struts as standard for the F95 and feature the subtle model designation X5 M.



# F95/F96 Complete Vehicle

## 3. Body.

### 3.2.2. Front F96

As an M vehicle, the BMW X6 M also bears the Coupe radiator grill which widens towards the bottom. The front bumper suggests the driving dynamic potential with precisely modelled air inlets and large air vents.

#### Bumper, front

The one-piece M-specific bumper cover on the F96 has a distinct design and has M-specific flaps for reducing front-wheel lift. It is - including the standard ultrasonic sensors for Park Distance Control (PDC) and the license plate baseplate - painted to match the vehicle color. The grills are finished in high-gloss black. The standard Surround View with 3D view camera and the ultrasonic sensors for the Parking Assistant Plus are integrated similar to the G06/production vehicle at side front. .

The F95/F96 is equipped with Adaptive Full LED Headlights as standard.



F96, front view (Competition model)

#### Radiator (kidney) grill

The frame and the double-rib kidney grill bars of the BMW M radiator grill have high-gloss black struts as standard for the F96 and feature the subtle model designation X6 M.

# F95/F96 Complete Vehicle

## 3. Body.

### 3.2.3. Cooling air routing

The new air duct is identical for the F95 and F96. New cooling air routing for all radiators/coolers: multifunction air routing, air duct for brakes, air duct for auxiliary radiator and air duct with additional air guide for the additional low-temperature cooler.

The air inlet areas for the required cooling air on the front bumper panel have been enlarged and optimized in such a way that there is more air inlet area available for cooling air compared with the G05/G06. This design feature has had a positive effect on the cooling power for the charge air cooling, capacitor cooling-air conditioning system, engine cooling, engine oil cooling and transmission cooling.

### 3.2.4. Side F95

The side of the X5 M has a very sporty design. The powerful X proportions create an athletic impression. The aero edges of the surrounding clamp movement of the bumper cover highlight the distinctive shark nose and thus the forward-thrusting torque of the front. Behind the front wheel the air breather decorative element with individually designed M side gills and integrated model inscription highlight the vehicle character. The exclusively designed M light alloy wheels and the M compound brakes are a highlight at the side. Different rim sizes of 21" (front) and 22" (rear) with the same wheel dimensions were chosen for optimal performance.



F95, side view (Competition model)

The precise and clear-cut character line draws upwards in an S shape in the area of the rear door and portrays a powerful shoulder element. Exposed wheel well trims painted in vehicle color highlight the wide toe and give the side view a clear on-road orientation. The M roof spoiler of the BMW X5 M visibly extends the silhouette, highlighting the dynamics on the sides.



# F95/F96 Complete Vehicle

## 3. Body.

### 3.2.5. Side F96

The BMW X6 M has a sportier, on-road oriented design. The painted, exposed wheel well trims highlight the wide toe and the visible connection with the road. After the front wheel well the air breather decorative element shows an individually designed M side gill with integrated model inscription. It is the starting point of the area design of the side and adds a high-quality touch. Exclusive M mirrors, M rims and the M compound brakes indicate the high-performance concept in the side of the BMW X6 M. Similar to the BMW X5 M, 21" wheels at the front and 22" wheels at the rear ensure optimal performance.



TG19-0844

F96, side view (Competition model)

In combination with the roof spoiler, the M Carbon rear spoiler ensures optimal contact pressure at the rear axle. At the same time, it lends a sporty accent and directs the view to the sophisticated shoulder element.

### 3.2.6. Front fenders

While sharing the same design language, the front fenders on the F95 and F96 differ from each other geometrically. Distinctive design features include the M gills and the X5 M/X6 M model inscriptions on the front left and right fenders. In addition, the air breathers in the left and right fenders, are used as design features integrated in the typical M gills.



TG19-0849

F95/F96, M gill element with integrated air breather

# F95/F96 Complete Vehicle

## 3. Body.

### 3.2.7. F95 rear

The rear of the BMW X5 M has a massive, solid design accentuating the width. The M roof spoiler can be clearly seen in the rear view. It makes the rear window appear smaller and the entire rear flatter. The distinctive diffuser closes off the rear to the road and frames the characteristic BMW M twin exhaust pipe.



F95, rear view (Competition model)

The M-specific bumper panel is designed in three pieces. The trim panel of the upper bumper with PDC is painted to match the vehicle color. The lower diffuser is painted to match the vehicle color apart from the center grill which has a black grain finish.

The full LED tail lights add a technically sculptural touch to the rear design of the new BMW X5 M. 3D light elements are visible through the strong shape of the glass cover both when cold and warm. The inner darkened area creates a narrow appearance. Turn indicators and brake lights are positioned here. However, they are only visible when activated.

# F95/F96 Complete Vehicle

## 3. Body.

### 3.2.8. F96 rear

The rear of the BMW X6 M has an impressive appearance with maximum effect. Dynamic areas and flat tail lights portray a sporty rear. The rear bumper makes a very graphic and expressive statement with outer, vertical reflectors. The distinctive diffuser with classic twin exhaust pipe logic rounds off the rear part.



F96, rear view (Competition model)

The M-specific bumper panel is designed in four pieces. The trim panel of the upper bumper with PDC is painted to match the vehicle color. The upper bumper panel is separated from the diffuser by a black grained finished rear trim. The lower diffuser is painted to match the vehicle color apart from the center grill which has a black grain finish.

The tail lights of the BMW X6 M are fully implemented in LED technology. Their narrow shape reaches far into the rear section, thus highlighting the central BMW logo. The sculptural shape of the glass cover emphasizes the typical BMW L theme. The long, red LED strip appears very clear and precise when switched on. It shows the L theme in reverse form. The long turn indicators set a high-quality accent.

### 3.2.9. Trailer tow hitch

A specifically adapted trailer tow hitch is used on the F95/F96.

# F95/F96 Complete Vehicle

## 3. Body.

### 3.2.10. Underbody and thermal protection

#### Underbody panelling

- An M-specific stiffening plate is used at the underbody.
- The engine compartment shielding is a new part with an integrated air outlet for the additional upstream low-temperature charge air cooler and the additional transmission oil cooler.
- In order to achieve an additional optimization in terms of reducing the lift on the F95/F96, M-specific air guides in front of the front wheels that differ geometrically from the G05/G06 have been developed in a wind tunnel.
- The underbody panelling at the left and right of the fuel tank was adapted in the course of the rear axle stiffening.

#### Thermal protection

- The thermal protection in the center of the fuel tank was adapted.
- The heat insulation at the left and right of the rear silencer was adapted.

## 3.3. Interior equipment

### 3.3.1. Driving area and steering wheel

#### M driving area



F95/F96, M dashboard (Competition model)

# F95/F96 Complete Vehicle

## 3. Body.

The upper instrument panel is leather-covered as standard. With the “Full leather” optional extra the lower instrument panel including all the flaps are also leather-covered. Merino fine graining leather with contrast stitching is used. The leather-covered center console in the F96 has been adopted from the G06, including the knee pads. (F95 only in the Competition model).

### M leather steering wheel

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

The steering wheel has increased in its outer diameter to 380 mm compared with the G05/G06. The steering wheel rim is reinforced and ergonomically optimized from a round to an oval cross-section, improving the driver's grip.

Left shift paddle "-" downshift, right shift paddle "+" upshift.

The colored M stitching constitutes another difference to the standard 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.

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 G05/G06. For more details, please see the chapter "M configuration menu".



F95/F96, M leather steering wheel

# F95/F96 Complete Vehicle

## 3. Body.

### 3.3.2. Seats

#### M multifunction seats

The M multifunction seats are standard equipment.

These are fully electric multifunction 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 control unit is also installed in the seat. To increase safety, the crash-active head restraints are installed as standard.

Equipment of the M multifunction seats (driver and front passenger):

- Merino leather, two-tone and M-specific stitching
- M-specific seam in the middle section
- Heated seats
- Electric forward/back seat adjustment, seat height, seat angle, backrest angle, upper backrest and head restraint height adjustment
- M-specifically moulded beads in the seat area for increased side support
- Foam parts and covers M-specifically new
- Pneumatic lumbar support
- Memory function for the driver's seat and front passenger seat
- Illuminated M logo in the head restraints

Optional equipment:

- Front ventilated seats SA 453
- Front massage seats SA 4T7

#### Rear seats

**F95:** Full foam seat with backrest and seat cushion division with an upper body angle of 27°. The split ratio is 40/20/40. The folding center armrest includes a fixed, height-adjustable head restraint and a cup holder. The outer head restraints are manually adjustable.

Optional equipment: Seat heating. The 3rd row of seats option is not available.

**F96:** Full foam set with backrest and seat distribution and an upper body angle of 26°. The split ratio is 40/20/40. In the F96 the cargo adjuster of the rear seats helps to increase the storage space in the luggage compartment. The integrated head restraints and the individual seats with moulded side sections accentuate the sporty coupe character of the rear seats. The special design layout of the roofliner ensures optimum headroom, without having to forego a folding center armrest and a ski bag (optional equipment).

Standard equipment: Heated front seats, steering wheel and arm rests.

# F95/F96 Complete Vehicle

## 3. Body.

### 3.3.3. Doors and strips

#### Doors

Upper door trims (shoulders) in black Merino leather with contrast stitching. For the full leather version with door pockets made from Merino leather.

#### Sill trims, footrest and compact spare wheel

- Sill trims with M lettering
- Entry sills for M Competition package, illuminated "Competition" lettering
- M footrest
- An spare wheel is, as for the G05/G06, offered as standard equipment for the F95/F96.



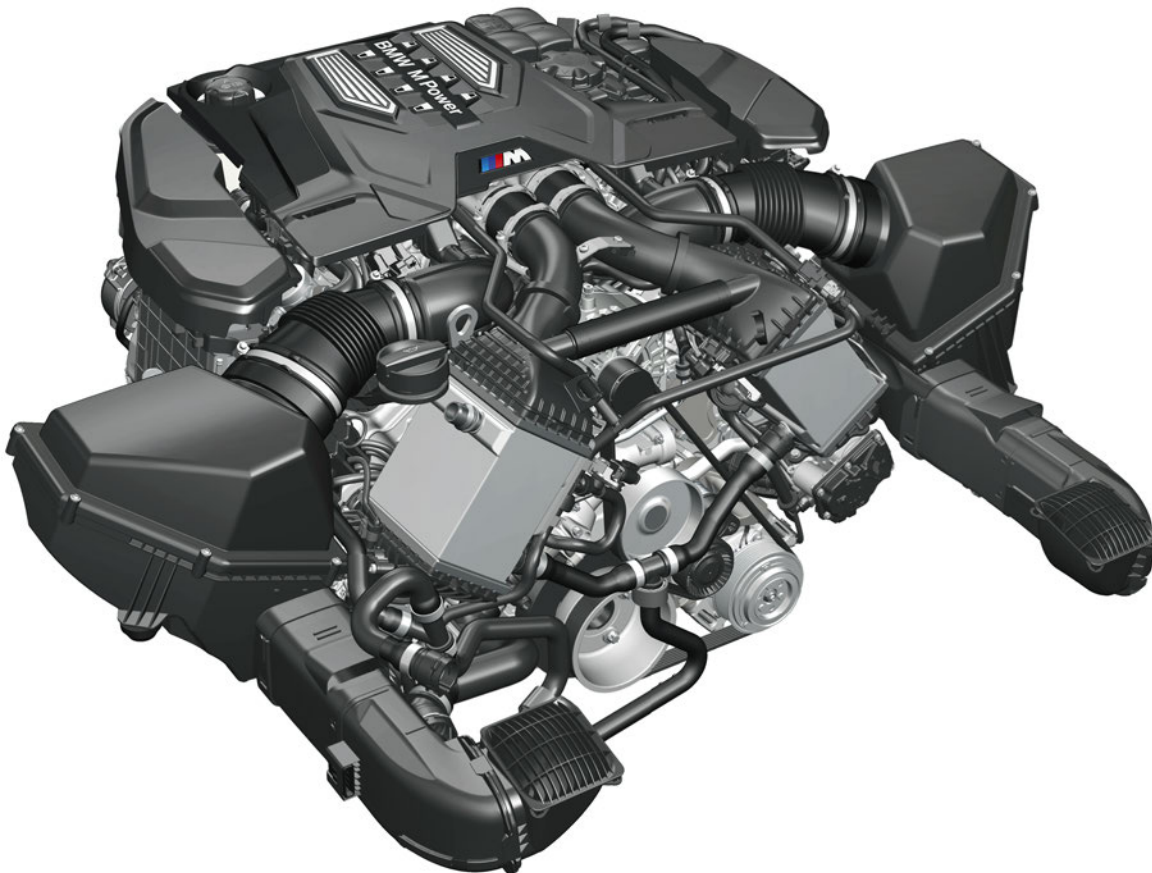
# F95/F96 Complete Vehicle

## 4. Engine.

### 4.1. M TwinPower turbo engine S63B44T4

In this reference manual only the changes to the S63B44T4 engine for the F95/F96 are described.

The S63B44T4 engine is described ST1916 S63TU4 Engine.



TA17-0125

S63B44T4 engine (example F90)

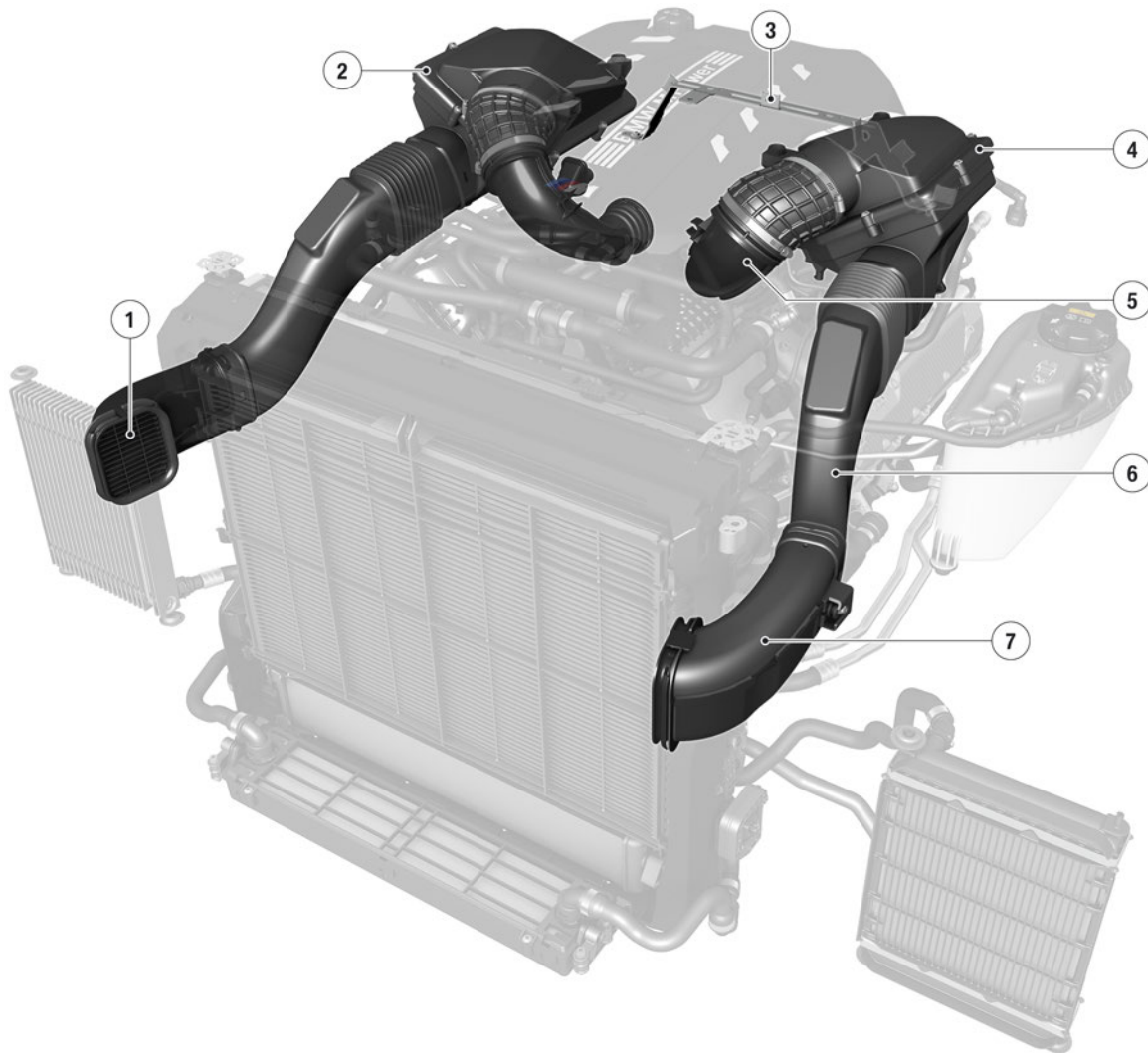
Further information on the S63TU4 engine can be found in the reference manual "ST1916 S63TU4 Engine".

### 4.2. Air duct

The air duct of the S63B44T4 engine was adapted to the installation position of the F95/F96. Here the concept of the air intake duct could almost be completely adopted from the G05/G06 basic vehicle. There are differences in the filtration and acoustics area, as well as for the clean air pipes. In the F95/F96 vehicles, a resonator was not necessary in the air intake duct and air filter inserts specific for the F95/F96 are used.

# F95/F96 Complete Vehicle

## 4. Engine.



TO19-1395

S63B44T4 engine, air duct F95/F96

Index	Explanation
1	Untreated air inlet (adopted from G05/G06)
2	Intake silencer, cylinder bank 1
3	V-area bridge
4	Intake silencer, cylinder bank 2
5	Clean air pipe
6	Untreated air line
7	Untreated air line, front (adoption from G05/G06)

The dimensions of the V-area bridge were reduced and it is used for mounting the holders for the differential pressure sensors of the gasoline particulate filter, as well as for the expansion tank coolant-low temperature circuit charge air.

# F95/F96 Complete Vehicle

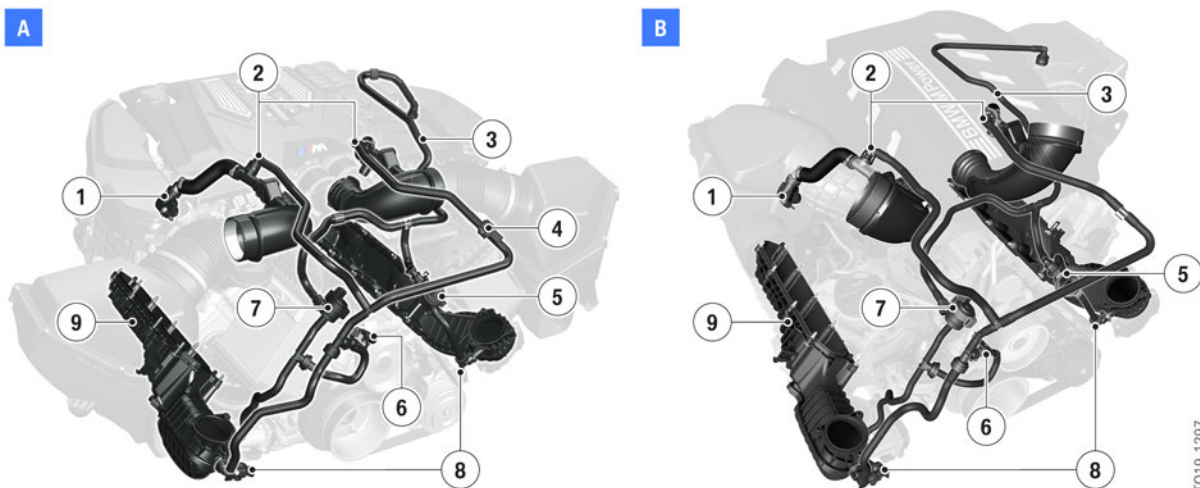
## 4. Engine.

### 4.3. Crankcase ventilation/tank ventilation

As part of the ULEV125 measures, further systems are monitored for compliance with the legally required emission limits. Systems that are included with the S63B44T4 engine are leak monitoring of the crankcase ventilation and tank ventilation.

To detect a leakage in the crankcase ventilation or tank ventilation, a crankcase pressure sensor and a tank ventilation differential pressure sensor are used in the S63B44T4 engine and are connected to the engine control units DME 1 and DME 2 up to July 2019.

For S63B44T4 engines built from July 2019, the crankcase pressure sensor is no longer used. The function of the crankcase pressure sensor can be assumed by the tank ventilation system differential pressure sensor using a calculation model.



S63B44T4 engine, pressure sensors

Index	Explanation
A	S63B44T4 engine up to 07/2019 (example F90)
B	S63B44T4 engine from 07/2019 (example F95/F96)
1	Crankcase ventilation connection, cylinder head cover
2	Tank ventilation system connection to crankcase ventilation (suction jet pump)
3	Tank ventilation line to carbon canister
4	Crankcase pressure sensor (deleted from 07/2019)
5	Tank vent valve, bank 2
6	Tank ventilation differential pressure sensor
7	Tank vent valve, bank 1
8	Tank ventilation system connection to intake system
9	Intake manifold

Blow-by gases and gases from the tank ventilation contain a large quantity of hydrocarbon concentrates. Existing control systems in the S63B44T4 engine, such as the crankcase ventilation and tank ventilation, return these gases to the combustion in a controlled manner via the intake system.

# F95/F96 Complete Vehicle

## 4. Engine.

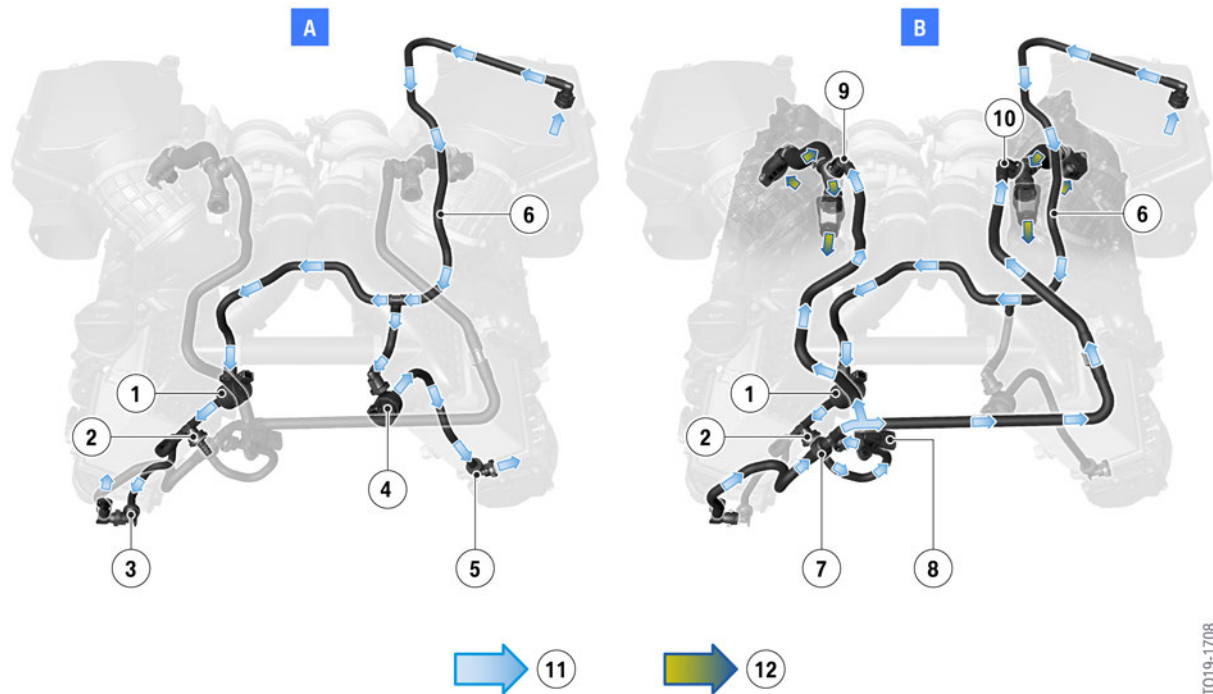
The tank ventilation is monitored with the tank ventilation system differential pressure sensor to ensure that if a malfunction occurs, e.g. a leakage, unburned hydrocarbons do not enter the ambient air.

The leakage is detected on the basis of defined setpoint values in the characteristic map of the DME engine control. For this purpose, the DME engine control performs the following steps:

- Measures the pressure in the tank ventilation system at a specific engine speed and load defined in the characteristic map.
- Comparison of the actual pressure reading with the setpoint pressure value stored in the characteristic map.
- If the setpoint pressure value is exceeded, a leakage is detected.
- Output of a CC message CCM as driver information.

Good leakage detection by the tank ventilation system differential pressure sensor is provided at a medium engine speed of between 500 rpm and 3000 rpm. The engine load for leakage detection is on average between 20% and 80% during crankcase pressure measurement.

The tank ventilation system differential pressure sensor is connected to the DME 1.



S63B44T4 engine, crankcase ventilation/tank ventilation

T019-1708

Index	Explanation
A	Tank ventilation in naturally aspirated operation
B	Tank ventilation in charged operation
1	Tank vent valve, bank 1
2	Non-return valve 2

# F95/F96 Complete Vehicle

## 4. Engine.

Index	Explanation
3	Non-return valve 3
4	Tank vent valve, bank 2
5	Non-return valve 4
6	Tank ventilation line to carbon canister
7	Non-return valve 1 with suction jet pump
8	Tank ventilation differential pressure sensor
9	Tank ventilation system connection to crankcase ventilation, cylinder bank 1
10	Tank ventilation system connection to crankcase ventilation, cylinder bank 2
11	Tank ventilation
12	Crankcase ventilation/tank ventilation

### 4.3.1. Tank ventilation in naturally aspirated operation

In naturally aspirated operation there is a vacuum in the intake system. As a result, the gases from the tank ventilation system are directed into the intake system through the open tank vent valves.

### 4.3.2. Crankcase ventilation/tank ventilation in charged operation

In charged operation the pressure in the intake system increases. As there is a vacuum in this operating condition in the clean air pipe, the non-return valve for the clean air pipe opens and the gases from the tank ventilation system are conveyed via the compressor of the exhaust turbocharger and the charge air cooler into the intake system when the tank vent valve is open.

## 4.4. Engine mount F95/F96

The engine mounts of the F95/F96 have an optimized characteristic curve with an increased spring rate of 900 N/mm. This facilitates 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 F95/F96.

Furthermore, the new engine mounts in the F95/F96 increase the drive experience in that the engine acoustics in the vehicle interior are perceived more directly and unfiltered.

# F95/F96 Complete Vehicle

## 4. Engine.

### 4.5. Exhaust system

#### 4.5.1. Overview of available exhaust systems

<b>Standard exhaust system</b>	<b>US version</b>
Upstream catalytic converter	●
Underfloor catalytic converter	●
Front oxygen sensor	●
Monitoring oxygen sensor	●
Crosstalk center silencer 75 mm	●
Exhaust flap	●
Chrome-plated tailpipe trims	●
<b>M Sport exhaust system</b>	
Exhaust flap	●
Crosstalk center silencer 55 mm	●
Black chrome-plated tailpipe trim	●

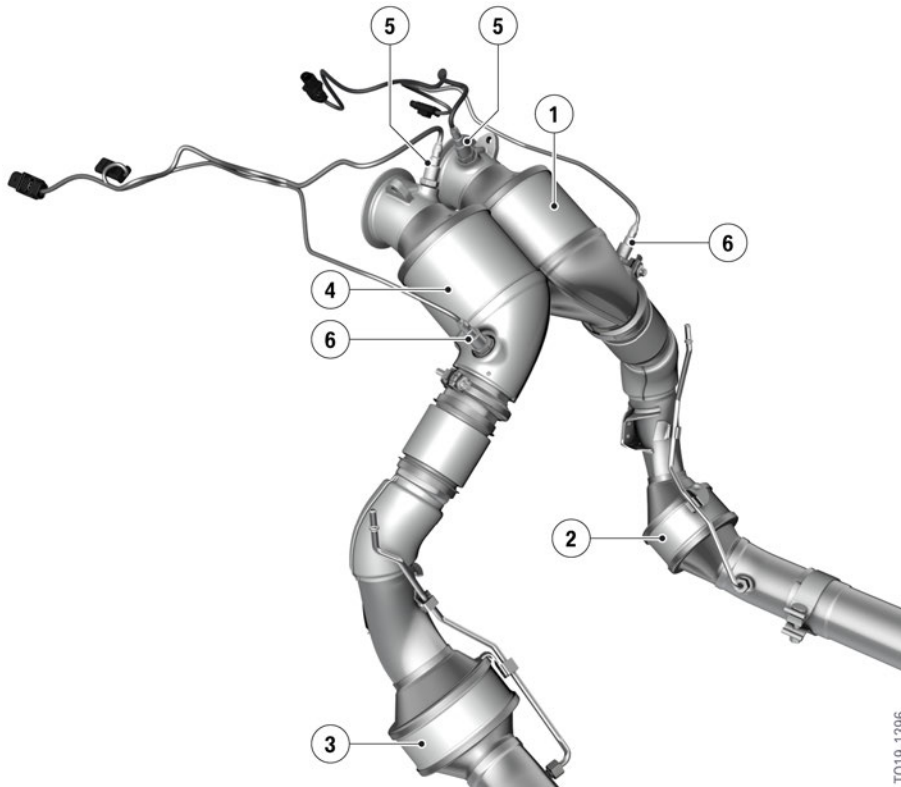


# F95/F96 Complete Vehicle

## 4. Engine.

### 4.5.2. Catalytic converter

The S63B44T4 engine has in the F95/F96 2 catalytic converters per cylinder bank, each with one ceramic monolith.



F95/F96, catalytic converters

Index	Explanation
1	Catalytic converter near engine, bank 1
2	Underfloor catalytic converter, bank 1
3	Underfloor catalytic converter, bank 2
4	Catalytic converter near engine, bank 2
5	Lambda oxygen sensor LSU 5.2
6	Monitoring oxygen sensor LSF Xfour

# F95/F96 Complete Vehicle

## 4. Engine.

### **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, whereby 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:

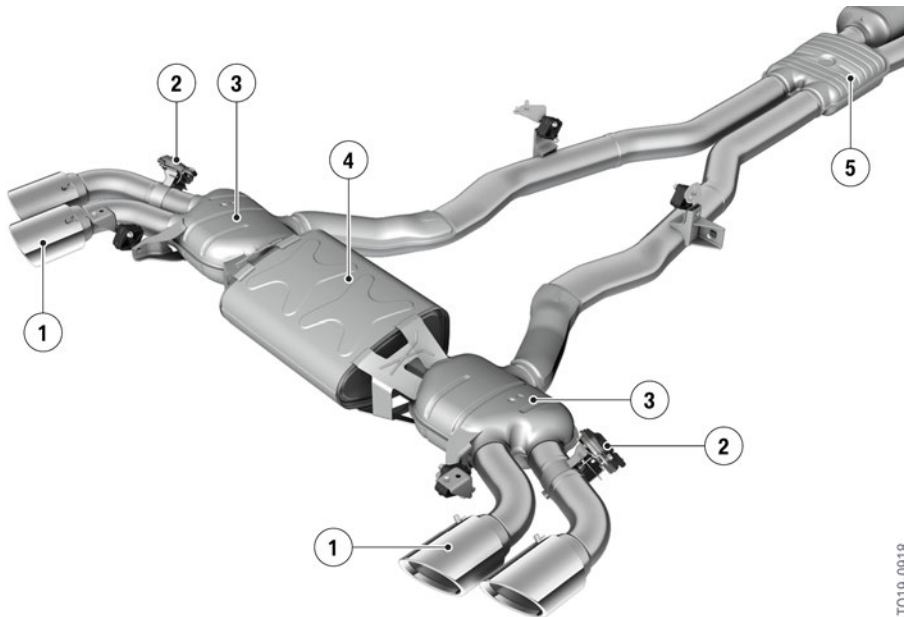
- To achieve quicker response characteristics after engine start (half of the LSF 4.2 value), a stronger controlled heater has been integrated in the LSF Xfour.
- This improves signal stability.
- Less space is required for installation.
- Thanks to the high temperature resistance and optimal thermoshock protection, the resistance to condensation in the exhaust tract following a cold start has been improved.

# F95/F96 Complete Vehicle

## 4. Engine.

### 4.5.3. Exhaust system

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



F95/F96, exhaust system

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

The production exhaust system of the F95/F96 features chrome-plated tailpipe trims as an optical identifying feature.

### 4.5.4. Sports exhaust system

The M Sport exhaust system is available as optional equipment SA 1MA on the F95/F96 and standard on the F95/F96 Competition model as of market launch.

The design of the 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 silencer and rear silencer there are additional perforations in the perforated transitions of the silencer chambers, which work according to the principle of the absorption silencer. This design measure in the area of the center silencer and rear silencer has made it possible to give the F95/F96 with sport exhaust

# F95/F96 Complete Vehicle

## 4. Engine.

system above all at high loads and rotational speeds an even more distinctly powerful, richer and more emotive sound that is more akin to motorsport applications. This again enhances the emotive driving experience of the F95/F96.

A further, more emotive adaptation of the interior sound in the F95/F96 with sport exhaust system is made possible by a different Active Sound Design (ASD) tuning.

The sports exhaust system of the F95/F96 features black chrome-plated tailpipe trims as a visual identification feature.

### 4.5.5. 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 axially arranged electric motor with integrated gears and electronics. The electrical controller for the exhaust flap has the following connections:

- Voltage supply (+)
- Ground (-)
- Actuating 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 cannot adopt 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 stopped, the preferred position is the closed position.

<b>Electrical exhaust flap</b>	<b>S63B44T4 engine</b>
Installation location	Right and left
PWM signal open	10% duty cycle
PWM signal closed	90% duty cycle

Like the exhaust flaps on the standard exhaust system, the exhaust flaps of the M Sport exhaust system cannot adopt intermediate positions.

A further, more emotive adaptation of the interior sound in the F95/F96 with M Sport exhaust system is made possible by a different Active Sound Design (ASD) tuning.

# F95/F96 Complete Vehicle

## 4. Engine.



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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.

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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.



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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.

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### 4.6. Cooling

The cooling system is similar to that in the F85/F86 engine. The engine and charge air cooling both have separate cooling circuits.

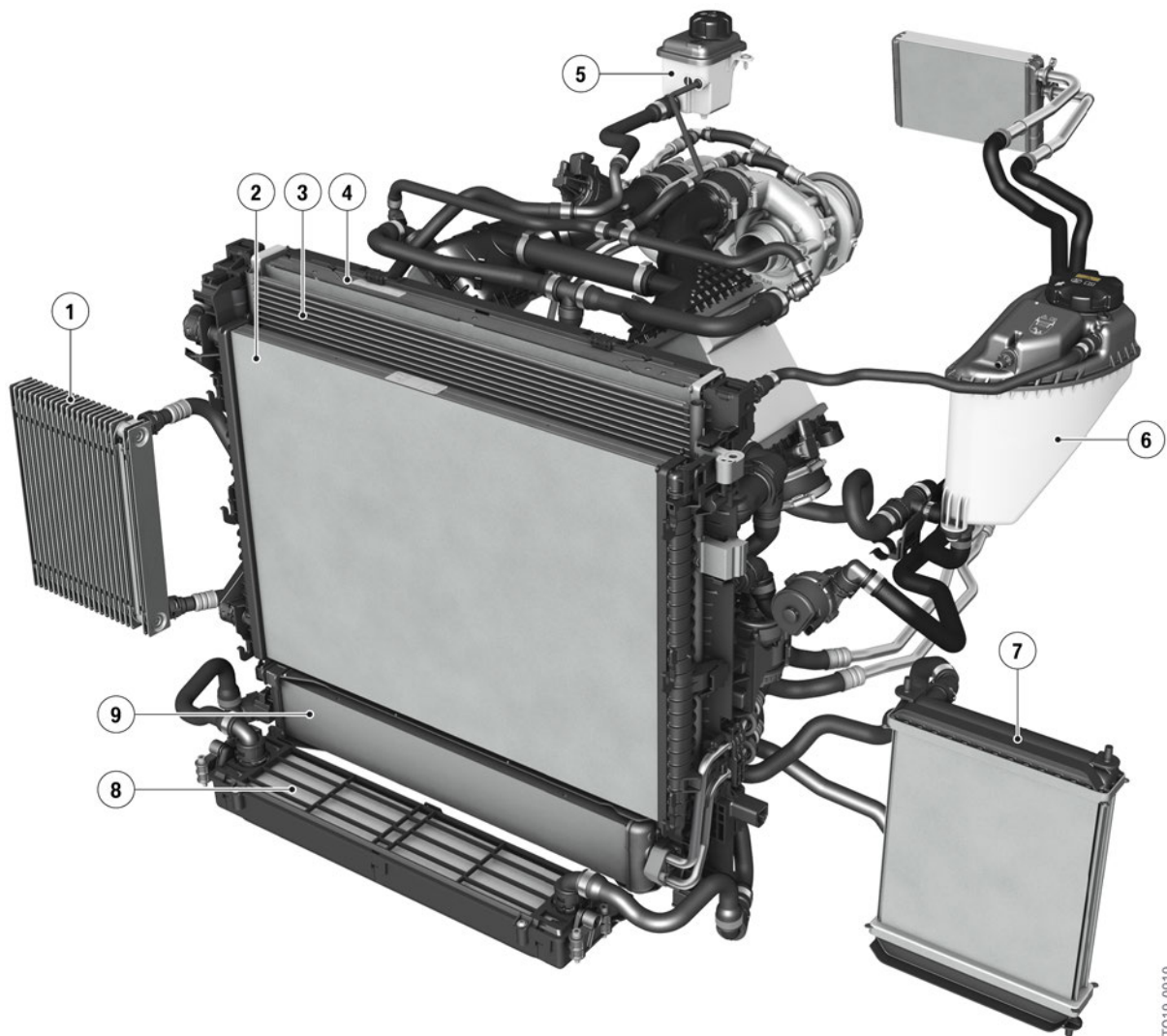
#### 4.6.1. Cooling system

##### Differences in the cooling between F85/F86 and F95/F96

- Deletion of the ARS hydraulic fluid cooler
- Adaptation of the installation position of the transmission oil cooler
- Adaptation of the installation position of the thermostat for the transmission oil cooler
- Deletion of the transmission oil-coolant heat exchanger.

# F95/F96 Complete Vehicle

## 4. Engine.



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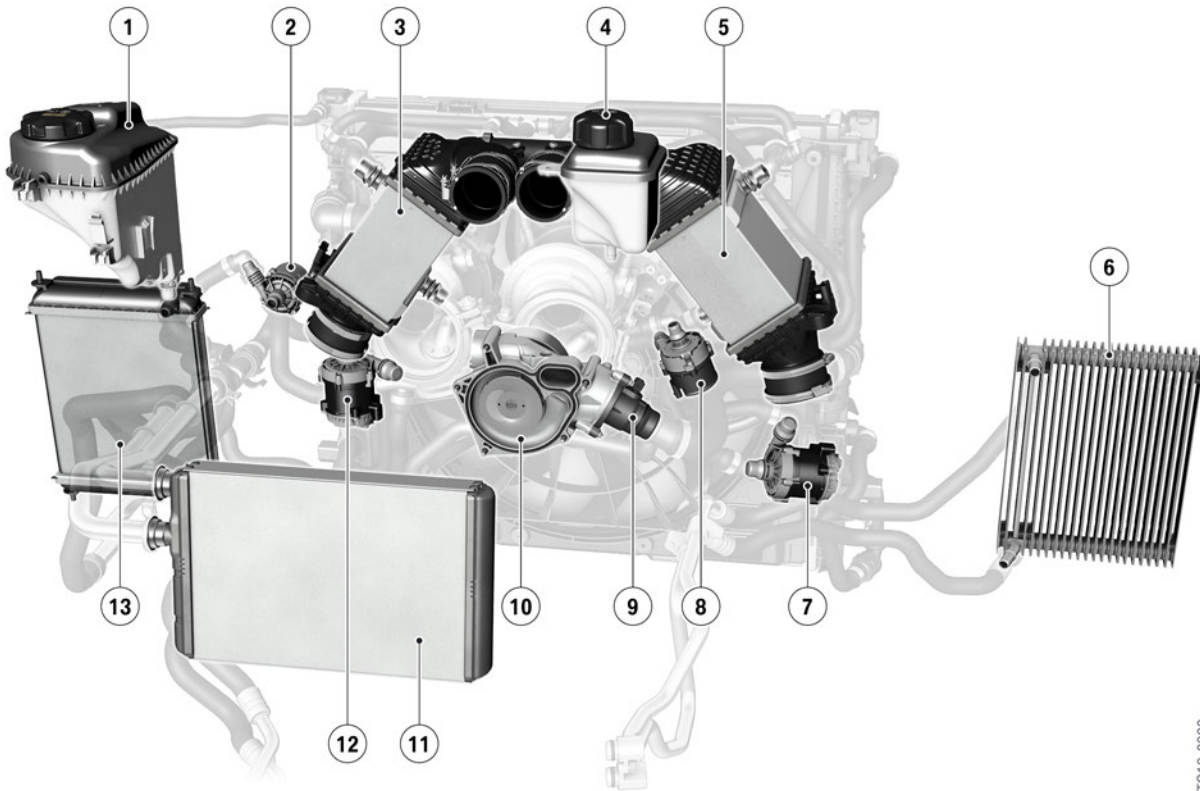
F95/F96, radiator/cooler assembly from front

Index	Explanation
1	Engine oil cooler
2	Low-temperature cooler, charge air
3	Condenser, air conditioning
4	Radiator, engine
5	Coolant expansion tank, low-temperature circuit, charge air
6	Coolant expansion tank, engine
7	Auxiliary radiator, engine
8	Upstream low-temperature cooler, charge air
9	Transmission oil cooler



# F95/F96 Complete Vehicle

## 4. Engine.



T019-0920

F95/F96, coolant package from rear

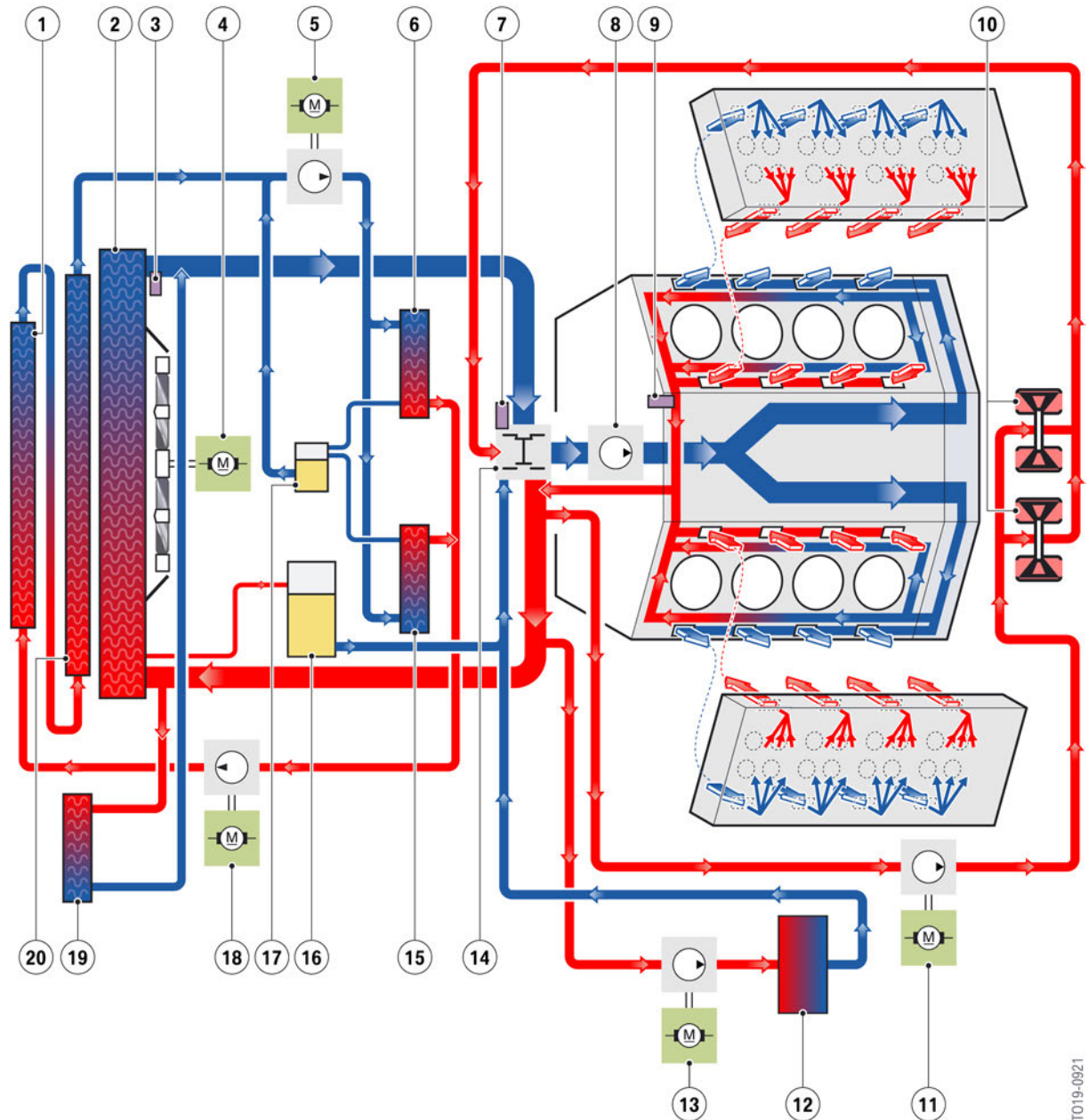
Index	Explanation
1	Coolant expansion tank, engine
2	Electric coolant pump, heating, vehicle interior
3	Indirect charge air cooler, bank 2
4	Coolant expansion tank, low-temperature circuit, charge air
5	Indirect charge air cooler, bank 1
6	Engine oil cooler
7	Electric coolant pump, low-temperature circuit, charge air
8	Electric coolant pump, exhaust turbocharger
9	Thermostat
10	Mechanical coolant pump
11	Heat exchanger for heating system
12	Electric coolant pump, low-temperature circuit, charge air
13	Auxiliary radiator, engine

# F95/F96 Complete Vehicle

## 4. Engine.

### 4.6.2. System overview

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



F95/F96, complete cooling system without oil cooling, schematic

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# F95/F96 Complete Vehicle

## 4. Engine.

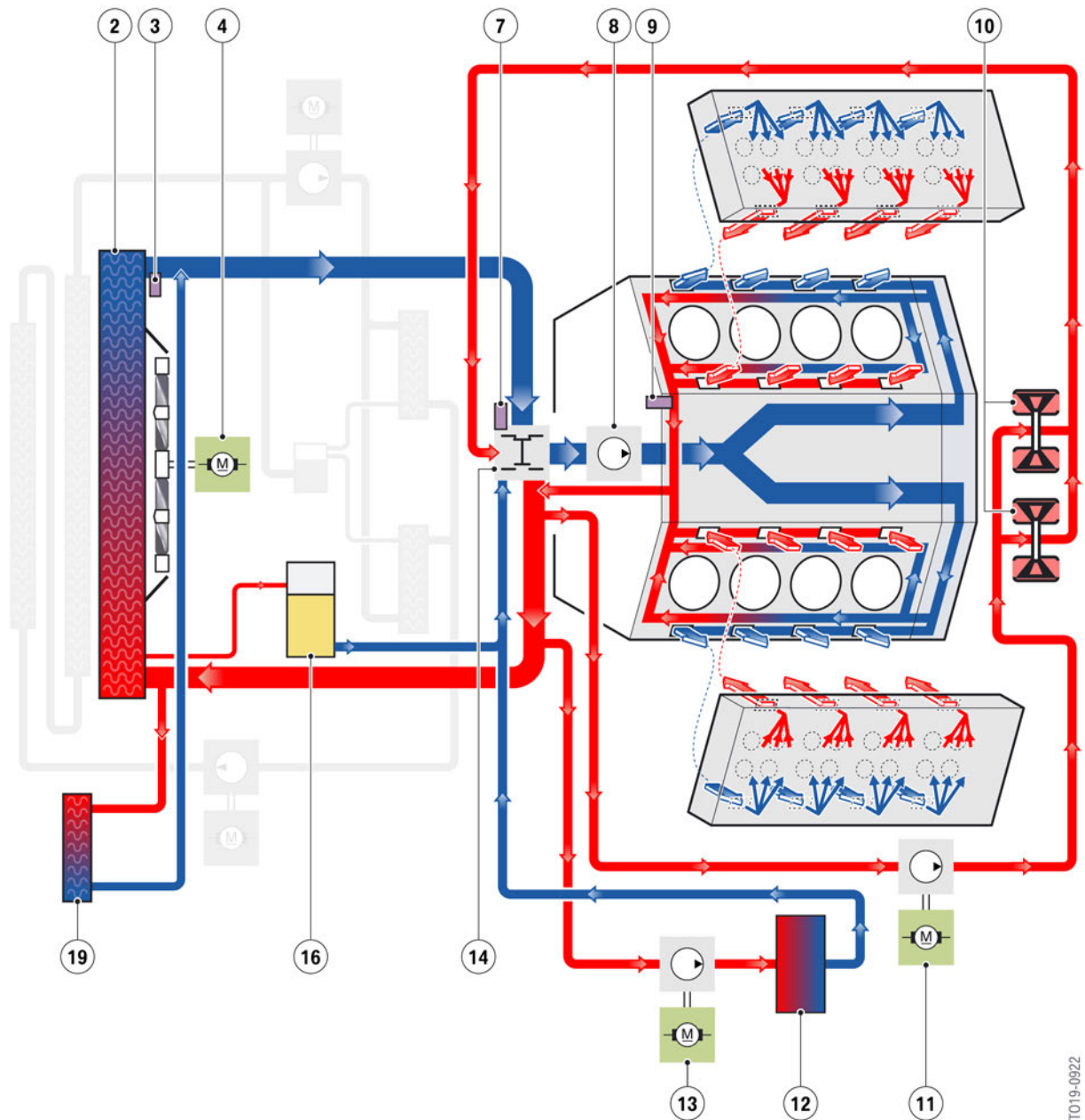
Index	Explanation
1	Upstream low-temperature radiator, charge air
2	Radiator, engine
3	Coolant temperature sensor at radiator outlet
4	Electric fan 1 kW
5	Electric coolant pump, low-temperature circuit, charge air
6	Indirect charge air cooler, bank 1
7	Heater, map thermostat
8	Mechanical coolant pump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

### 4.6.3. Engine cooling with exhaust turbocharger

The engine cooling system is an independent coolant circuit, the “**high-temperature circuit**”. It comprises the conventional engine cooling and cooling of the turbochargers. Even the vehicle interior heating is supplied by the coolant circuit of the engine cooling system.

# F95/F96 Complete Vehicle

## 4. Engine.



F95/F96, engine cooling with exhaust turbocharger, schematic

Index	Explanation
2	Radiator, engine
3	Coolant temperature sensor at radiator outlet
4	Electric fan
7	Heater, map thermostat
8	Mechanical coolant pump
9	Coolant temperature sensor

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# F95/F96 Complete Vehicle

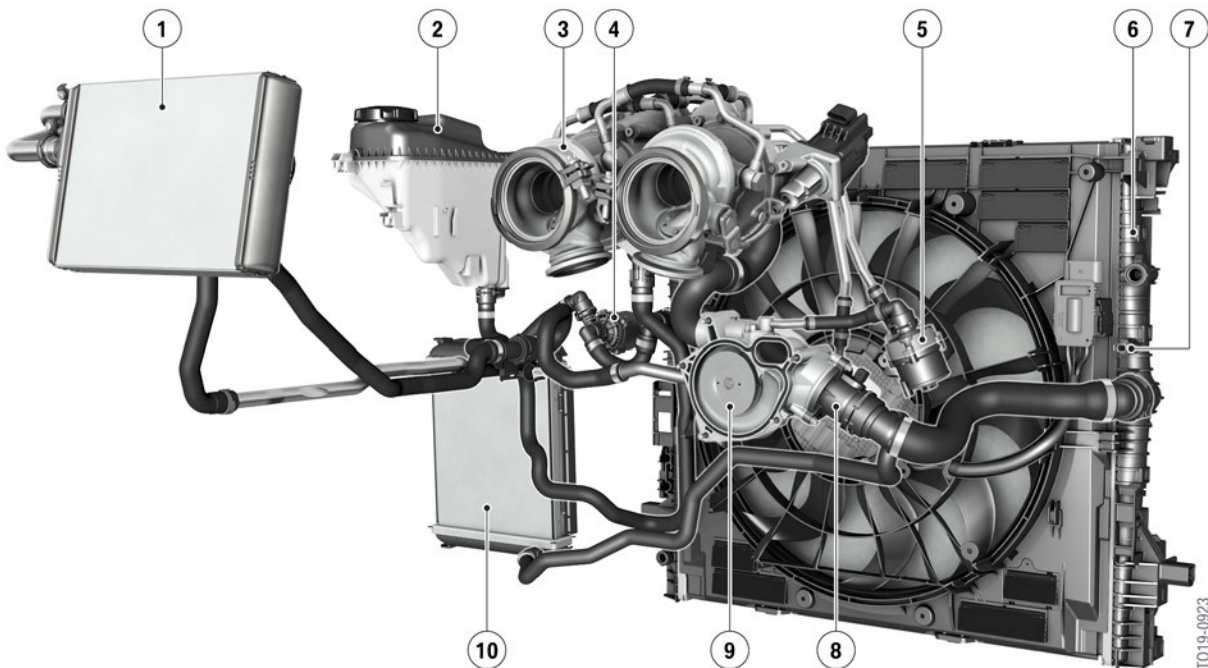
## 4. Engine.

Index	Explanation
10	Exhaust turbocharger
11	Electric coolant pump, exhaust turbocharger
12	Heat exchanger for heating system
13	Electric coolant pump, heating, vehicle interior
14	Data-map thermostat
16	Coolant expansion tank, engine
19	Auxiliary radiator, engine

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 cooling 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 down for up to a max. of 11 minutes. For further information, please also refer to the chapter "BMW Remote Software Upgrade".



T019-0923

F95/F96, engine cooling with exhaust turbocharger, components

# F95/F96 Complete Vehicle

## 4. Engine.

Index	Explanation
1	Heat exchanger for heating system
2	Coolant expansion tank, engine
3	Exhaust turbocharger
4	Electric coolant pump, heating, vehicle interior
5	Electric coolant pump, exhaust turbocharger
6	Radiator, engine
7	Coolant temperature sensor at radiator outlet
8	Thermostat
9	Mechanical coolant pump
10	Auxiliary radiator, engine

### 4.6.4. Charge air cooling

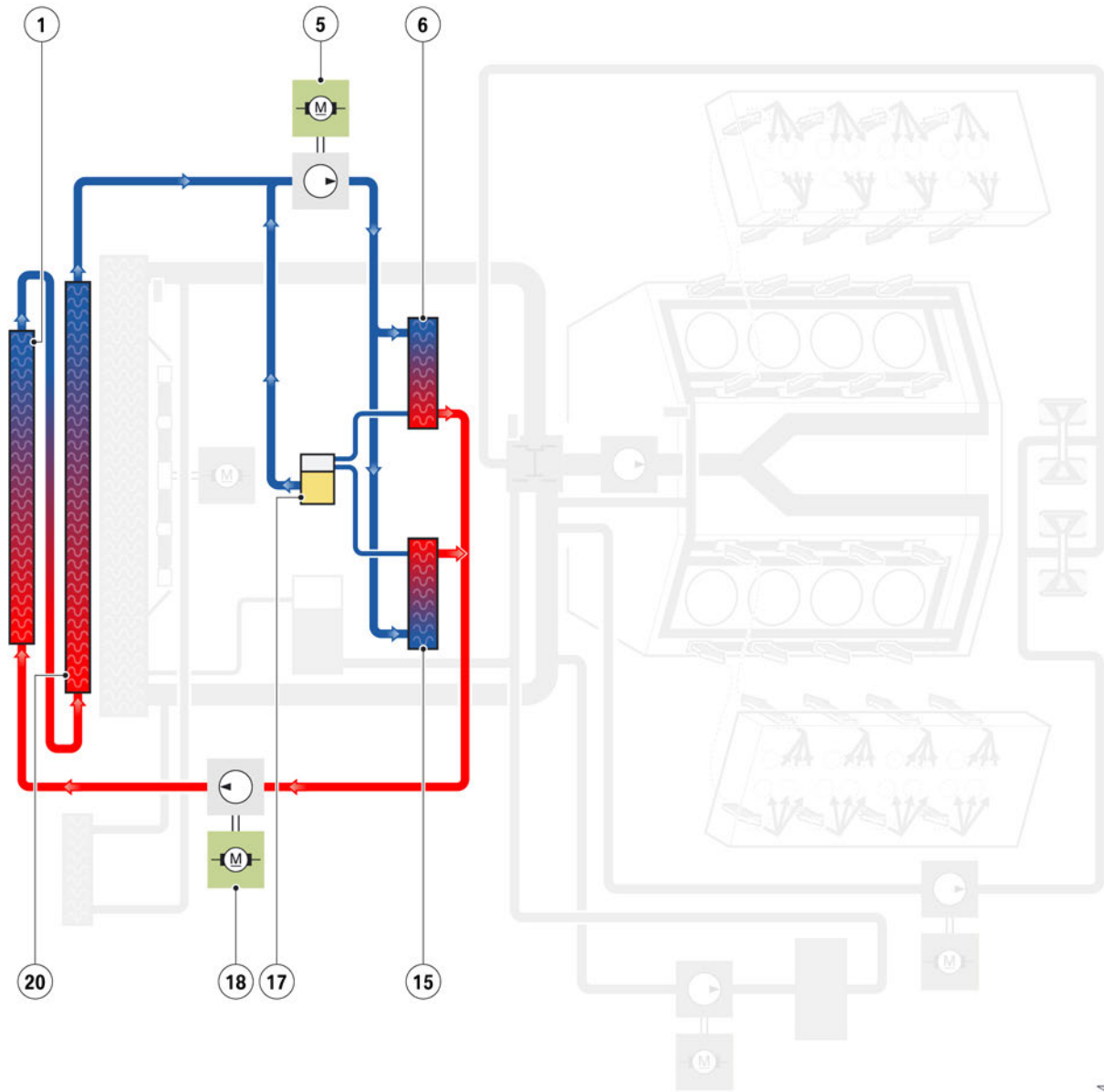
The system again makes use of "**indirect**" charge air cooling, which is cooled by a separate coolant circuit, the "**low-temperature circuit**".

Because a larger surface area is available to the F95/F96 for the coolant radiators at the front of the vehicle, two low-temperature radiators are used. One low-temperature charge air cooler is located directly after the front of the vehicle as the first component of the radiator assembly. A second low-temperature charge air cooler is located upstream of the radiator assembly. These are supplied with coolant via an independent cooling system with two electric coolant pumps.



# F95/F96 Complete Vehicle

## 4. Engine.



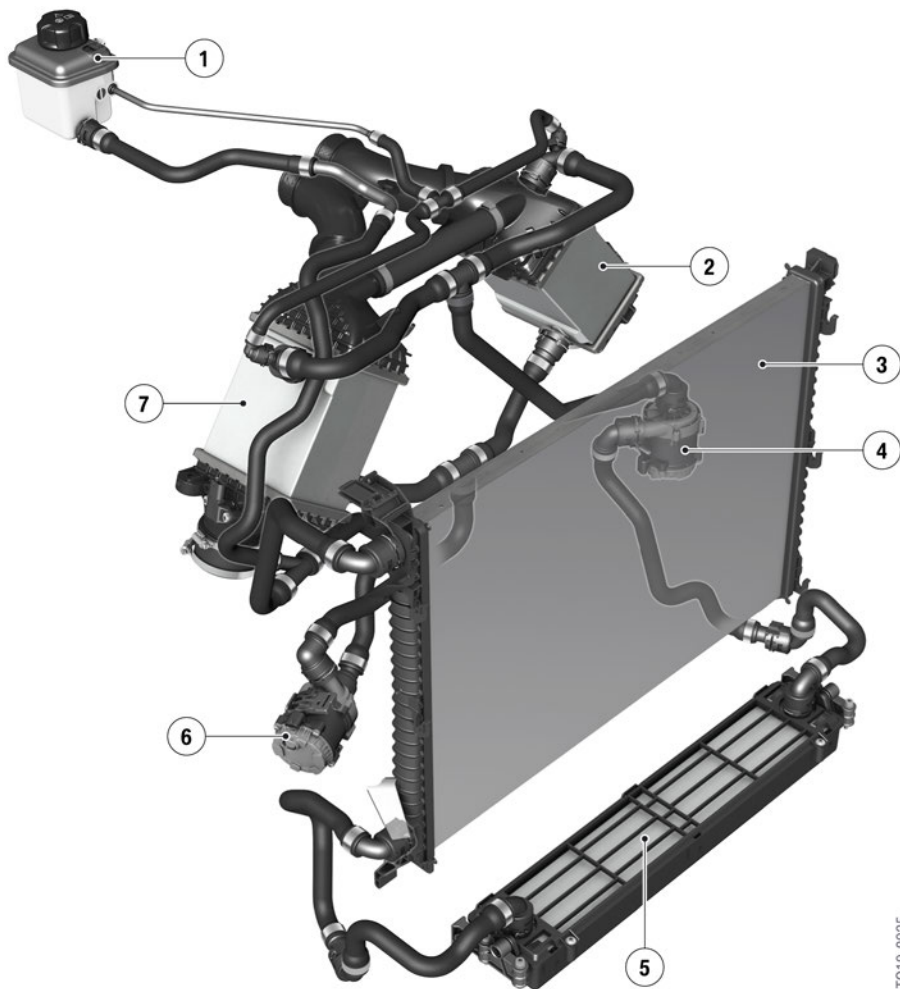
T019-0924

F95/F96, charge air cooling, schematic

# F95/F96 Complete Vehicle

## 4. Engine.

Index	Explanation
1	Upstream low-temperature cooler, charge air
5	Electric coolant pump, low-temperature circuit, charge air
6	Indirect charge air cooler, bank 1
15	Indirect charge air cooler, bank 2
17	Coolant expansion tank, low-temperature circuit, charge air
18	Electric coolant pump, low-temperature circuit, charge air
20	Low-temperature cooler, charge air



F95/F95, charge air cooling, components

T019-0925

# F95/F96 Complete Vehicle

## 4. Engine.

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Index	Explanation
1	Coolant expansion tank, charge air
2	Indirect charge air cooler, bank 2
3	Low-temperature coolant radiator, charge air
4	Electric coolant pump, low-temperature circuit, charge air
5	Upstream low-temperature coolant radiator, charge air
6	Electric coolant pump, low-temperature circuit, charge air
7	Indirect charge air cooler, bank 1

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The S63B44T4 engine again uses 2 electric auxiliary coolant pumps, as on the S63B44T2 engine, for the charge air cooling low-temperature circuit.

Both 50 W pumps have self-diagnosis and dry-running protection, which can lead to fault memory entries in the DME. If the engine speed is increased by 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.



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If the electric coolant pump is removed and then to be 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 upshot 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.

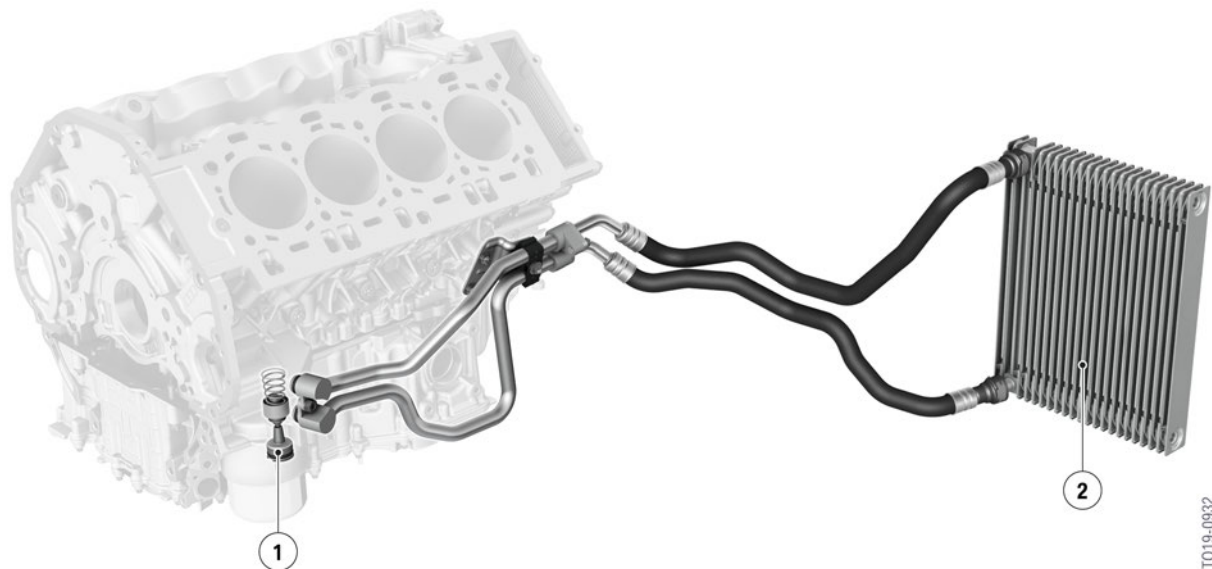
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### 4.6.5. Engine oil cooling

The S63B44T4 engine has an air-engine oil heat exchanger for cooling the engine oil which is installed on the right beside 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).

# F95/F96 Complete Vehicle

## 4. Engine.



S63B44T4, engine, engine oil cooling

Index	Explanation
1	Thermostat
2	Engine oil cooler

### 4.6.6. Cooling power limits

If under extreme conditions such as for example in countries with high outside temperatures and the cooling power reaches its limits on the racetrack under race conditions, the cooling power of the vehicle air conditioning is initially 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 cooling and charge air cooling. The driver is alerted by a Check Control message if the cooling power of the engine cooling 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 essential first to take these boundary conditions into consideration before starting troubleshooting on the cooling system and on the air conditioning.

# F95/F96 Complete Vehicle

## 4. Engine.

### 4.7. Fuel preparation

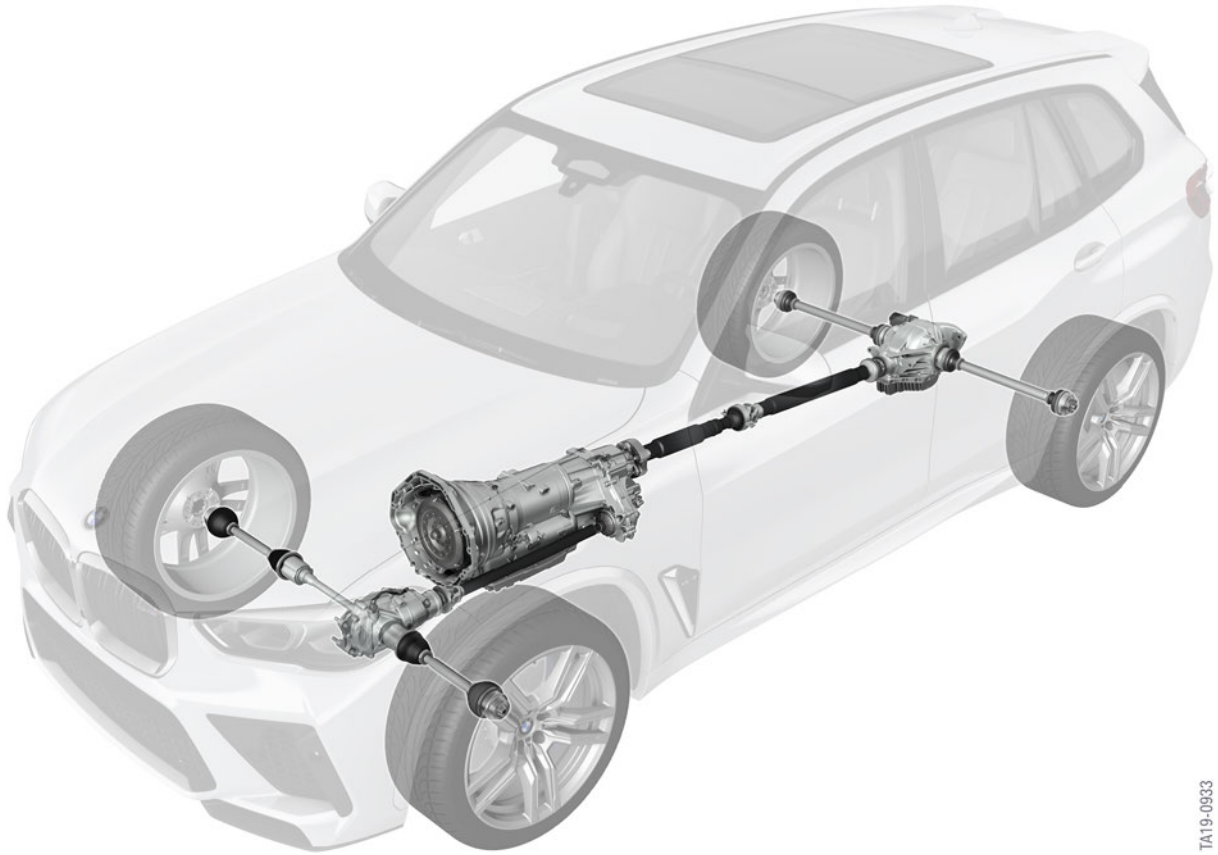
Regarding the fuel treatment the following changes have been made compared to the G05/G06 basic vehicle.

#### 4.7.1. Low-pressure fuel system

- For the surge tank with the electric fuel pump in the tank, in the F95/F96 a different delivery unit is used than in the production vehicle G05/G06. The reason for this is that the necessary delivery volume of the electric fuel pump of the G05/G06 for safely filling the surge tank during acceleration of the F95/F96 with S63B44T4 engine could not be guaranteed. Therefore, in the F95/F96 a delivery unit from TI Automotive is used, which provides the required delivery volume (G05/G06 with N63TU3 engine, delivery unit from Continental).
- The suction jet pump in the fuel tank in the F95/F96 is located on the pressure side in the surge tank. As a result, there are greater pump flow rates from the left tank half to the right tank half.
- The fuel low-pressure sensor is located at the front right in the area of the high pressure pump for cylinder bank 2.

# F95/F96 Complete Vehicle

## 5. Powertrain.



F95, power transmission

TA19-0933

### 5.1. M automatic transmission/M GWS

#### 5.1.1. M automatic transmission

In the F95/F96 the M automatic transmission with Drivelogic is used with the designation GM8HP76Z, hereinafter called 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 damp 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.

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



# F95/F96 Complete Vehicle

## 5. Powertrain.

In the F95/F96, as in the F90, the **"Idle coasting"** function known from the BMW AG vehicles is not implemented. However, the M8HP76 supports, as known from the BMW AG vehicles, the **"ConnectedShift"** function.

### Transmission ratios, comparison of F85/F86 - F95/F96

	F85/F86	F95/F96
Transmission designation	M8HP75 (ZF)	M8HP76 (ZF)
Steering axis inclination	7.8	7.8
Maximum engine speed [rpm]	7.200	7.200
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

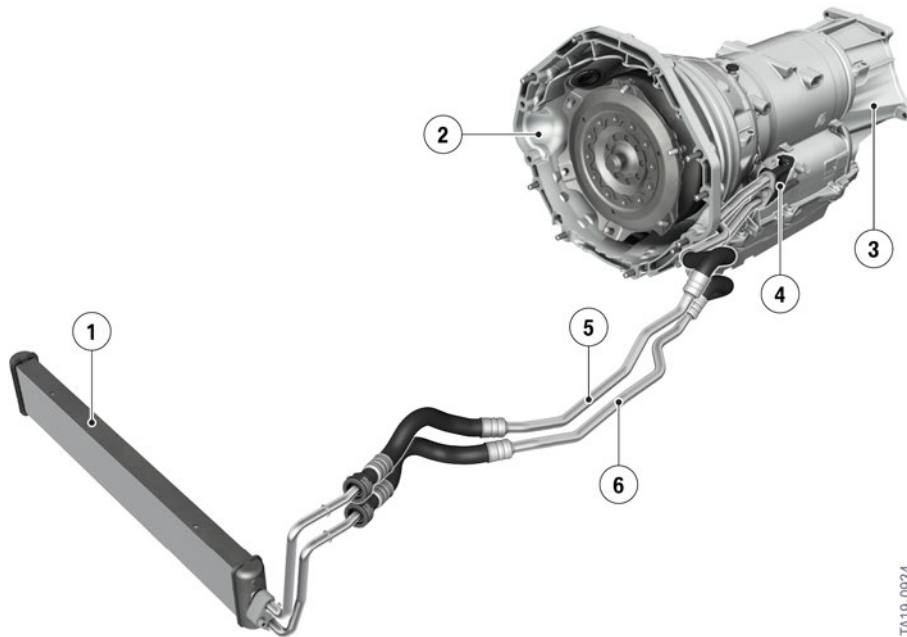
### Transmission oil cooling

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 F95/F96. This additional transmission oil cooler, which is designed as a plate heat exchanger, operates according to the oil-to-air heat exchanger principle and is installed vertically in front of the radiator assembly.

# F95/F96 Complete Vehicle

## 5. Powertrain.



F95/F96, transmission oil cooling

Index	Explanation
1	Transmission oil cooler (oil-to-air heat exchanger principle)
2	M automatic transmission
3	Mounting for transfer box
4	Thermostat
5	Transmission oil return
6	Transmission oil feed

Some of the external pipes and hoses carrying transmission oil to the supplementary transmission oil cooler have had their cross-sectional area 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 F95/F96 from the lines carrying transmission oil to the transmission housing. The thermostat of the transmission oil cooler opens at 76 °C (169 °F) and is fully open at 96 °C (205 °F) .

### 5.1.2. 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.

# F95/F96 Complete Vehicle

## 5. Powertrain.



F95/F96, 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 using the **“Drivelogic switch”**.

### Drivelogic

A rocker switch is used on the F95/F96 for changing the transmission mode up or down.

After each change between 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

Automated mode, all the forward gears are automatically shifted. 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 times

3: Sporty driving shifting time.

# F95/F96 Complete Vehicle

## 5. Powertrain.

### 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 are the requirement for the activation of Launch Control.

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

### 5.1.3. Launch Control



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During the first 5000 km (3100 miles) run-in distance, the Launch Control must not be used.

The Launch Control is released at the factory. Release of the Launch Control is no longer restricted to the 2000 km (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.

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Sequence	Precondition/Action
1.	The vehicle must be stationary, the engine running and at operating temperature (approximately 10 km warm-up journey).
2.	M Dynamic Stability Control integrated (M DSCi) 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.
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.

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# F95/F96 Complete Vehicle

## 5. Powertrain.

### 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.

A renewed Launch Control start is possible as long as the transmission oil temperature satisfies the prerequisites for this.

### Automatic deactivation

- The customer leaves (even if only briefly) the accelerator pedal full-load range during acceleration.



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

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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.



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

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### 5.1.4. Emergency gearbox release



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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 Handbook of the vehicle.

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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.

# F95/F96 Complete Vehicle

## 5. Powertrain.

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 KOMBI 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 Handbook for the vehicle.

### 5.1.5. 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 owing to a repair, there must be maximum cleanliness. They include:

- Optimal 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 workbay in which an automatic transmission is opened must be extremely clean and secured against dirt contamination, also during work interruptions. For example by sufficiently clean and lint-free cover.

#### Lifetime oil filling

Currently, as with the F90 BMW M5 with M automatic transmission, for the F95/F96 with M automatic transmission a transmission oil change is **not** scheduled at 2000 km (1200 mile) (running-in check) or with every third engine oil change.



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

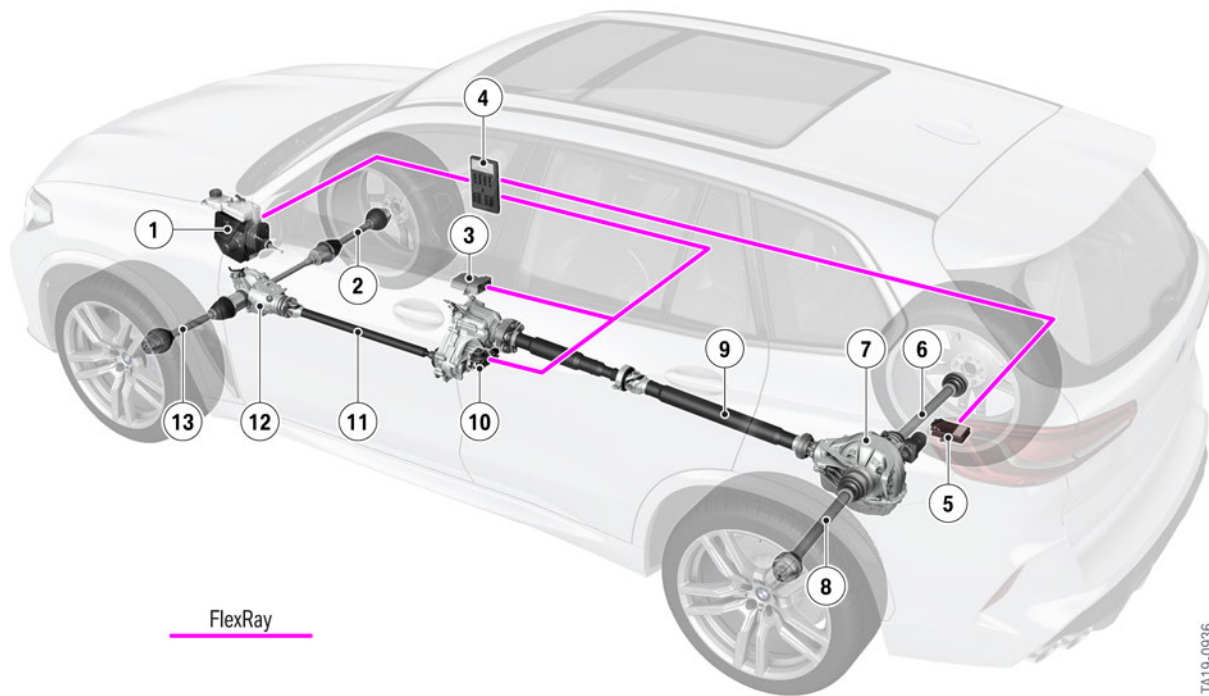


# F95/F96 Complete Vehicle

## 5. Powertrain.

### 5.2. M xDrive

"High-performance dynamic handling on the one hand and the everyday usability of an SUV/SAC on the other" is how we could summarize the typical M concept approach in which the individual drivetrain components are perfectly matched with the M xDrive system. That enables the new BMW X5 M and BMW X6 M to have the same familiar precise sports handling whether being driven on the race track or the public road. In addition, they are also a delight to drive even in unpleasant weather conditions such as rain and snow or off road thanks to noticeable extra traction and controllability right up to the limits of handling stability. The agile rear-oriented design is achieved by allowing the M xDrive to bring the front axle to bear only when the rear wheels have reached their limits and additional traction force is required. Even when adopting a very vigorous driving style using a lot of power, the new BMW X5 M and BMW X6 M with M xDrive show themselves to be predictable and effortless to control for the driver, so that the outstanding performance of the vehicles can be experienced even more intensely.



F95, system overview, M xDrive

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	Front output shafts, right
3	Advanced Crash Safety Module (ACSM)
4	Body Domain Controller (BDC)
5	Control unit, regulated M rear axle differential lock (M GHAS)
6	Rear output shafts, right
7	M rear axle differential lock
8	Rear output shafts, left

# F95/F96 Complete Vehicle

## 5. Powertrain.

Index	Explanation
9	Prop shaft
10	M transfer box (M VTG)
11	Front drive shaft
12	Front axle differential
13	Front output shafts, left
FlexRay	FlexRay bus

### 5.2.1. Four-wheel drive

The M xDrive system used on the F95/F96 is based on the all-wheel drive system of the G12 with the ATC13 transfer box and has been carried over from the F90.

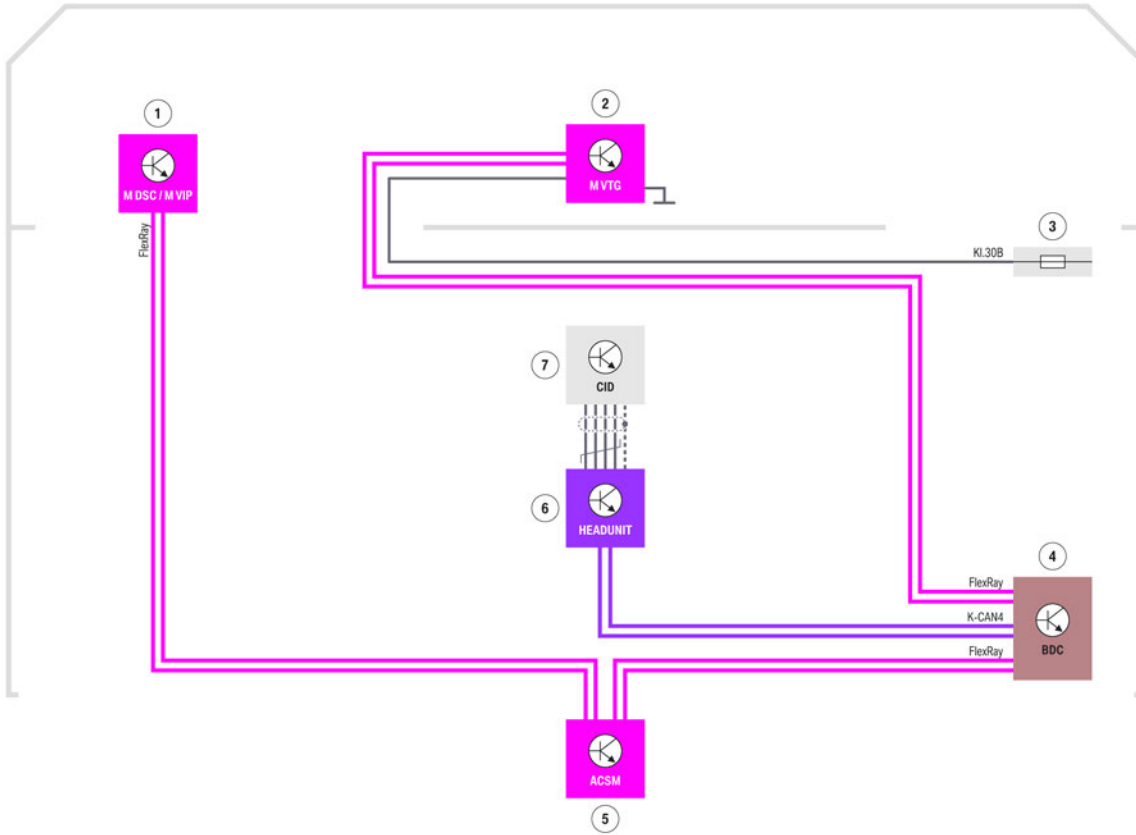
The torque generated by the engine is stepped up in the automatic transmission and is supplied via the transmission output shaft to the transfer box. The transfer box forming the next stage in the drivetrain has the task of varying the torque distribution between the front and rear wheels across the full range from 0:100 % to 100:0 % as demanded by the driving situation. Since a rigid connection of the rear axle with the front axle is not possible due to possible differences in the wheel speeds, there is a multidisc clutch inside the transfer box. The multidisc clutch performs the task of variable torque distribution between the two drive axles.

General information on BMW xDrive can be found in the reference manual "ST1501 G12 Powertrain".

# F95/F96 Complete Vehicle

## 5. Powertrain.

### 5.2.2. M VTG system wiring diagram



TA19-0704

F95/F96, M transfer box system wiring diagram

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	M transfer box (M VTG)
3	Power distribution box, front right
4	Body Domain Controller (BDC)
5	Advanced Crash Safety Module (ACSM)
6	Head Unit High 3 (HU-H 3) (M-specific)
7	Central Information Display (CID)

# F95/F96 Complete Vehicle

## 5. Powertrain.

### 5.2.3. Service information

- The vehicle must **not** be driven when the front drive shaft has been removed.
- When carrying out work on a brake test stand, it is not necessary to take into account any all-wheel drive-specific points. (roller mode for testing the brake system is detected automatically.)
- The vehicle must **not** be towed if only one axle is raised.
- The oil filling of the transfer box is designed for the entire unit service life. However, a fault code entry with an oil change recommendation for the transfer box oil is stored when a mileage of 150,000 km (9300 miles) is exceeded. When refilling the transfer box oil, it is necessary to move the oil partition to the open position using the BMW ISTA diagnosis system.
- Various test plans are available in the BMW diagnosis system ISTA for Service.



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The tire tread depth as well as the tire manufacturer should be the same on the front and rear axles if possible in order to ensure proper functioning of the xDrive. It is also advisable to only use tires that have been approved or recommended by BMW M.

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### 5.2.4. Lifetime oil filling

The oil filling of the transfer box is designed for the entire unit service life. This corresponds to a mileage of approximately 150,000 km (9300 miles). A fault code entry with an oil change recommendation for the transfer box is stored when this mileage is exceeded.

The transfer box does not have an oil drain plug. The oil filling to be renewed must be removed using an extractor unit.

The new transfer box oil can be filled using an oil filler plug.

In order to ensure that the entire oil filling has been exchanged, the oil firewall must remain open for the duration of extraction and filling.



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The Service employee can move the oil storage chamber to the open position by means of the "Service function > Transfer box VTG > Oil change" in the BMW ISTA diagnosis system.

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Current transfer box oil recommendations and capacities can be found in the current documentation of the BMW workshop information systems.

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# F95/F96 Complete Vehicle

## 5. Powertrain.

### 5.2.5. 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 F95/F96 is a carry-over from the F90.

For the F95/F96 the following changes were made to the active M Differential:

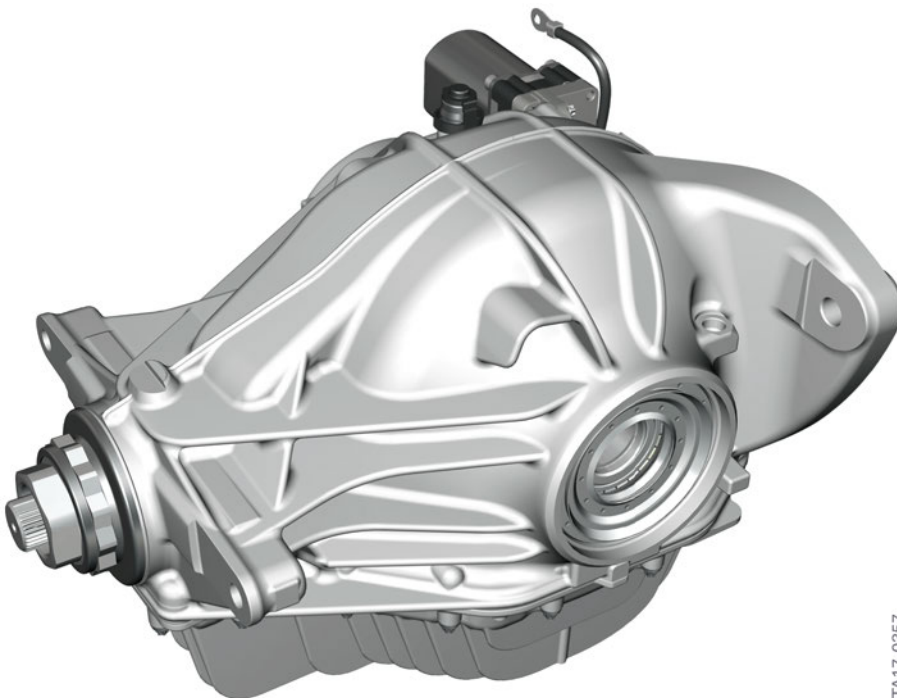
- Geometric adaptation of the rear axle differential housing
- Adaptation of the cooling fins at the aluminum oil pan. The cooling fins at the aluminum oil pan have been shortened in order to guarantee a higher ground clearance. This was necessary in order to meet the requirements for a light duty truck road license in the USA.

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 for this is "regulated M rear axle differential lock", the control unit designation is M GHAS (**G**eregelte **H**inter **A**chsgetriebe **S**perre (regulated rear axle differential lock)).

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 43 kg (95 lbs).



F95/F96, M GHAS external view

TA17-0357

# F95/F96 Complete Vehicle

## 5. Powertrain.

### Demand-controlled lock

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

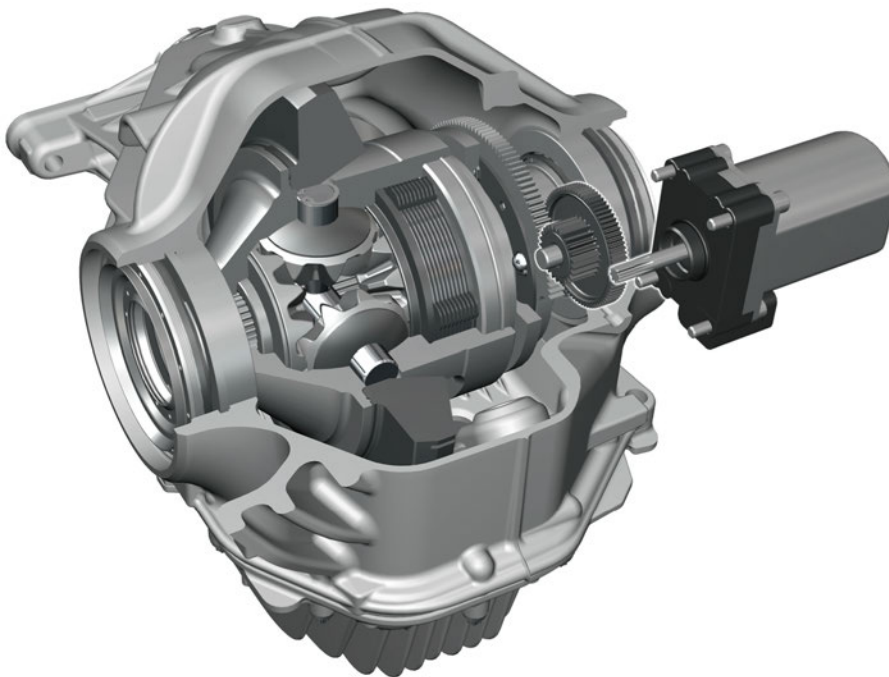
- Pullaway
- Differential speed at the rear axle for straight-ahead driving under tension due to various coefficients of friction, left/right
- M dynamic cornering tensioned
- Power oversteer (drifting)
- Stabilization in coasting/overrun mode.

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.

### 5.2.6. Structure/Function

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



F95/F96, sectional view of rear differential

TA17-0358

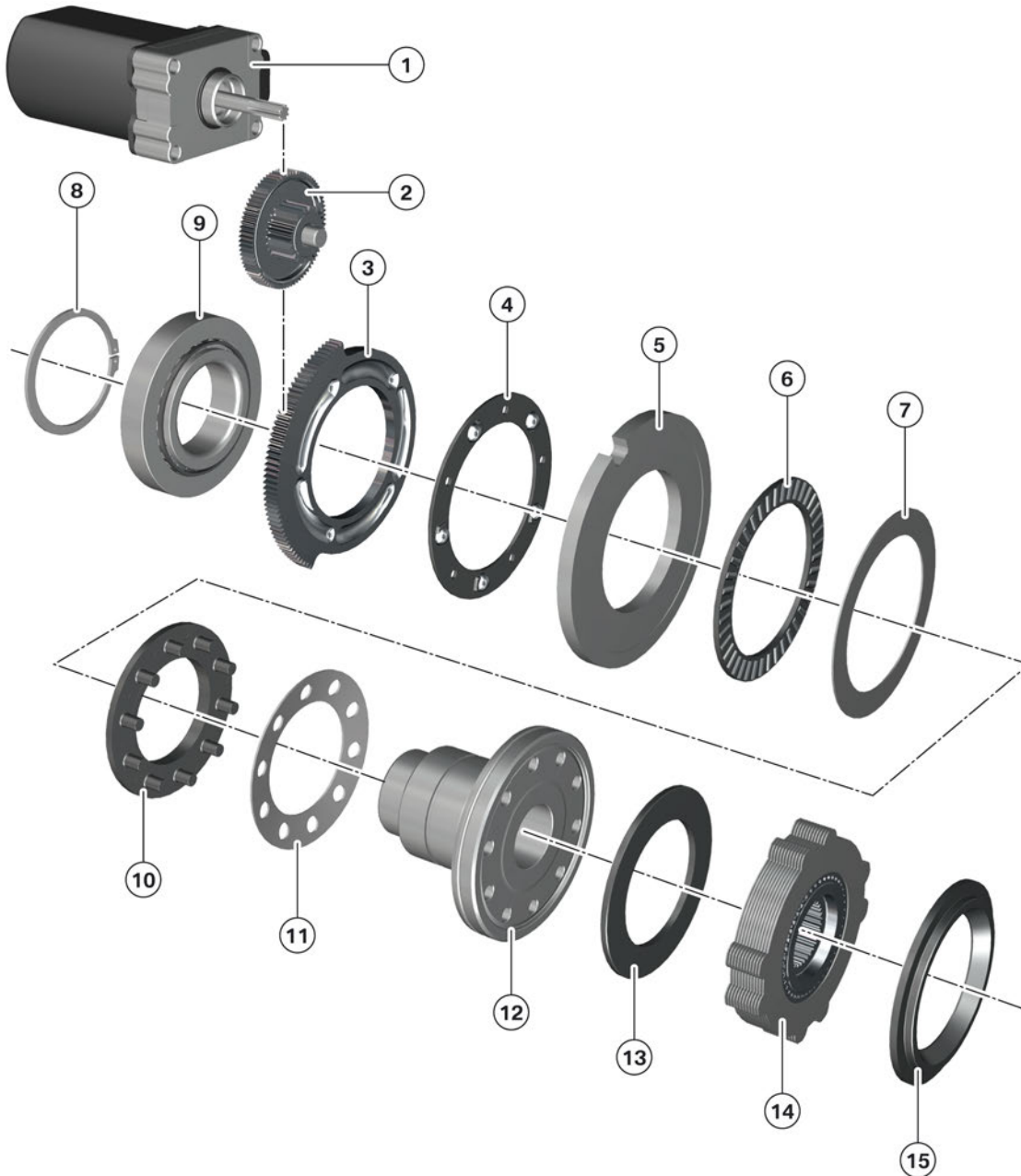


# F95/F96 Complete Vehicle

## 5. Powertrain.

System components:

- Wiring harness
- Regulated rear axle differential lock, control unit
- Electric motor and transmission gearing
- Lock



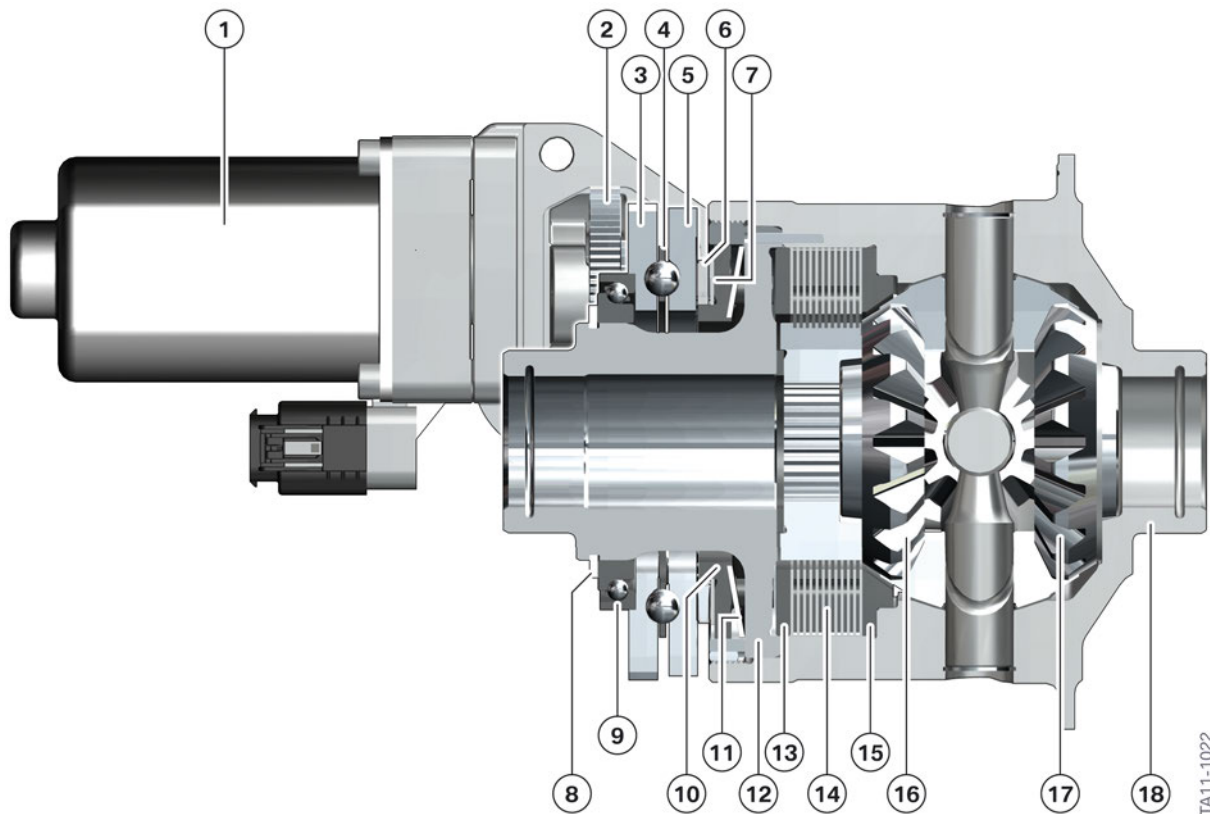
F95/F96, components of internal differential lock: Exploded diagram

TA17-0454

# F95/F96 Complete Vehicle

## 5. Powertrain.

Index	Explanation
1	Electric motor
2	Transfer box
3	Ball ramp consisting of geared mobile adjusting disc and first half of ball ramp
4	Balls/Spherical washer
5	Fixed pressure disc with second half of ball ramp
6	Axial needle bearing
7	Axial bearing thrust washer
8	Circlip (ball bearing fixing)
9	Ball bearing between inner output hub and differential housing
10	Disc spring pressure ring
11	Disc spring
12	Differential lid (connected to differential housing, cannot rotate)
13	Pressure plate
14	Disc set
15	Counter pressure plate



F95/F96, sectional view of parking lock differential

TA11-1022

# F95/F96 Complete Vehicle

## 5. Powertrain.

Index	Explanation
1	Electric motor
2	Transfer box
3	Ball ramp consisting of geared mobile adjusting disc and first half of ball ramp
4	Balls/Spherical washer
5	Fixed pressure disc with second half of ball ramp
6	Axial needle bearing
7	Axial bearing thrust washer
8	Circlip (ball bearing fixing)
9	Ball bearing between inner output hub and differential housing
10	Disc spring pressure ring
11	Disc spring
12	Differential lid (connected to differential housing, cannot rotate)
13	Pressure plate
14	Disc set
15	Counter pressure plate
16	First output bevel gear
17	Second output bevel gear
18	Differential housing (connected to 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 mobile 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 transmission rotation and are disconnected from the rotating components by an axial needle bearing (6).

The components with the index 6 to 18 belong to the differential and rotate proportional to the rear axle gear speeds.

The lock is effected between the right output (16) 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 engine is not supplied with current.

# F95/F96 Complete Vehicle

## 5. Powertrain.

### 5.2.7. System information

The M DSCi control unit evaluates the dynamic handling characteristics parameters made available by other control units via the FlexRay data bus and determines the lock-up 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.

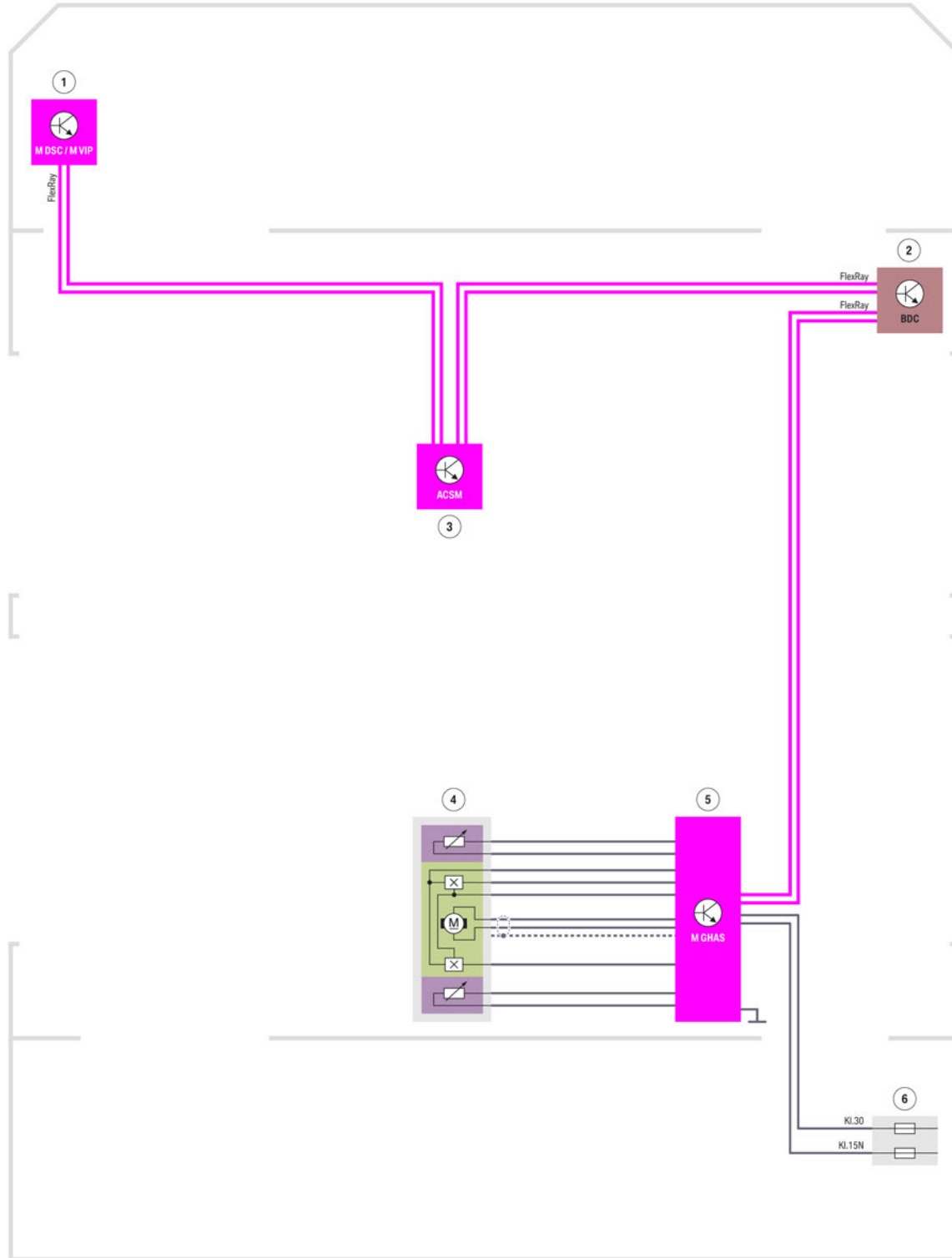
The position-controlled direct current motor is activated directly by the power electronics of the M GHAS control unit with vehicle voltage via a pulse-width-modulated signal. The frequency is approximately 4 kHz and the maximum current level is 30 A.

To determine the position and the direction of rotation of the electric motor it is equipped with 2 hall effect sensors.

# F95/F96 Complete Vehicle

## 5. Powertrain.

### System wiring diagram



F95/F96, M GHAS system wiring diagram

TA19-0703

# F95/F96 Complete Vehicle

## 5. Powertrain.

Index	Explanation
1	M Dynamic Stability Control integrated (M DSCi)
2	Body Domain Controller (BDC)
3	Advanced 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	<ul style="list-style-type: none"><li>- Terminal status</li><li>- Vehicle identification number (for encoding)</li><li>- Vehicle condition (power management and fault memory block, e.g. in the event of voltage drop by engine start)</li></ul>
DME	FlexRay	<ul style="list-style-type: none"><li>- "Engine running" signal</li></ul>
M DSCi	FlexRay	<ul style="list-style-type: none"><li>- Wheel speed</li><li>- Setpoint axial torque distribution</li><li>- Stabilization status</li><li>- Brake value</li><li>- Tolerance adjustment of wheel (adjustment of different wheel circumferences)</li><li>- Driving speed</li></ul>
ACSM	FlexRay	<ul style="list-style-type: none"><li>- Lateral acceleration</li><li>- Yaw rate</li><li>- Road longitudinal tilt</li><li>- Steering angle</li></ul>

### Electric motor location determination

To determine the position of the electric motor, two hall effect sensors in the engine are evaluated.

To determine the characteristic curve of the lock-up torque via the engine position a recalibration is regularly performed to compensate the wear in the clutch.

To be able to assign a certain position of the servomotor a certain coupling lock-up torque and to take the wear influences into account while doing so, a reference run is performed after the vehicle engine is switched off. During this reference run the engine is subjected to a defined current level. The lock-up 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.

# F95/F96 Complete Vehicle

## 5. Powertrain.

The temperature thresholds are:

- Control unit 85 °C (185 °F)
- Electric motor 160 °C (320 °F)
- Oil temperature 190 °C (374 °F)

### 5.2.8. Service information

- For a replacement of the M GHAS control unit, an encoding (activation of vehicle-related characteristic curve) and then an initial 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.
- For a replacement of the electric motor, electric motor plus intermediate gear or oil temperature sensor, only the fault memory must be deleted.

The final drive oil is currently replaced every 2000 km (1200) (pre-delivery check) and at every third engine oil change.



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

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

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

1. Deterioration of traction with dynamic driving style and low coefficients of friction, particularly with different coefficients of friction, left/right.
  2. Possible deterioration of stability in dynamic driving situations.
- 

## 5.3. Differential



# F95/F96 Complete Vehicle

## 5. Powertrain.

### 5.3.1. Front axle differential

The front axle differential VAG175AL already deployed in the G11/G12 is also used here.

#### Technical data

Technical data	Front axle differential 175AL
Oil volume	0.6 l
Oil grade in BMW Service	Fuchs Titan EG3846
Maximum input torque	1300 Nm
Possible ratios	3.15
Weight without oil filling	13.7 kg (30 lbs)



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

## 5.4. Drive shafts and output shafts

### 5.4.1. Front drive shaft

The front drive shaft was taken over from the G12 for the F95/F96.

### 5.4.2. Rear drive shaft

The drive shaft of the F95/F96 is a steel drive shaft. The dimensioning and strength of the prop shaft, the center bearing, the flange connecting to the flexible disc on the transfer box and the flange connecting to the rear differential have been adapted to the higher torque of the F95/F96.



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.

### 5.4.3. Front output shafts

The front output shafts have been adopted from the G05/G06.

# **F95/F96 Complete Vehicle**

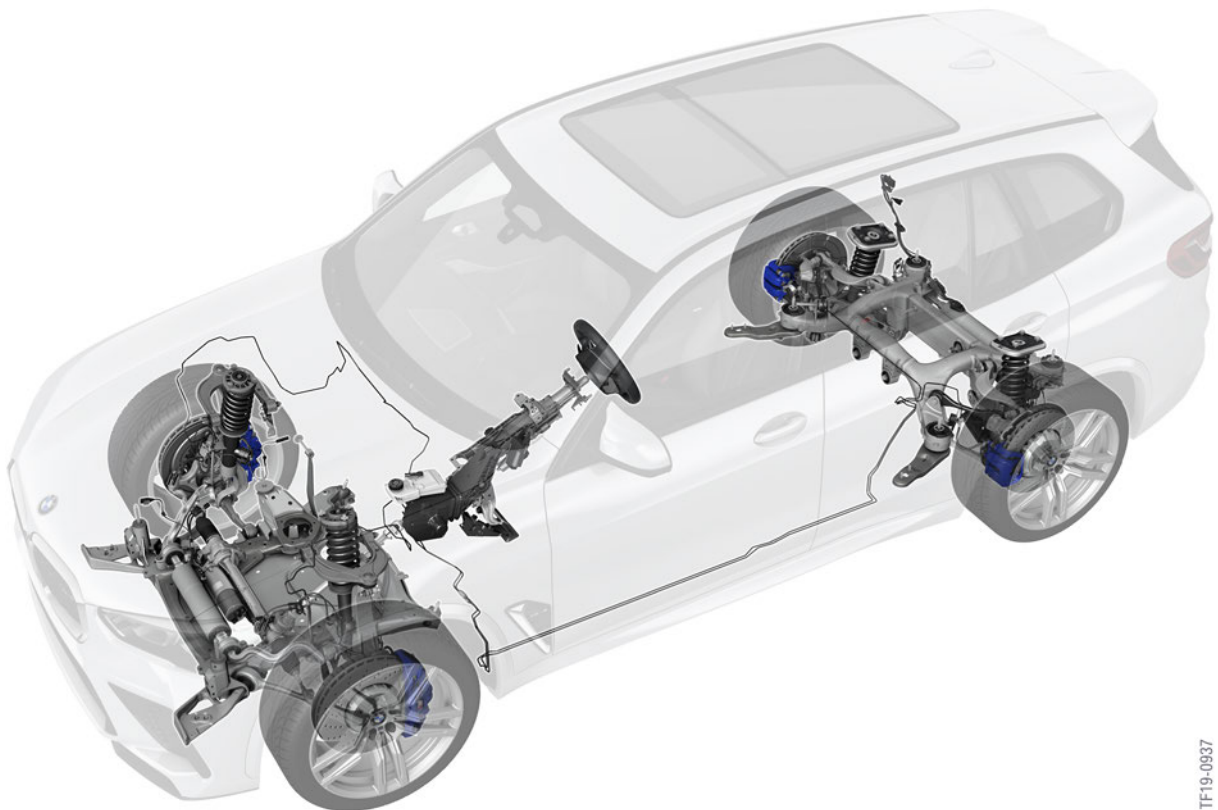
## **5. Powertrain.**

### **5.4.4. Rear output shafts**

The rear output shafts have been adapted in terms of their length, design and strength to the increased torque of the F95/F96.

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



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F95, chassis and suspension

The chassis and suspension is based on the technology of the G05/G06, though once again with almost all new M-specific or adapted components.

Designation	Unit	F85/F86	F95/F96
Wheelbase/Turning circle	[mm/m]	2933/12.8	2972/12.8
Front track width	[mm]	1666	1699
Rear track width	[mm]	1667	1688
Front axle		Double-wishbone axle	Double-wishbone axle
Steering		Electronic Power Steering (EPS)	M Electronic Power Steering (M EPS)
Average overall ratio		17.9	13
Rear axle		Integral IV rear axle	HA5 Rear axle
Final drive ratio		3.154	3.154

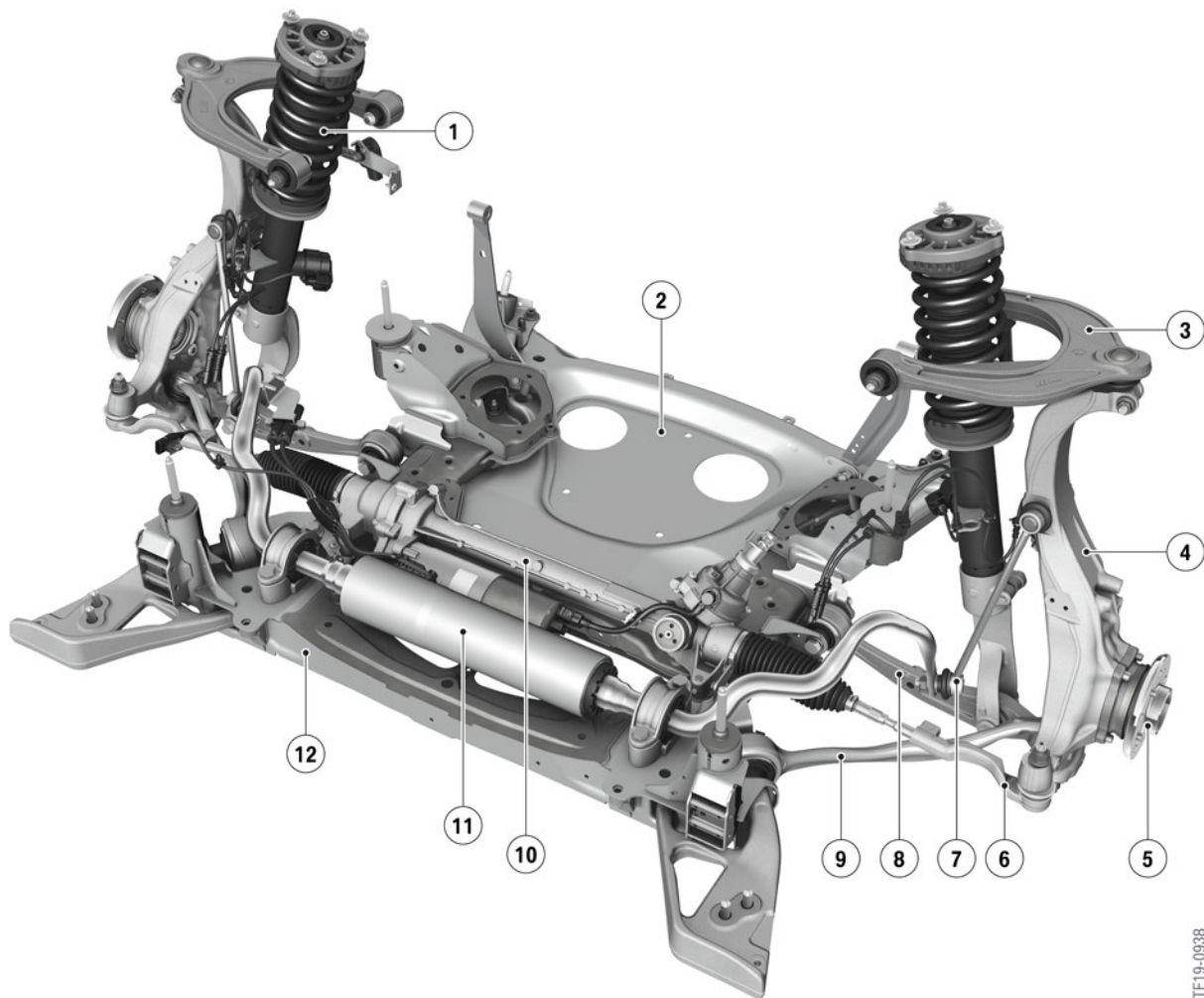
# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### 6.1. Suspension systems

#### 6.1.1. Front axle

The double-wishbone front axle known from the G05/G06 is used as the front axle. Compared to the standard suspension, the front axle was not lowered. This was necessary in order to meet the requirements for a light duty truck road license in the USA. The upper triangular wishbone was adapted in order to achieve the M-specific higher camber values for sportier suspension settings. The rubber mounts of the lower wishbone and the tension strut have been adapted for the F95/F96. The spring strut has been adapted by a separate damper variant together with the coil spring to the F95/F96 and bolted at the top by a newly dimensioned support bearing in the spring strut dome; in addition, the auxiliary damper, installed between the shock absorber and the support bearing on the piston rod, has been adapted. For further information on the double-wishbone front axle, please refer to the reference manual "ST1831 G05 Powertrain & Chassis".



F95/F96, double-wishbone front axle

TF19-0938

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

Index	Explanation
1	M spring strut with support bearing
2	M stiffening plate
3	M wishbone, top
4	Swivel bearing
5	M wheel hub
6	M track rod
7	M anti-roll bar link
8	M wishbone, bottom
9	M trailing link with hydro mount
10	M Servotronic (M EPS)
11	Electrical roll stabilization
12	Front axle support (carry-over from G05/G06)

### 6.1.2. Steering

Within the framework of the EfficientDynamics measures for the F95/F96, the steering used is a rack-and-pinion steering with electrical steering wheel support “M Servotronic based on an EPS”.

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.

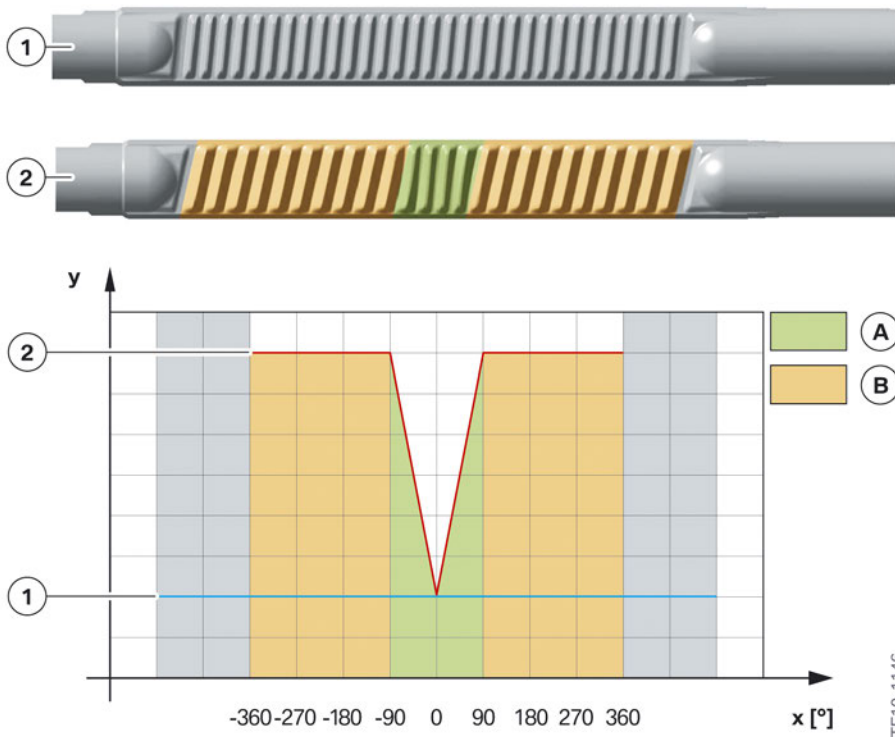
As components of M Servotronic (M EPS) the ratio of the rack has been specifically adapted for the F95/F96. With this measure the development of the steering was able to be coordinated to the typical M properties. Special attention was paid here to the typical M features:

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

The ratio of the M Servotronic (M EPS) was adapted to the F95/F96. Particularly worth noting is the fact that the rack ratio increases by 8% after every eighth of a steering wheel revolution.

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



F95/F96, comparison of M Servotronic (M EPS) steering gear ratios

Index	Explanation
1	Rack, basic version G05/G06 (constant gear geometry)
2	Rack, variable sport steering F95/F96 (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 (M EPS) is ThyssenKrupp.

For further information on EPS, please refer to the reference manual ST1831 "G05 Powertrain/Chassis".

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### 6.1.3. M Servotronic

The Servotronic function familiar from conventional hydraulic power-steering systems is also used on the M Servotronic (M EPS) and is available as standard on the F95/F96. 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 F95/F96 is that this can be selected in 2 stages (3 stages in the F85/F86). In contrast to the F85/F86, in the F95/F96 the Servotronic settings menu is reached via a SETUP button in the center console. Using the button or via the M1/M2 buttons, the driver can switch between "COMFORT" and "SPORT". Here the corresponding characteristic curve is activated and in Sport direction the power steering support is also noticeably withdrawn. The program selection can also be preconfigured in the Head Unit (HU) and selected using the M1/M2 buttons on the steering wheel.

#### **SETUP button, program description, M Servotronic:**

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

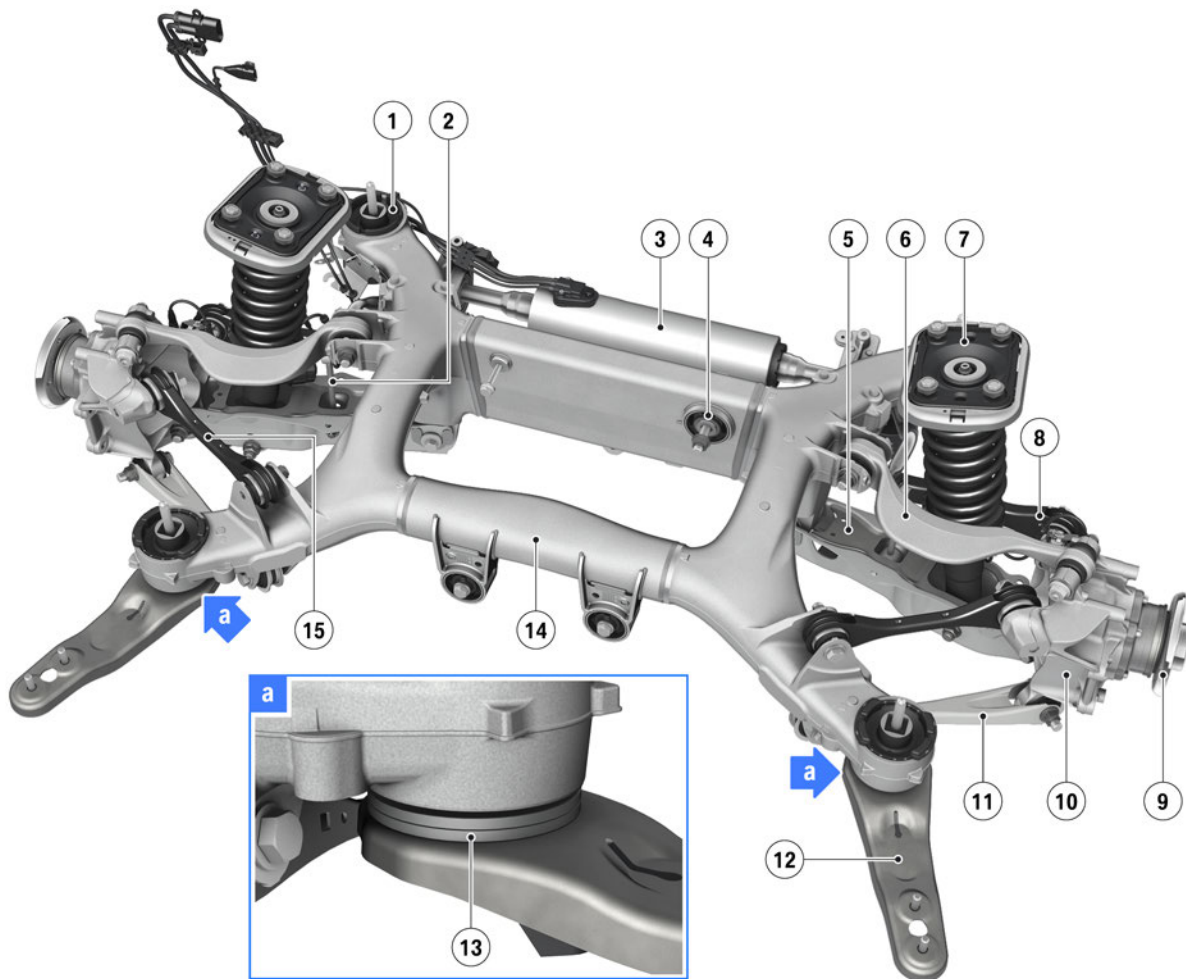
### 6.1.4. Rear axle

The five-link rear axle known from the G05/G06 is used as the rear axle. The rear axle has not been lowered in comparison to the standard suspension on the F95/F96. This was necessary in order to meet the requirements for a light duty truck road license in the USA. The rear axle support of the F95/F96 is however supported by the incorporation of Cellasto discs at the top and bottom of the bolting points of the rear axle bearings. The incorporation of Cellasto discs at the front prevents the rear axle support from tilting at the rear axle support bearings in the event of a marked load reversal. The rear axle support bearings have been adapted in terms of a harder design to the F95/F96. The shock absorbers have been adapted to the F95/F96 by a separate damper variant with outer EDC valves together with the coil spring and bolted at the top with a newly dimensioned support bearing. In addition, the auxiliary spring, installed between the shock absorber and the support bearing on the piston rod, has been adapted. All rubber mounts of the suspension arms have been adapted to the M-specific model. For further information on the five-link rear axle, please refer to the reference manual ST1831 "G05 Powertrain/Chassis".



# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



TF19-0939

F95/F96, rear suspension

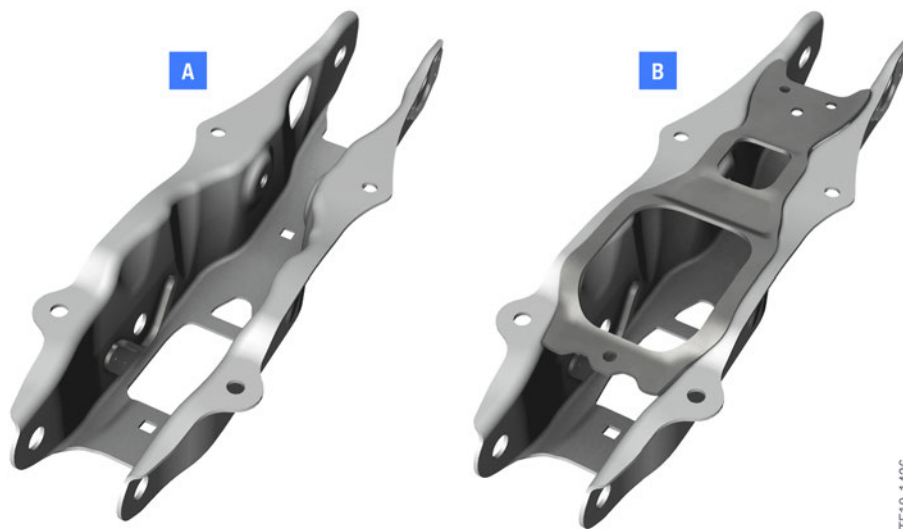
Index	Explanation
1	Attachment point of rear axle bearing (with hard rubber mount)
2	M anti-roll bar link
3	Electrical roll stabilization (adoption from G05/G06)
4	Attachment point for rear axle differential, M compression strut
5	M camber control arm
6	M wishbone
7	M spring strut with M support bearing
8	M track control arm
9	Wheel hub
10	M wheel carrier
11	M trailing arm

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

Index	Explanation
12	M front compression strut
13	Cellasto disc (2 x 5 mm)
14	M rear axle support
15	M control arm

The camber control arm was closed to increase the stability in the lower area. Apart from the adaptation of the rubber mounts for the suspension arms, this makes a significant contribution to even better and more stable drivability in the F95/F96.



F95/F96, camber control arm

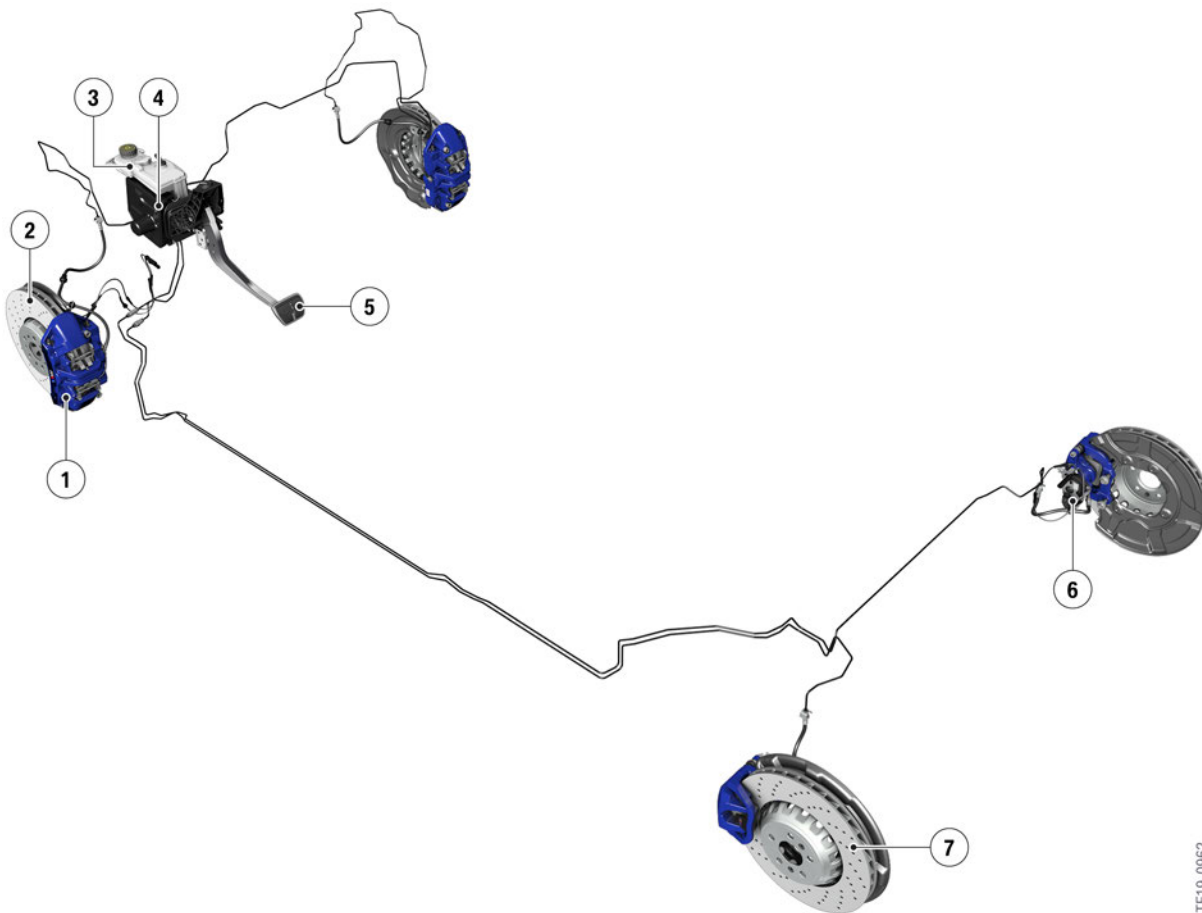
Index	Explanation
A	G05/G06 camber control arm
B	F95/F96 camber control arm

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### 6.2. Brakes, wheels and tires

#### 6.2.1. Brakes



TF19-0962

F95/F96, brake system

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

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### M compound brakes

Designation	Unit	F85/F86	F95/F96
Front brakes		6 pistons, fixed caliper	6 pistons, fixed caliper
Brake disc, front	[mm]	395 x 36	395 x 36
Design, brake disc, front		Internally ventilated M compound brake disc, perforated	Internally ventilated M compound brake disc, perforated
Rear brakes		1 piston, floating caliper	1 piston, floating caliper
Brake disc, rear	[mm]	385 x 24	380 x 28
Design, brake disc, rear		Internally ventilated M compound brake disc, perforated	Internally ventilated M compound brake disc, perforated
Parking brake		Electromechanical parking brake EMF	Electromechanical parking brake

The front brakes are completely F95/F96-specific. It is a large perforated and ventilated M compound brake disc combined with a four-piston fixed caliper.

The length of the brake hose at the front and the trims of the brake guard plate at the front have been adapted to the six-piston fixed caliper of the F95/F96.

All front brake calipers are blue with a colored M logo irrespective of the exterior vehicle body color chosen.

The M compound brakes offers even greater braking power than the Sport brake offered in the G05/G06. In a direct comparison it also offers:

- 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
- Copper-free brake pads
- Perforated 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.

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



F95/F96 front brake

The rear perforated and ventilated M Compound brake disk has different dimensions compared to the E85/F86. The rear brake caliper is a single-piston fixed caliper and has been adopted from the production F05/G06.

The rear brake calipers are blue irrespective of the exterior vehicle body color chosen.

### **M carbon ceramic brakes**

M carbon ceramics brakes are not offered.



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### **Brake noise**

- Humming of the perforated BMW M compound brake discs when braking at high speeds
- Squeaking brakes shortly before coming to a halt
- 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 50 km/h (31 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.

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### 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 make possible 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.



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.

### 6.2.2. Wheels/Tires

#### Summer equipment

The following wheels are offered:



A



B



C

F95/F96, summer wheels

Index	Explanation
A	21" 808M standard wheel
B	21"/22" 809M wheel, optional equipment
C	21"/22" 818M wheel, Competition wheel

#### Standard equipment

The following wheel/tire combinations are offered:

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

Designation	F85/F86	F95/F96
LM wheel rim standard wheel front (cast)	10J x 20 Styling 611M EH2 Wheel rim	10.5J x 21 Styling 808M EH2+ rim
LM wheel rim standard wheel rear (cast)	11.5J x 20 Styling 611M EH2 Wheel rim	11.5J x 21 Styling 808M EH2+ rim
Standard tires, front	Pirelli Zero 285/40 R20	Pirelli Zero 295/35 R21 107Y XL
Standard tires, rear	Pirelli Zero 325/35 R20	Pirelli Zero 315/35 R21 111Y XL

### Tires: Non-Runflat

Tires without run-flat technology are used on the F95/F96. UHP tires (Ultra-High-Performance tires) without run-flat properties are used. Tires without run-flat properties are softer in the sidewall area and afford the handling and comfort benefits that are wanted in a BMW M vehicle.



The components of the above-listed wheel/tire combinations have been developed specially for the F95/F96. This can be recognized by the star on the outer side of the tire, among other things.

Other combinations may have a negative effect on the performance and the driveability of the F95/F96 and lead to forfeiture of the operating license with forfeiture of the insurance cover.

### Optional equipment

The following wheel/tire combinations are offered:

Designation	F95/F96	F95/F96 Competition
LM rims, front	Cast 10.5J x 21 Styling 809M EH2+ rim	Forged 10.5J x 21 Styling 818M EH2+ rim
LM rims, rear	Cast 11.5J x 22 Styling 809M EH2+ rim	Forged 11.5J x 22 Styling 818M EH2+ rim
Front tires	295/35 R21 Pirelli Zero Michelin PS 4s	295/35 R21 107Y XL Pirelli Zero Michelin PS 4s
Rear tires	315/30 R22 Pirelli Zero Michelin PS 4s	315/30 R22 107Y XL Pirelli Zero Michelin PS 4s

### Tires: Non-Runflat



# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

Tires without run-flat technology are used on the F95/F96. UHP tires (Ultra-High-Performance tires) without run-flat properties are used. Tires without run-flat properties are softer in the sidewall area and afford the handling and comfort benefits that are wanted in a BMW M vehicle.



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The components of the above-listed wheel/tire combinations have been developed specially for the F95/F96. This can be recognized by the star on the outer side of the tire, among other things.

Other combinations may have a negative effect on the performance and the driveability of the F95/F96 and lead to forfeiture of the operating license with forfeiture of the insurance cover.

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### 6.3. Driving dynamics systems

The F95/F96 has all driving dynamics systems as known from the suspension package "Adaptive M Dynamic Professional" from the G05/G06.

Rear axle slip angle control is not offered in the F95/F96. Both vehicles have exclusively an M Servotronic system based on electromechanical power steering (EPS) with a more direct, variable steering gear ratio.

All driving dynamics systems have been adapted specifically for M models.

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

#### 6.3.1. Vertical Dynamics Management

##### Dynamic Drive

Electric active roll stabilization (EARS), as known from the G05/G06 basic vehicles, is used on the F95/F96.

The anti-roll bars at the front and rear axles are separated and can be connected together using an electrical swivel motor. Dynamic Drive can very quickly generate a torque at the anti-roll bars in order to stabilize the vehicle. For straight-ahead driving the two halves of the anti-roll bars are disconnected.

The electrical swivel motors in the F95/F96 generate a torque up to 900 Nm at the front axle and up to 1000 Nm at the rear axle (in comparison, the electrical swivel motor in the G05/G06 generates a torque of up to 900 Nm at the rear axle).

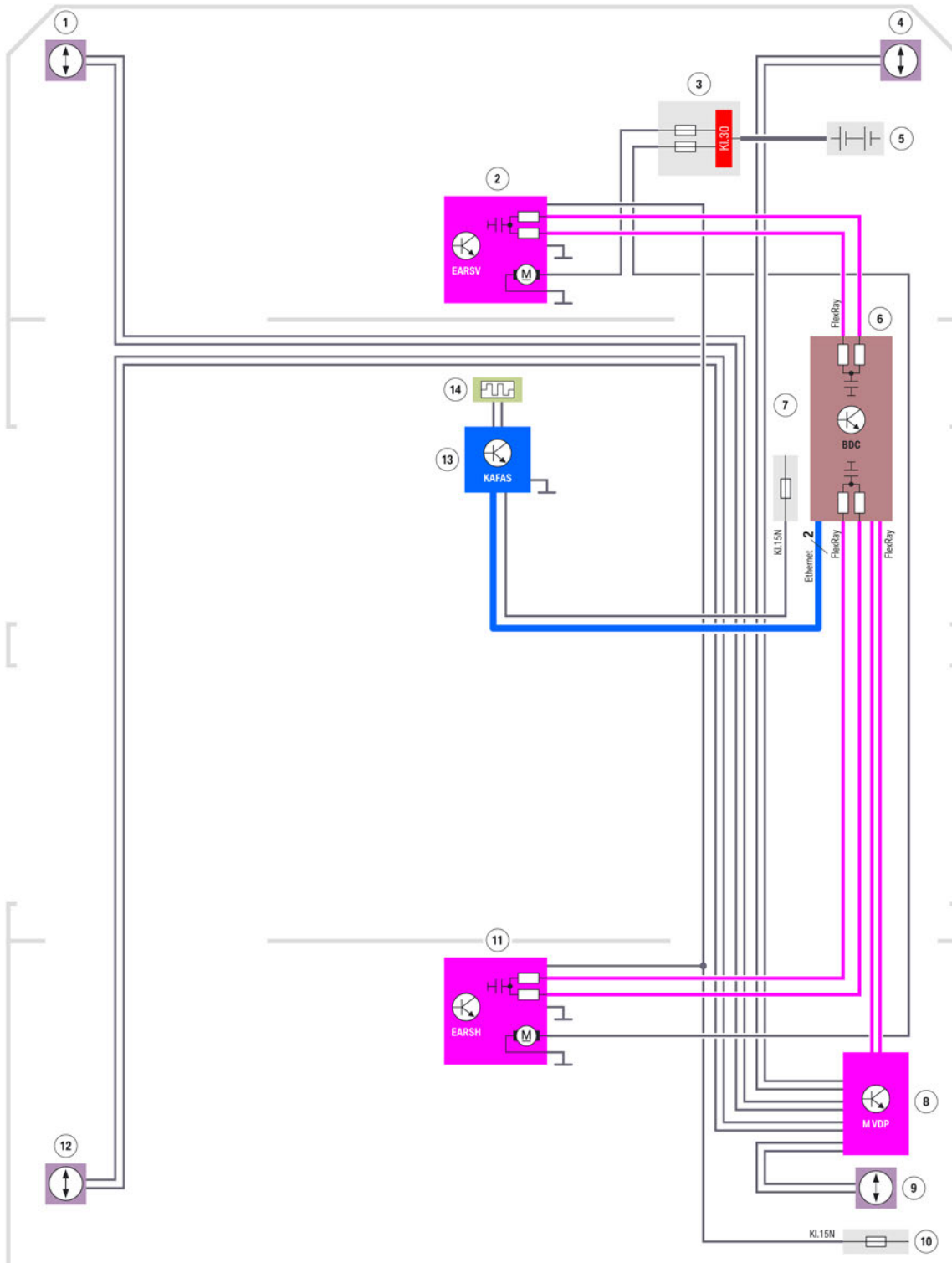
The settings of the electric active roll stabilization (EARS) are linked to the vertical dynamic platform M VDP-EDC:

- M VDP **Comfort** = ARS **Comfort**
- M VDP **Sport** = ARS **Sport**
- M VDP **Sport+** = ARS **Sport**

For further information on Dynamic Drive, please refer to the reference manual ST1831 "G05 Powertrain/Chassis".

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



F95/F96, EARS

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# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

Index	Explanation
1	Vertical acceleration sensor, front left
2	Electric active roll stabilization, front axle (EARSV)
3	Power distribution box, engine compartment
4	Front right vertical acceleration sensor
5	12 V battery in engine compartment (vehicle electrical system support)
6	Body Domain Controller (BDC)
7	Power distribution box, front
8	M vertical dynamic platform (M VDP)
9	Rear right vertical acceleration sensor
10	Power distribution box, rear right
11	Electric active roll stabilization, rear axle (EARSH)
12	Rear left vertical acceleration sensor
13	KAFAS camera control unit
14	Stereo camera

### Adaptive M suspension (EDC)

Similar to the G05/G06, EDC control valves are also installed at the shock absorbers on the outside. The shock absorbers have been developed with the supplier ZF Sachs and the system has been adapted to the F95/F96.

The EDC works with infinitely variable valves in the absorbers. The hydraulic oil flow is controlled via electromagnetic control valves. It is thus possible to make available the damping force actually required at all times. The infinitely variable control principle was introduced for the first time in the E65 and has consistently been further developed.

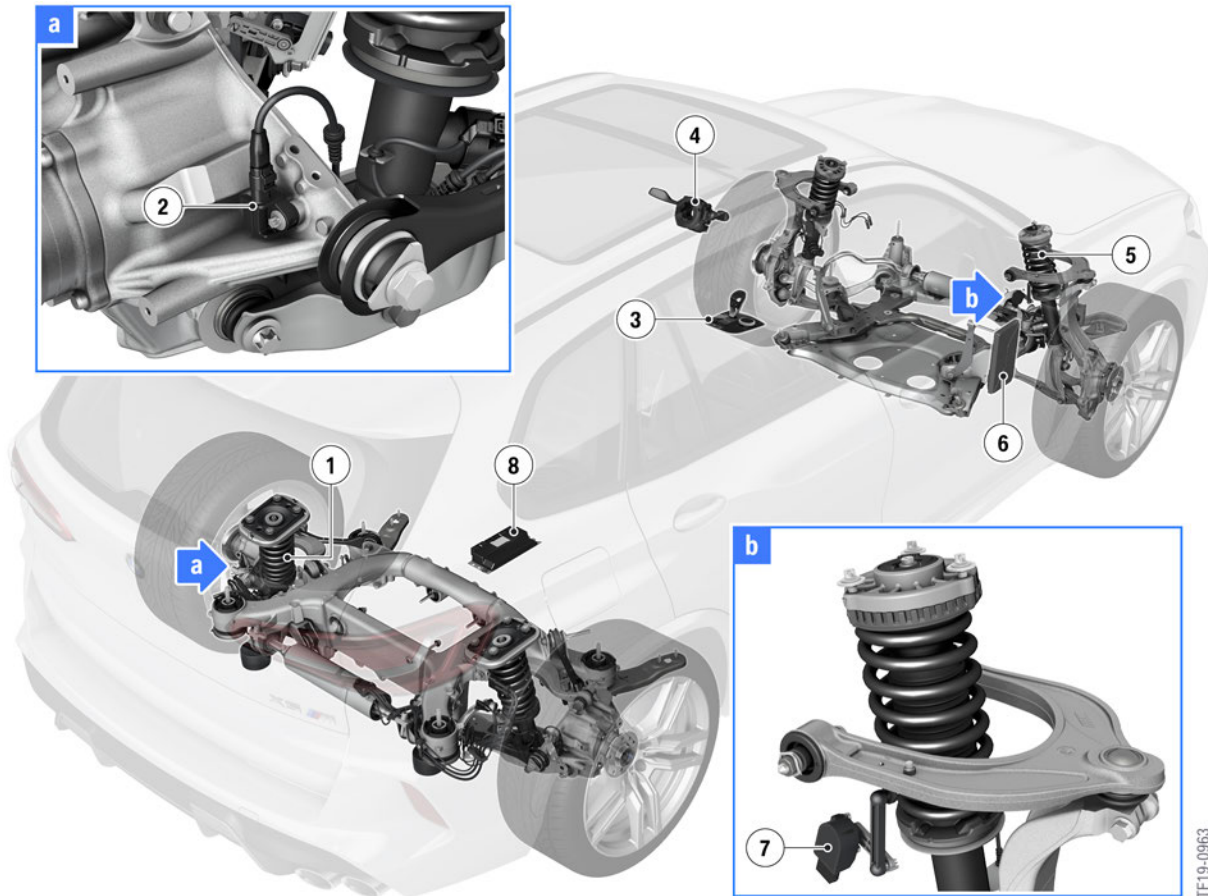
The following variables, among others, were processed into the corresponding control variables in the M vertical dynamic platform (M VDP): vertical acceleration, wheel speeds M DSCi, steering angle change M EPS, angle change rate ACSM and damper piston speed.

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 of the headlights. Two sensors each are installed at the front and rear. They operate on the basis of the potentiometer principle and their signal is made available to the M vertical dynamic platform (M VDP).

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### System overview



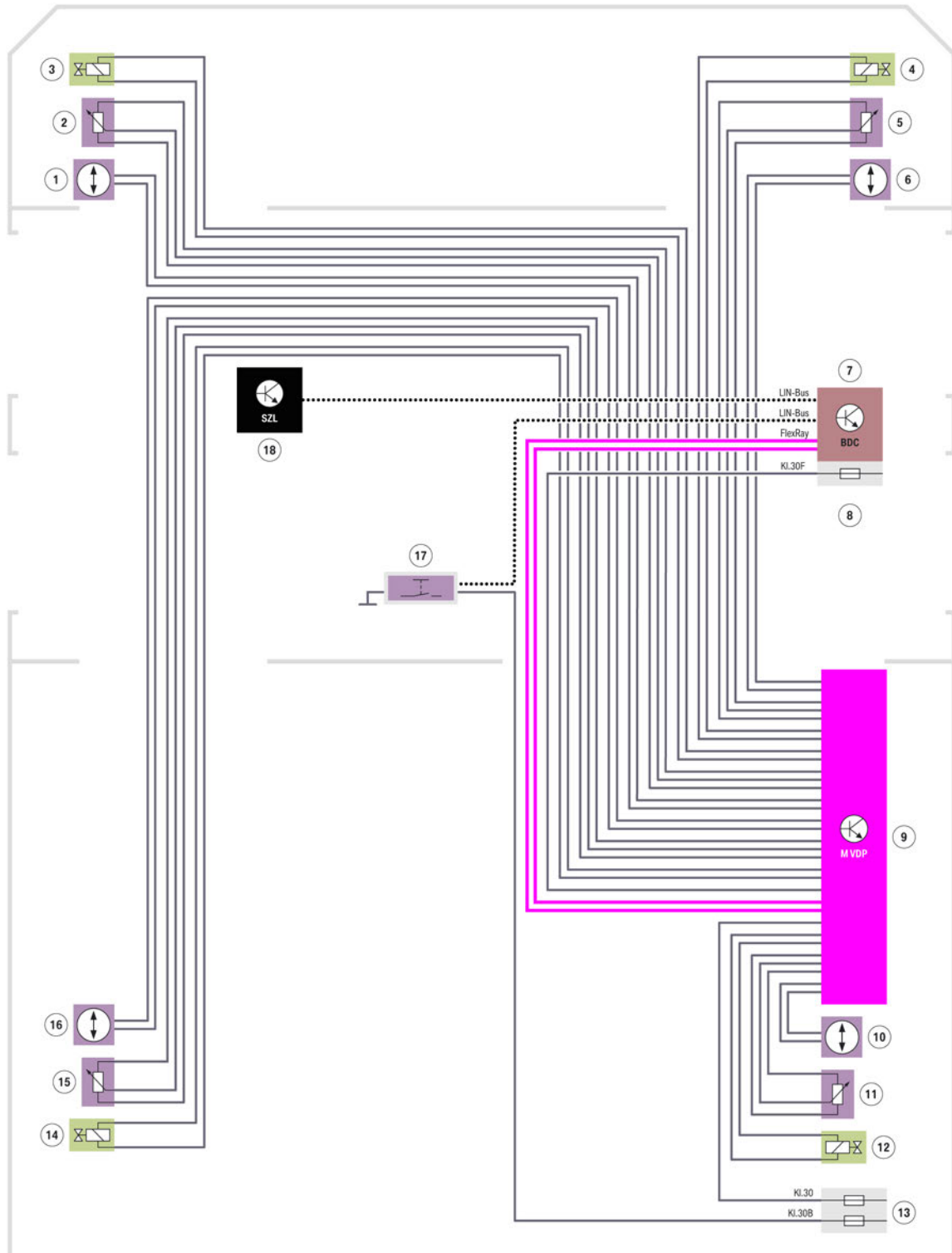
F95/F96, EDC system overview

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

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### System wiring diagram



F95/F96, EDC system wiring diagram

TF19-0700

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

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 independent 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.

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

The sensors in the vehicle permanently measure:

- 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 improves the vehicle's:

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

### **M sports 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 F95/F96 offers the options "COMFORT", "SPORT" and "SPORT+". All 3 programs feature M dynamic control on the F95/F96.

### **Note:**

In the first E92/E90 M3 models, the EDC had the 3 options, "COMFORT", "NORMAL" and "SPORT", whereby with the "SPORT" option there is no M dynamic control, but the dampers are 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 succeeding models including the F95/F96 are dynamically controlled in "SPORT+" mode.



# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### SETUP button, program description, EDC:

- "COMFORT" emphasizes the comfortable configuration in the F95/F96 in order to satisfy any comfort requirements a BMW X5 M/X6 M 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 hardness and sufficient remaining comfort (for example on country roads or bumpy racetracks such as the Nürburgring Nordschleife).
- "SPORT+" on the F95/F96 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".

### 6.3.2. M Dynamic Stability Control integrated (M DSCi)

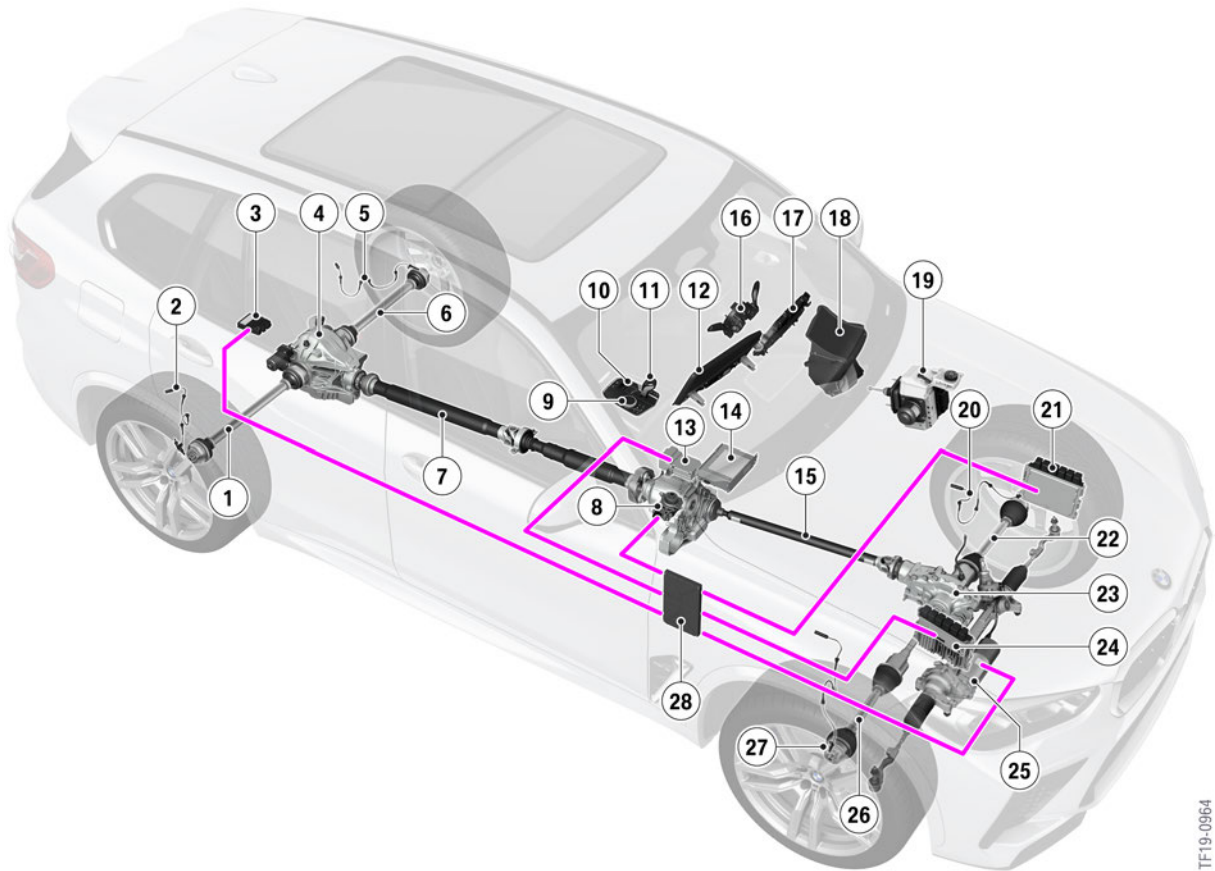
The main functions of Dynamic Stability Control integrated (DSCi) are the same as those in the G05/G06.

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

M Dynamic Stability Control integrated (M DSCi) represents the longitudinally dynamic system network in the F95/F96. This control unit coordinates the interaction between the M Servotronic motor control (M EPS), M Transfer box (M VTG) and the regulated M rear axle differential lock (M GHAS).

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



TF19-0964

F95, longitudinal dynamics system overview

Index	Explanation
1	Output shaft, rear left
2	Wheel speed sensor, rear right
3	Regulated M rear axle differential lock (M GHAS)
4	M rear axle differential lock
5	Wheel speed sensor, rear left
6	Output shaft, rear left
7	Prop shaft
8	M transfer box (M VTG)
9	Controller (CON)
10	SETUP button
11	M gear selector switch (M GWS)
12	Central Information Display (CID)
13	Advanced Crash Safety Module (ACSM)
14	Head Unit High 3 (HU-H 3) (M-specific)
15	Front drive shaft

# F95/F96 Complete Vehicle

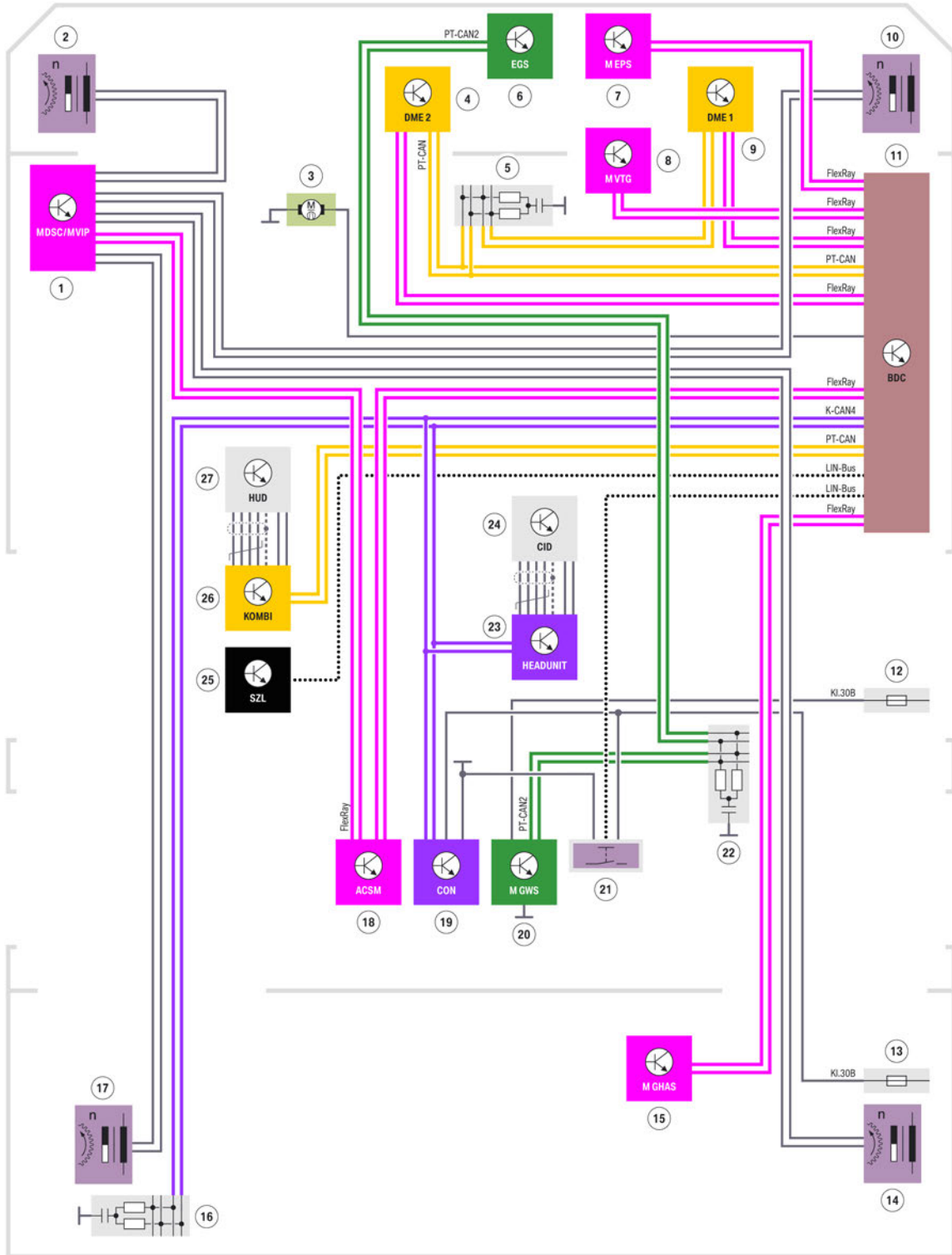
## 6. Chassis/Driving Dynamics Systems.

<b>Index</b>	<b>Explanation</b>
16	Steering column switch cluster (SZL)
17	Instrument cluster KOMBI (M-specific)
18	Head-Up Display (HUD) (M-specific)
19	M Dynamic Stability Control integrated (M DSCi)
20	Wheel speed sensor, front left
21	Digital Motor Electronics 2 (DME 2)
22	Output shaft, front left
23	Front axle differential
24	Digital Motor Electronics 1 (DME 1)
25	M Servotronic (M EPS)
26	Output shaft, front right
27	Wheel speed sensor, front right
28	Body Domain Controller (BDC)

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### System wiring diagram



F95/F96, longitudinal dynamics system wiring diagram

TF19-0706

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

<b>Index</b>	<b>Explanation</b>
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	Advanced 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)

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

### 6.3.3. Integrated actuation (longitudinal transverse dynamics)

A integrated actuation is used in the F95/F96, like in the F90/F91/F92/F93 and F97/F98. 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 F95/F96:

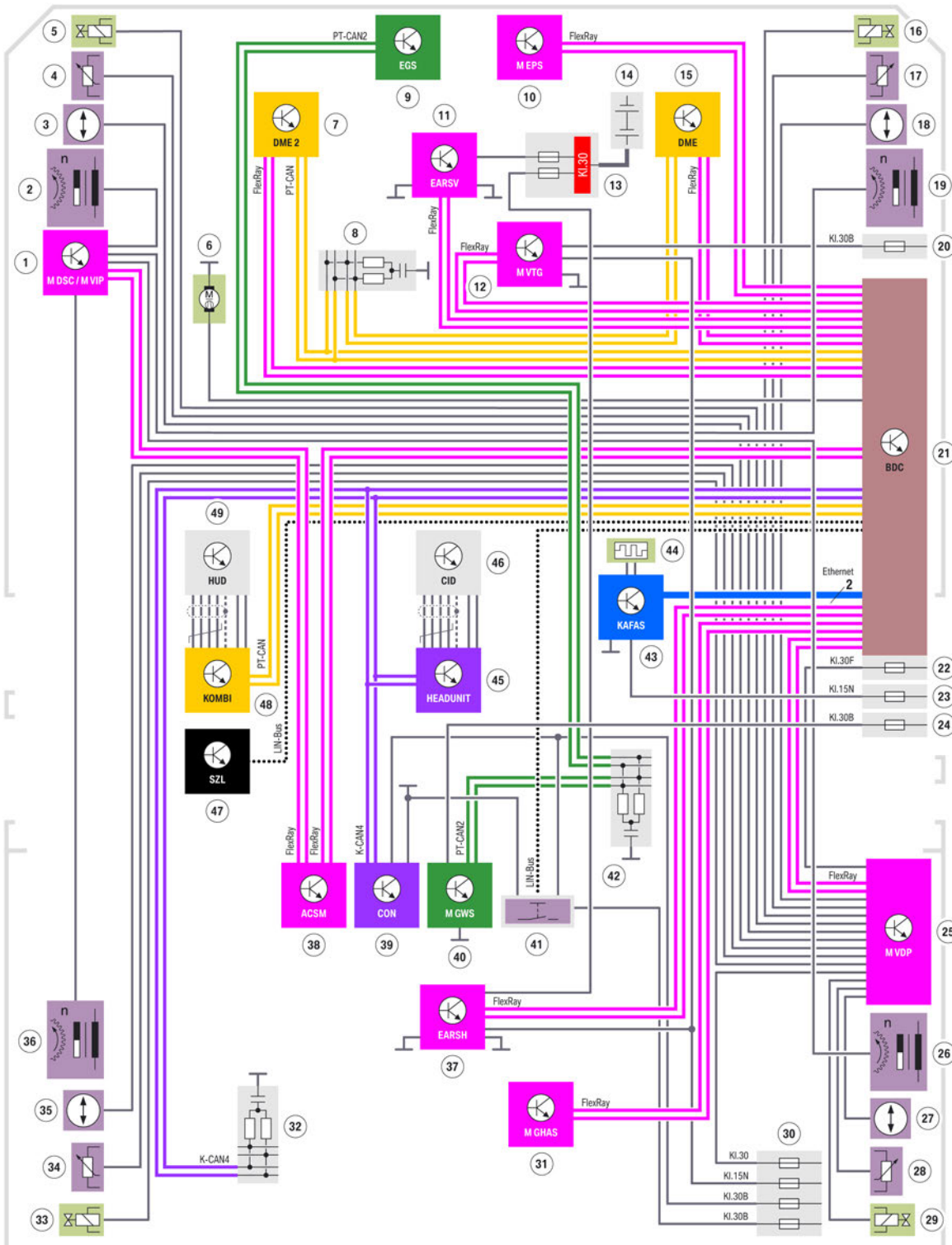
- Excellent traction, especially on low coefficients of friction
- M-specific agility and playfully intuitive control of the vehicle
- Superiority in every day use
- Depending on the customer request, variable functions of the M xDrive possible.

The actuator and control units that are used depending on the customer's request are:

- 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)
- Electric active roll stabilization (EARS)
- Digital Motor Electronics (DME)

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.



TF19-1536

F95/F96, integrated actuation



# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

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	Electric active roll stabilization, front axle (EARSV)
12	M transfer box (M VTG)
13	Power distribution box, engine compartment (EARS fuse)
14	12 V battery in engine compartment (vehicle electrical system support)
15	Digital Motor Electronics 1 (DME 1)
16	EDC control valve, front right
17	Ride height sensor, front right
18	Front right vertical acceleration sensor
19	Wheel speed sensor, front right
20	Power distribution box, front (M VTG fuse)
21	Body Domain Controller (BDC)
22	Power distribution box, front (M VDP fuse)
23	Power distribution box, front (KAFAS fuse)
24	Power distribution box, front (M GWS fuse)
25	M vertical dynamic platform (M VDP)
26	Wheel speed sensor, rear right
27	Rear right vertical acceleration sensor
28	Ride height sensor, rear right
29	EDC control valve, rear right
30	Power distribution box, rear
31	Regulated M rear axle differential lock (M GHAS)
32	K-CAN4 terminating resistor
33	EDC control valve, rear left
34	Ride height sensor, rear left
35	Rear left vertical acceleration sensor

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

Index	Explanation
36	Wheel speed sensor, rear left
37	Electric active roll stabilization, rear axle (EARSH)
38	Advanced Crash Safety Module (ACSM)
39	Controller (CON)
40	M gear selector switch (M GWS)
41	SETUP button
42	PT-CAN2 terminating resistor
43	KAFAS camera control unit
44	Stereo camera
45	Head Unit High 3 (HU-H 3) (M-specific)
46	Central Information Display (CID)
47	Steering column switch cluster SZL
48	Instrument cluster (KOMBI) (M-specific)
49	Head-Up Display (HUD) (M-specific)



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.

### 6.3.4. M Dynamic Mode and M DSCi OFF Mode

In M Dynamic Mode (MDM) the control threshold of the brake interventions is expanded/raised and the engine power reduction by ASC is applied significantly later. This enables customer-oriented dynamic and sporty handling. The "M DSCi OFF" mode is described separately in one of the following chapters.

### 6.3.5. M brake

The use of M Dynamic Stability Control integrated (M DSCi) enables the customer to select two different ranges of adjustment for the brake in the F95/F96.

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.

# F95/F96 Complete Vehicle

## 6. Chassis/Driving Dynamics Systems.

**SETUP button, program description, brake:**

### **M compound brakes**

- **"Low speed"**

At low speeds an approximately equal deceleration is set for up to 1/5 of the brake pedal travel in COMFORT and SPORT. The upshot of this is that the customer can meter the brake more sensitively at low speeds.

In the middle range of the brake pedal travel (2/5-4/5) the deceleration in SPORT is increased in comparison with COMFORT. The upshot 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 (5/5) 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 1/5 of the brake pedal travel in COMFORT and SPORT. The upshot 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 (2/5-4/5) the deceleration in SPORT is increased in comparison with COMFORT. The upshot 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 upshot of this is that the customer must actively increase the pedal force.

This underlines the sporty driving feel.



---

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.

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# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

### 7.1. Voltage supply

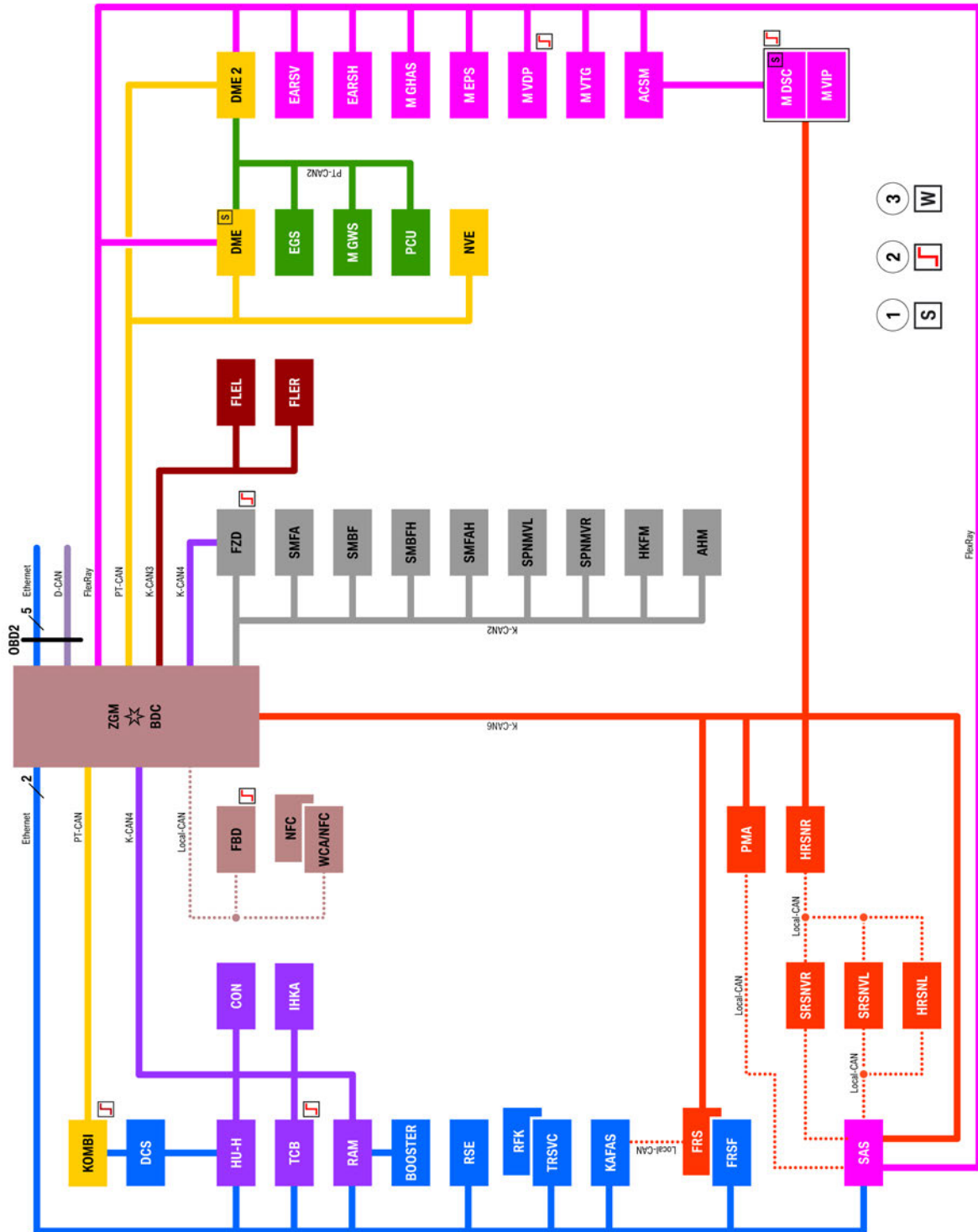
A 105 Ah AGM battery is used for the power supply of the electrical system in the F95/F96. Similar to the G05/G06, a 60 Ah auxiliary battery is used in the engine compartment.

Further information on the power supply can be found in the reference manual "ST1831 G05 General Vehicle Electronics".

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

### 7.2. Bus overview



F95/F96, bus overview

TE19-0965

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

Index	Explanation
1	Start-up node control units for starting and synchronizing the FlexRay bus system
2	Control units authorized to perform wake-up function
3	Control units also connected to wake-up line.
ACSM	Advanced Crash Safety Module (ACSM)
AHM	Trailer module
BDC	Body Domain Controller
BOOSTER	Hi-fi amplifier
CON	Controller
DME	Digital Motor Electronics
DME 2	Digital Engine Electronics 2
DCS	Driver Camera System
EGS	Electronic transmission control
EARSH	Electric active roll stabilization rear
EARSV	Electric active roll stabilization front
FBD	Remote control receiver
FLEL	Frontal Light Electronics Left
FLER	Frontal Light Electronics Right
FRS	Front radar sensor
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 3)	Head Unit High 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

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

Index	Explanation
M VIP	M Virtual Integration Platform
M VTG	M transfer box
NVE	Night Vision Electronics
PCU	Power Control Unit
PMA	Parking Assistant
RAM	Receiver Audio Module
RFK	Rear view camera
RSE	Rear Seat Entertainment
SAS	Optional equipment system
SMBF	Front passenger seat module
SMBFH	Seat module, front passenger's side, rear
SMFA	Driver's seat module
SMFAH	Seat module, driver's side, rear
SRSNVL	Side radar sensor short range front left
SRSNVR	Side radar sensor short range front right
TCB	Telematic Communication Box
TR SVC	Top rear side view camera
WCA	Wireless charging station
ZGM	Central Gateway Module

The following deviations exist in comparison with the standard G05/G06:

### FlexRay

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

The rear axle slip angle control (HSR) and the Electronic Height Control (EHC) control units are not used. By means of the special M GmbH software application the control units for Electronic Power Steering (EPS), transfer box (VTG), Dynamic Stability Control (DSC), integrated 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 DSC, M VIP, M GHAS and M vertical dynamic platform.

### PT-CAN2

By means of the special M GmbH software and hardware application, the GWS gear selector switch becomes the M GWS gear selector switch with Drivelogic button.



# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

### 7.3. On-board information

#### 7.3.1. SETUP

##### 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).



F95/F96, SETUP button

Index	Explanation
1	M MODE
2	SETUP button (direct skip to the M menu)
3	Sound pattern

##### 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 and suspension
- Steering
- Brake
- M xDrive

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.



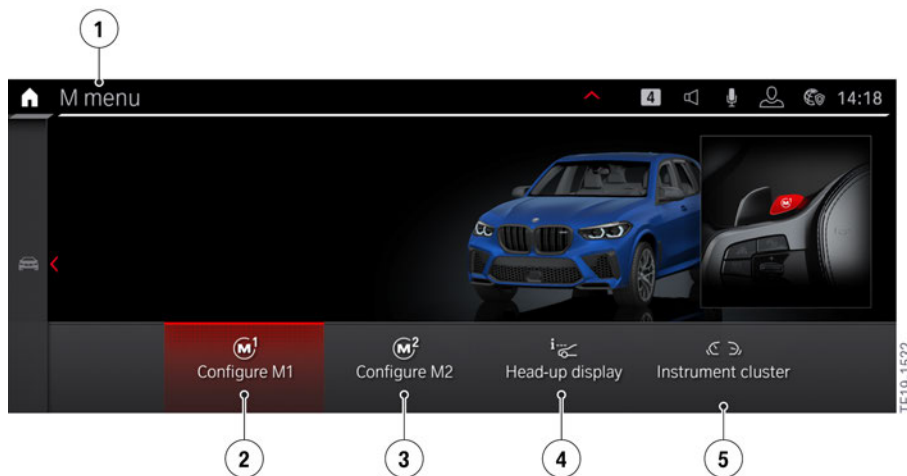
F95/F96, M menu HU

Index	Explanation
1	Engine
2	Chassis and suspension
3	Steering
4	Brake
5	M xDrive

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

### 7.3.2. M1/M2

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



F95/F96, M menu

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

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 two available M buttons on the multifunction steering wheel.



F95/F96, 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 M1 or M2 configuration can be changed at any time while driving. The M1 or M2 symbol in the instrument cluster goes out if M1 or M2 was previously active.

If M1/M2 is configured to open and a system is adjusted while M1 or M2 is active, a live adjustment of the active M1 or M2 configuration is effected.

With an adjustment in the M setup menu, M1 or M2 is deactivated and the M1/M2 symbol goes out.

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

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.



F95/F96, Configure M (excerpt)

Index	Explanation
1	Steering
2	Brake
3	DSC
4	M xDrive
5	Auto start/stop function
6	Sound Control

The following functions and configurations can be selected and set:

### Engine dynamics 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

An adjustment in the area of the Electronic Damping Control (M vertical dynamic platform) also influences, as described below, the electric active roll stabilization,

### Electric active roll stabilization

- **COMFORT:** Comfort-optimized tuning
- **SPORT:** Balanced

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

### Transmission

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

### M Servotronic

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

### M Brake

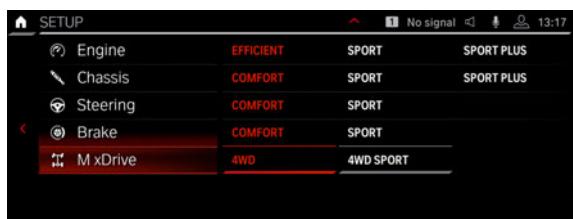
- **COMFORT**
- **SPORT**

### M Dynamic Stability Control, M DSC

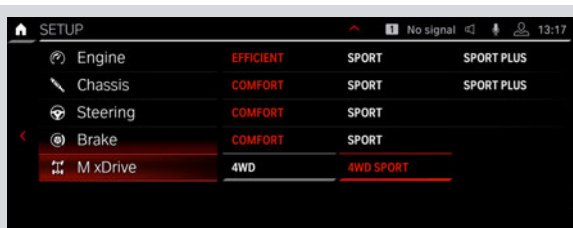
- **ON**: Maximum possible driving stability with 4WD
- **MDM**: Reduced stabilizing interventions with 4WD Sport. Permits driving with a higher lateral and longitudinal acceleration on dry and wet roadways
- **OFF**: Stability control switched off. ABS control remains active

### DSC OFF

"Configure DSC" is automatically displayed after acknowledging the disclaimer 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 2 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

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

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

### Automatic Start/Stop function (MSA)

- These functions are activated
- Deactivated

### Sound pattern Active Sound Design (ASD) and exhaust flaps

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

### 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 an unjustified customer complaint.

---

### Live adjustment

During the journey, the desired ideal tuning of the individual driving dynamics systems must be determined using the M setup 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. While M1 or M2 is active, a live adjustment can be made via the M1/M2 configuration menu.



---

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 deadlocked. As a result, on restart the default setting is obtained again without M1 or M2 being active. This ensures that subsequent customers are not confronted with a configuration of the vehicle which could potentially overextend them in driving dynamics terms.

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:

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

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
Engine dynamics control	DME	EFFICIENT	X		
		SPORT		X	
		SPORT PLUS			X
Electronic Damper Control	M VDP	COMFORT	X		
		SPORT		X	
		SPORT PLUS			X
Electric active roll stabilization	EARS	COMFORT	X		
		SPORT		X	X
M Servotronic	M EPS	COMFORT	X	X	
		SPORT			X
M Brake	M DSCi	COMFORT	X	X	X
		SPORT			
Head-Up Display	KOMBI	Standard view	X	X	
		M view			X
Gearbox: D/S	EGS	D	X	X	
		Sequential			X
Gearbox: Drivelogic	EGS	1	X		
		2		X	
		3			X
Sound pattern	DME	SPORT	X	X	X
		COMFORT			
Automatic start-stop	DME	These functions are activated	X*		
		Deactivated		X	X

\* Last activated setting by the customer remains active.

### 7.3.3. M MODE

To offer the customer a motorsport experience which is contrary to the intervening driver assistance systems in the G05/G06, the F95/F96 offers the customer the option of using the M MODE to set his/her vehicle quickly to the following demands:



# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

- 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 G05/G06	Reduced driver assistance systems (information, but no direct active interventions)	All driver assistance systems OFF
Intelligent Safety	All ON similar to G05/G06	Individual. Preassigned with: <ul style="list-style-type: none"> <li>• Frontal collision warning ON</li> <li>• Rest OFF</li> </ul>	All OFF
Driver Information systems	All ON similar to G05/G06	But: <ul style="list-style-type: none"> <li>• Speed Limit Info</li> </ul>	All OFF
Displays	<ul style="list-style-type: none"> <li>• M KOMBI = Basic</li> <li>• M HUD = Basic</li> </ul>	<ul style="list-style-type: none"> <li>• M KOMBI = M View</li> <li>• M HUD = M View</li> </ul>	<ul style="list-style-type: none"> <li>• M KOMBI = M View+</li> <li>• M HUD = M View+</li> </ul>
Others			<ul style="list-style-type: none"> <li>• CID OFF</li> <li>• Entertainment mute</li> <li>• Deactivate hazard warning flashers after emergency braking OFF</li> <li>• Rear collision warning OFF</li> <li>• HUD distance information OFF</li> <li>• Evasion Assistant OFF</li> </ul>

\*Only in conjunction with optimum Competition package SA 7MA.

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

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*
KOMBI	KOMBI	Standard	X		
		M View		X	
		M View+			X
HUD	KOMBI	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- collision warning	HRSNL/ HRSNR	Not prevented	X	X	
		Prevented			X
Entertainment	HU-H 3	No MUTE	X	X	
		MUTE			X
Central Information Display	HU-H 3	ON	X	X	
		OFF			X

\*Only in conjunction with optimum Competition package SA 7MA.

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

### 7.3.4. M instrument cluster

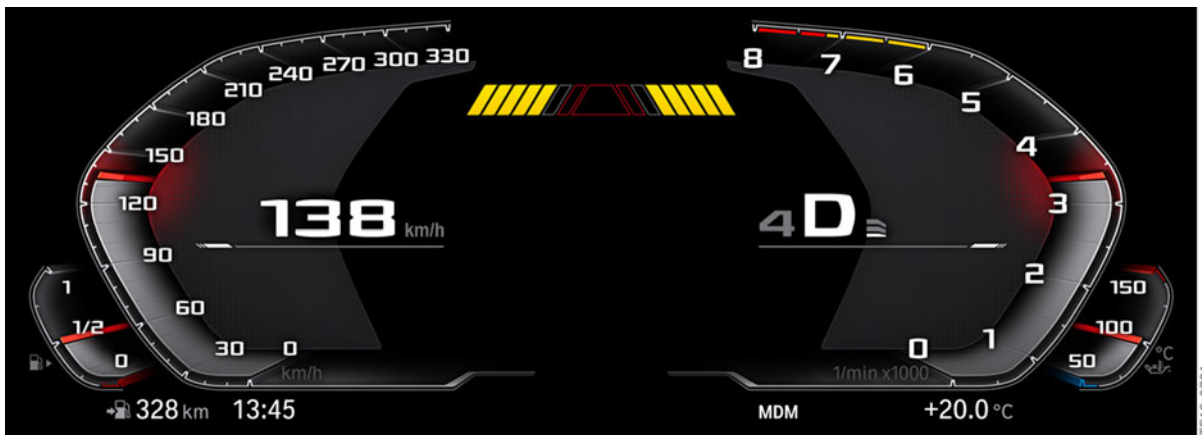
The M instrument cluster of the F95/F96 is based on the multifunctional instrument display (12.3" TFT display) of the G05 and is already known from the G11/G12.

The following M-specific changes exist in comparison with the G05:

- Speed and engine speed display correspond to the drive concept
- Typical M red needles, lighting of the dial in white (also during the day without driving lights), BMW X5 M model inscription when starting.

Two different views are made available to the customer:

#### Basic view



F95/F96, basic instrument cluster

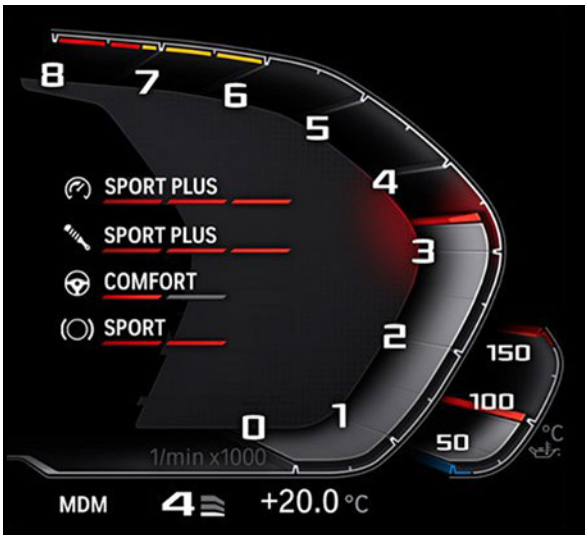
M-specific displays:

- MDM (M dynamic mode) symbol in place of the DTC
- Additional digital speedometer in km/h and mph
- 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 50 °C (122 °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.

# F95/F96 Complete Vehicle

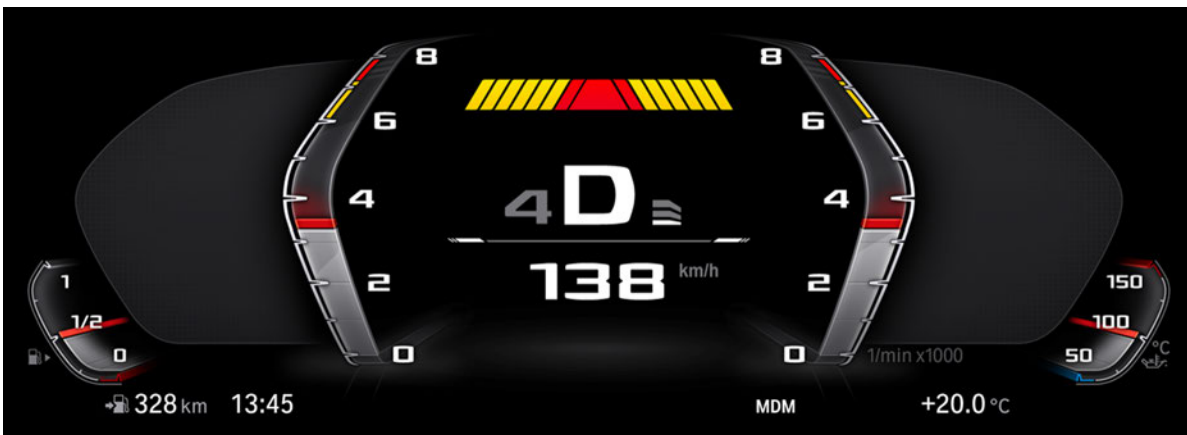
## 7. General Vehicle Electronics.



F95/F96, 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



F95/F96, 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.

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

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

Display	Information about	Content
	Engine	<ul style="list-style-type: none"> <li>• Engine oil temperature</li> <li>• Charging pressure</li> </ul>
	Tires	<ul style="list-style-type: none"> <li>• Tire pressures</li> <li>• Tire pressure warnings</li> <li>• Tire air temperatures</li> </ul>
	Centrifugal forces	<ul style="list-style-type: none"> <li>• Longitudinal acceleration</li> <li>• Lateral acceleration</li> <li>• Secondary indicator</li> </ul>

### 7.3.5. M Head-Up Display

The multi-color Head-Up Display (standard, depending on the national-market vehicle) can switch into the M-specific display.

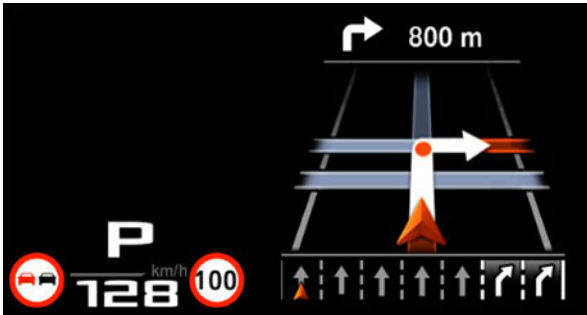
The following information/parameters can be shown:

- 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
- Speed limit info
- Navigation displays
- Driver assistance system not displayed
- Contents can be configured

# F95/F96 Complete Vehicle

## 7. General Vehicle Electronics.

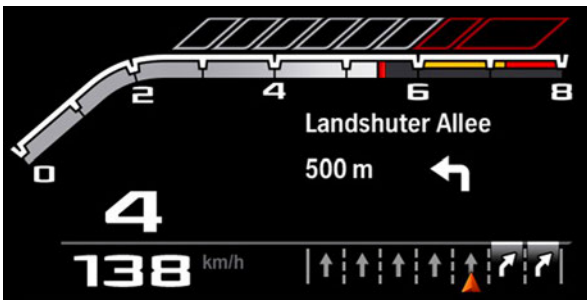
### Standard view



F95/F96, head-up display with navigation system

If the Shiftlight function is activated 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).

### M view



F95/F96, 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.

### 7.3.6. Active Sound Design

Active Sound Design (ASD) is a subfunction of the Receiver Audio Module (RAM) and is described in the separate reference manual "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+.

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## 7. General Vehicle Electronics.

### 7.4. 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 > -10 °C (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
- Trailer or load carrier uncoupled
- 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.

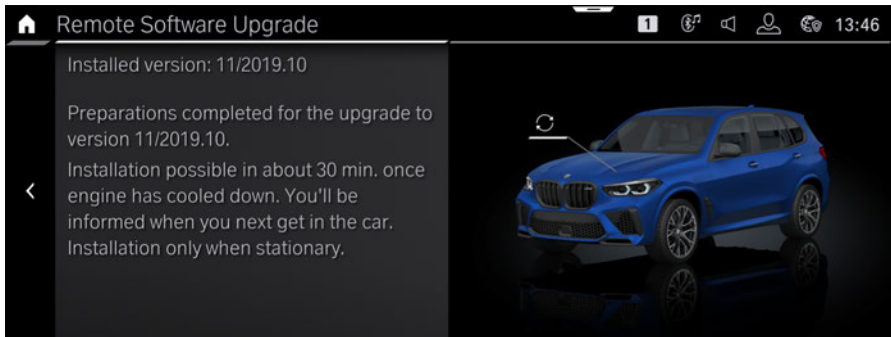
The customer is therefore prompted by way of a message in the Central Information Display (CID) to start the Remote Software Upgrade only after a waiting period of around 30 minutes.

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



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## 7. General Vehicle Electronics.



F95/F96, Remote Software Upgrade

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

- It is not a malfunction.
- Wait for the engine to cool down and then start the Remote Software Upgrade.
- Do not start the 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".

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## 8. Technical Comparison.

	<b>E70/E71</b>	<b>F85/F86</b>	<b>F95/F96</b>
Engine	S63B44O0	S63B44T2	S63B44T4
Engine control	MSD85.1	MEVD 17.2.H	DME 8.8T.0
Front axle	Double-wishbone front axle	Double-wishbone front axle	Double-wishbone front axle
Front axle differential	VAG180A	VAG178AL	VAG175AL
Steering	Hydraulic M Servotronic	Electrical M Servotronic (M EPS)	Electrical M Servotronic (M EPS)
Transmission	GA6HP26S	GM8HP75Z	GM8HP76Z
Gear selector switch	AG automatic transmission principle	M DKG principle	M DKG principle
Drivelogic	No	Yes	Yes
Mechanical Transmission Emergency release	Yes	Yes	Yes
Electric Transmission Emergency release	No	No	Yes
Transmission oil cooling	Oil-to-air heat exchanger principle	Oil-to-air heat exchanger principle and oil-to-coolant heat exchanger principle	Oil-to-air heat exchanger principle
Transfer box	ATC700	ATC45L	ATC13
Rear axle	Integral IV rear axle	Integral IV rear axle	Five-link rear suspension
Rear axle final drive	HAG225 QMV Dynamic Performance Control	HAG225 QMV Dynamic Performance Control	RAD 225 Active M differential
Electronic ride height control	EHC	EHC	Not available
Cellasto discs for rear axle support	No	1 front/rear-top/ bottom	2 front/bottom
Dynamic Damper Control	Inner EDC valves	Inner EDC valves	Outer EDC valves
Brake system	DSC 8 Bosch	DSC 9+ Bosch	DSCi MK C1 Continental
Vacuum brake booster	Yes	Yes	No
Brakes	Cast brake	M compound brake	M compound brake
Brake caliper, front	4 pistons, fixed caliper	6 pistons, fixed caliper	6 pistons, fixed caliper
Brake disc, front	395 x 36	395 x 36	395 x 36

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## 8. Technical Comparison.

	<b>E70/E71</b>	<b>F85/F86</b>	<b>F95/F96</b>
Brake caliper, rear	1 piston, floating caliper	1 piston, floating caliper	1 piston, floating caliper
Parking brake	EMF	EMF	Electromechanical holding brake
Brake disc, rear	385 x 24	385 x 24	380 x 28
Brake circuit split	Black/white	Black/white	Diagonal
Tires	RSC	Non-RSC	Non-RSC
Active roll stabilization (Dynamic Drive)	Hydraulic active roll stabilization ARS	Hydraulic active roll stabilization ARS	Electric active roll stabilization (EARS)
Front wheel rim	10J x 20 EH2 Wheel rim	10J x 20 EH2 Wheel rim	10.5J x 21 EH2+ rim
Front tires	275/40 R20	285/40 R20	295/35 R21
Rear wheel rim	11J x 20 EH2 Wheel rim	11.5J x 20 EH2 Wheel rim	11.5J x 21 EH2+ rim
Rear tire	315/35 R20	325/35 R20	315/35 R21
Transverse dynamics Management	ICM	ICM	DSCi

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## 9. Brief Overview of Equipment.

### 9.1. BMW X5 M/BMW X6 M standard equipment

- M TwinPower turbo engine
- M engine dynamics switch with symbol switch
- M 8-gear automatic transmission with Steptronic, Launch Control and shift paddles on the steering wheel
- M gear selector switch with Drivelogic button
- M xDrive with integrated control in M Dynamic Stability Control integrated (M DSCi)
- Active M differential
- BMW Live Cockpit Professional
- M configuration menu
- M Head-Up Display
- M MODE
- BMW gesture control
- ConnectedDrive Services
- Dynamic Damper Control
- Adaptive M suspension Professional
- M Servotronic
- M multifunctional seats, electrical, with seat heating and seat memory for driver and front passenger in Merino leather with extended features such as seats in the front and rear, head restraints, center console including armrest, door armrests, illuminated M logo on the front head restraints
- Lumbar support
- Armrest
- Backrest rear panel with pocket
- Rear seat backrest can be folded down and split 40:20:40
- Rear Center Armrest
- M leather steering wheel with 2 M buttons
- Steering column adjustment
- Heat/sun protection glazing
- M side gills, M door sill cover strip, illuminated, M driver footrest
- BMW X5 M/BMW X6 M Aerodynamics package: front and rear bumpers, front side panels with flairs and gills, exterior mirrors
- M rear spoiler
- BMW X5 M/BMW X6 M lettering at the rear (or X5 M/ X6 M Competition)
- M exhaust tailpipe, right and left, double, round
- Adaptive Full LED headlights,
- LED tail lights

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## 9. Brief Overview of Equipment.

- Automatic High-beams  
Dynamic Brake Control
- Mobility set
- Front and rear floor mats
- Ambient light design
- Automatic tailgate release
- Park Distance Control (PDC)
- Dynamic Cruise Control  
Speed limiter
- 4 Zone integrated automatic heating/air-conditioning system
- Harman Kardon surround sound system
- Expanded exterior mirror package
- Satin aluminum roof rails
- BMW Individual roof rails high-gloss Shadow
- BMW Individual exterior trim line with aluminum satin finish
- BMW Individual high-gloss Shadow Line
- BMW Individual high-gloss Shadow Line with extended scope.

### 9.1.1. Wheels/tires

- M light-alloy wheels double spoke 808M Bicolor, 21" with mixed tires.

### 9.1.2. Paint colors

- 300 Alpine White
- 416 Carbon Black metallic
- 475 Black Sapphire
- A96 Mineral White
- C1K Marina Bay Blue metallic
- C28 Donington Grey
- C3D Manhattan Green metallic
- C3G Toronto Red metallic
- C3Z Tanzanite Blue II metallic
- X1B Ametrine metallic.

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## 9. Brief Overview of Equipment.

### 9.2. BMW X5 M/BMW X6 M optional equipment

- SA 1CR Remote Engine Start
- SA 1MA M Sport exhaust system (standard with Competition package SA 7MN)
- OE 2VC Mobility kit
- OE 323 Soft-close automatic doors
- SA 44A Cup holder, preheated/precooled
- SA 4HA Front and rear seat heating
- SA 4T7 Massage function for front-seat passengers
- OE 5AL Active Protection
- OE 5AS Driving Assistant
- SA 5AU Active Driving Assistant Professional
- SA 5AZ BMW Laserlight
- OE 5DN Parking assistant plus
- OE 6F1 Bowers & Wilkins Diamond Surround Sound System
- SA 6FH Rear-seat entertainment – BMW Professional
- OE 6UK BMW Night Vision with pedestrian detection
- SA 7MA Competition package
- OE 7ME M Driver's Package
- SA 7MN M Competition package

#### 9.2.1. Wheels/tires

- SA 1TE M M light-alloy wheels star spoke 809 M Bicolor with mixed tires
- SA 1TF 21"/22" M light alloy wheels star-spoke 818 M Bicolor with mixed tires (standard equipment in conjunction with Competition package)
- SA 2VC Mobility set
- SA 300 Emergency spare wheel.

For further, up-to-the minute information, please refer to the BMW sales documentation.

