

BMW Group
Dealer: 32711/06
Model: M2
Development code: G87
Model code: 13DM
Lead type: 13DM

Functional description

All-wheel drive system xDrive with transfer box

FUB-FUB-FB-270001-A21 - V.2

All-wheel drive system xDrive with transfer box (VTG)

xDrive is the all-wheel drive system from BMW.

In addition to outstanding traction, further improved driving dynamics values were a high priority during the development.

The four-wheel drive offers the following innovations:

- Weight neutral increase of the maximum transmissible torque to 1300 Nm
- Reduction of the thermal load by over opening of the multi blade clutches
- Reduction in consumption by intelligent all-wheel control and appropriate oil level control in the transfer box

Brief component description

The following components are described for the all-wheel-drive system:

Drivetrain

The new transfer box (ATC13-2: ATC = Active Torque Control) has a chain for power transmission.

The torque generated by the engine is transmitted in the automatic transmission and is transferred by the gear output shaft to the transfer box. The transfer box has the task of variably splitting the torque in the front axle and rear axle directions to match the driving situation. Because a rigid connection of the rear axle with the front axle is not possible due to possible wheel RPM differences, a multi blade clutch is located in the inside of the transfer box. The multidisc clutch handles the task of variable torque distribution between the two drive axles.

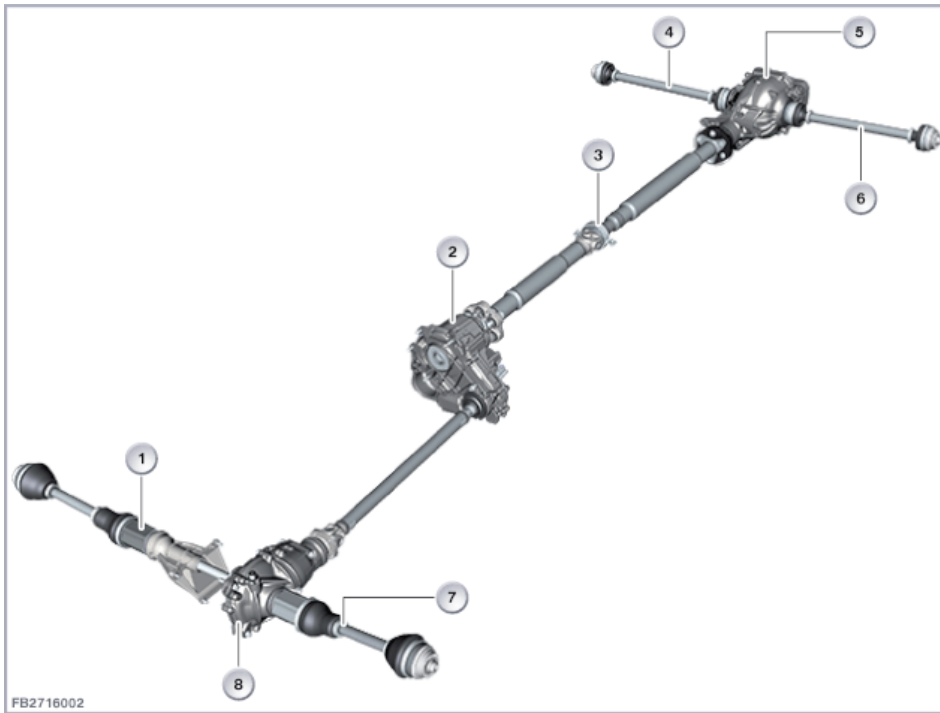
Notice!



In the case of the G70, the transfer box ATC14-1 (maximum 1400 Nm) is used.

Differences between ATC14-1 and ATC13-2:

- Central bearing (bolting point in the vehicle with the transmission cross member)
- New generation for the multidisc clutch
- Oil drain plug



Index	Explanation	Index	Explanation
1	Drive shaft front right	2	Transfer box ATC13-2
3	Propeller shaft	4	Drive shaft rear right
5	Rear axle differential	6	Drive shaft rear left
7	Drive shaft front left	8	Front axle differential

Transfer Box

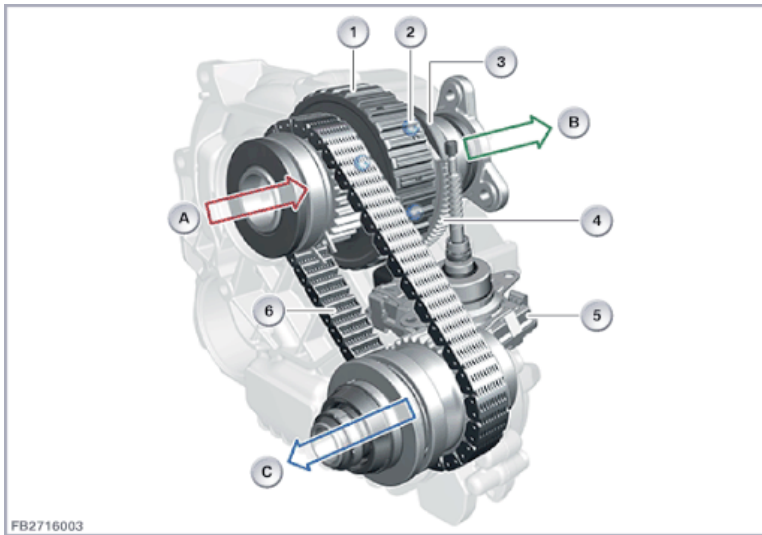
By using the multi blade clutch in the transfer box, the torque can be distributed between the two axles within certain limits. At the transfer box, the torque distribution to the two drive axles is divided evenly, 50:50 in each direction. For the calculation, however, additional important parameters come into consideration, such as the different values for the wheel slip. For varying wheel slip of the two drive axles, a torque distribution of 50 to 50 is no longer possible. In this case, the drive torques have a variable distribution in the range between 0 and 100 or 100 to 0, corresponding to the driving situation.

When the multidisc clutch is open, the entire torque is forwarded to the rear axle. To ensure the ability to transfer the torque to the front axle, the multidisc clutch must be closed.

The transmission torque is calculated in the Dynamic Stability Control (DSC) and forwarded via FlexRay to the transfer box (VTG) control unit. The transfer box (VTG) control unit calculates an angle to be adjusted at the geared ring from the requested transmission torque. The torque required for control is generated by an electric motor.

Depending on the required torque distribution, the contact pressure of the multidisc clutch increases.

The control unit for transfer box (VTG) is installed on the bottom of the servomotor for the multidisc clutch.



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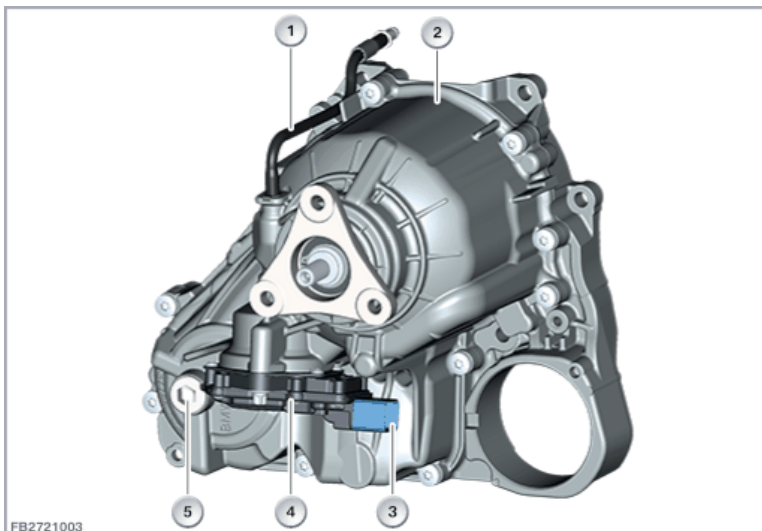
Example transfer box Active Torque Control 13-1

Index	Explanation	Index	Explanation
A	Drivetrain from the transmission	B	Output to the rear axle
C	Output to the front axle		
1	Multidisc clutch	2	Balls (3 pcs.)
3	Bearing ramp	4	Geared ring
5	Control unit transfer box (VTG)	6	Chain

VTG control unit

The VTG control unit is directly attached to the transfer box. The VTG control unit is connected to the vehicle electrical system via a 11-pin plug connection.

The VTG control unit is a bus user on the FlexRay network.



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Example ATC13-2

Index	Explanation	Index	Explanation
1	Tank vent line	2	Transfer Box
3	11-pin plug connection	4	Control unit transfer box (VTG)
5	Oil filler plug		

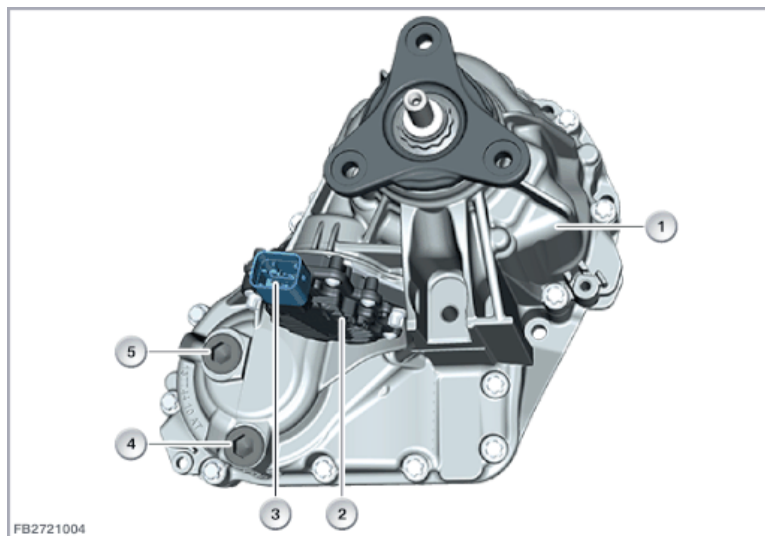


Notice!

Using the filler plug, both transfer box oil is topped up and transfer box oil is renewed.

To ensure complete emptying and filling of the transfer box, the service function "Oil change" must be carried out with the diagnostic system before removal and after installation of the transfer box.

Observe repair instructions.



Example ATC14-1

Index	Explanation	Index	Explanation
1	Transfer Box	2	Control unit transfer box (VTG)
3	11-pin plug connection	4	Oil drain plug
5	Oil filler plug		



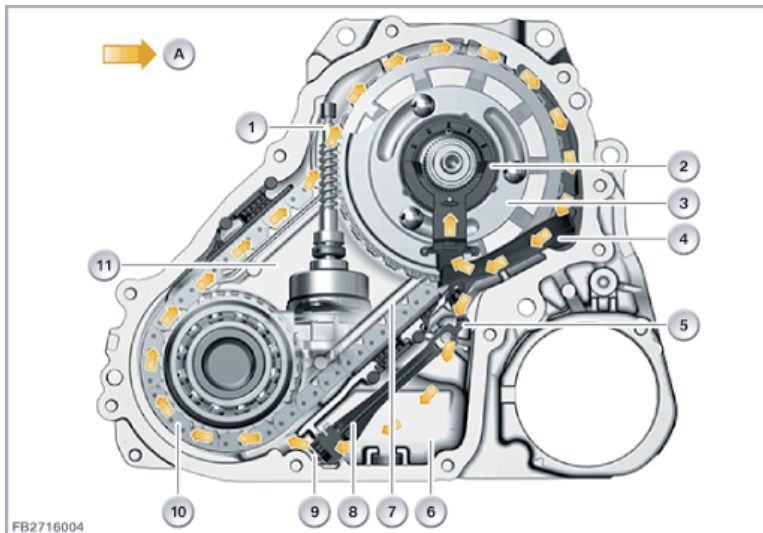
Notice!

The transfer box ATC14-1 also has an oil drain plug.

Consumption-optimized xDrive

By reducing the drag torques, the xDrive is optimized for consumption. This serves to increase efficiency. Intelligent control of the all-wheel-drive system is used to open the multidisc clutches of the transfer box based on the driving situation. This allows a reduction in lubrication in the transfer box.

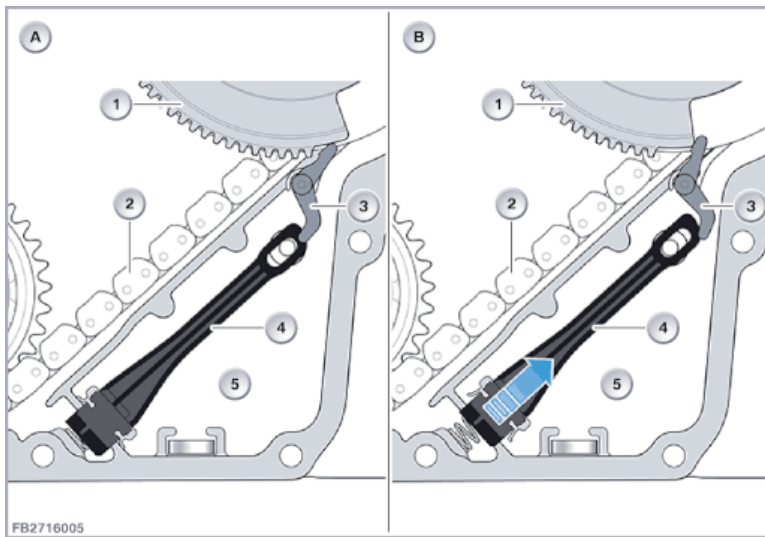
The low fill level of the oil eliminates losses from splashing that are caused by the dipping of the rotating multidisc clutch. This improves gas mileage as well as wear of the multidisc clutch.



Index	Explanation	Index	Explanation
A	Oil circuit		
1	Worm shaft	2	Lock for the multidisc clutch
3	Geared ring	4	Engine oil line with expansion tank
5	Gearshift shaft (oil bulkhead operation)	6	Oil chamber 2
7	Overflow	8	Oil bulkhead (lock between the oil chambers)
9	Spring	10	Chain
11	Oil chamber 1		

The oil partition is closed when there is no torque request being made to the transfer box (multidisc clutch open). The oil partition has the task of storing the oil in oil chamber 2. The oil partition is implemented using a lever that is located in the housing. An elastomer seal thereby closes an opening.

A gearshift shaft that is moved by the geared ring actuates the oil partition and keeps it in the designated position. As a result, the oil chambers are closed off from each other, which reduces the losses from splashing to a minimum. To ensure the lubrication of bearings and sealing rings, a defined volume of oil always remains in circulation. This is ensured by an overflow between the first oil chamber and the second.



Index	Explanation	Index	Explanation
A	Oil bulkhead closed	B	Oil bulkhead opened
1	Geared ring	2	Chain
3	Gearshift shaft (oil bulkhead operation)	4	Oil bulkhead (lock between the oil chambers)
5	Oil chamber 2		

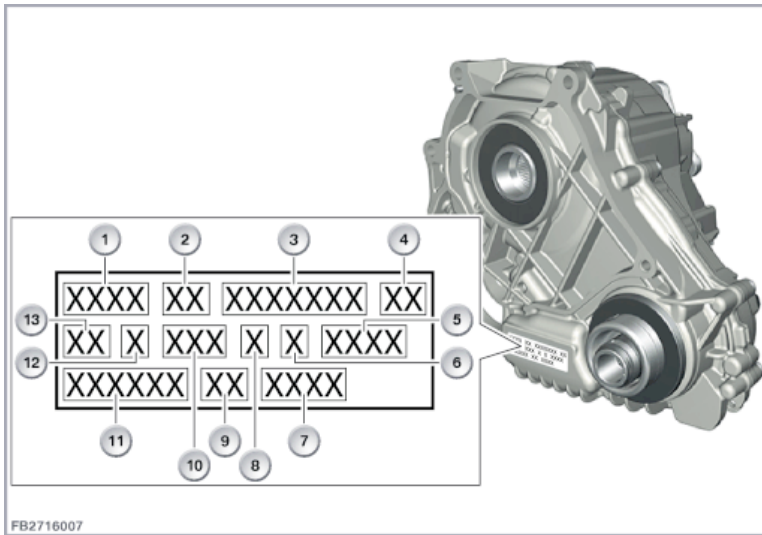
Please also find a video explaining the function of the oil partition here:

[Download video](#)

Classification of the transfer box

Due to the permitted tolerances of the various components of the transfer box, it is for instance the case that the stroke of the ball ramp for closing the multidisc clutch in the transfer box is different. However, the tolerances can be equalized using an adjusted actuation of the electric motor upon closing the multidisc clutch. To do so, the classification of the tolerances must be entered into the control unit of the transfer box (VTG).

The respective tolerance is determined during production and engraved on the transfer box.



FB2716007

Index	Explanation	Index	Explanation
1	Unified Parts Group	2	Installation location identification
3	Part number	4	Revision index
5	Production counter	6	Manufacturer identification
7	Classification	8	Installation location
9	Factory identification	10	Production day
11	Supplier number	12	Client
13	Production year		



Notice!

During service, the tolerance can be determined in the following way:

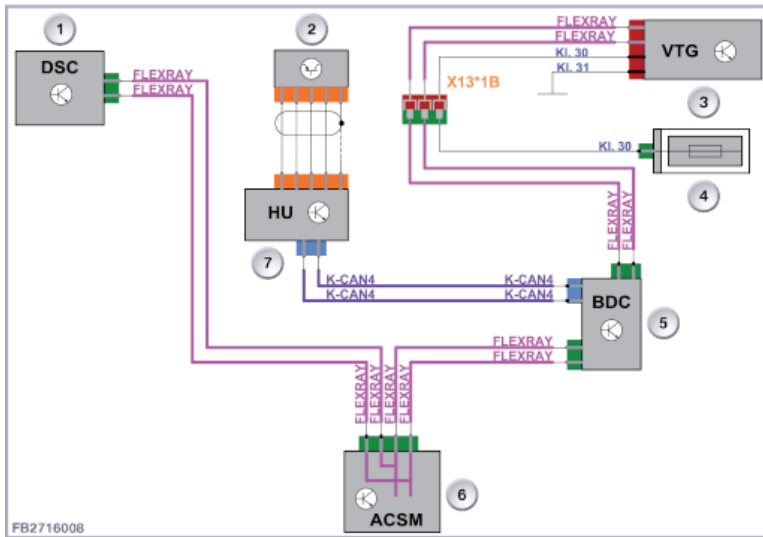
- Reading the classification of the tolerance from the transfer box
- Reading out the classification via the diagnostic system

The four-digit classification can be entered into the transfer box control unit (VTG) using a service function in the diagnostic system. To ensure that this transfer box control unit is accepted, the classification must lie within a stored range.

System functions

For actuation of the transfer box, the networking of a few control units is necessary.

The VTG control unit is a bus user on the FlexRay network.



FB2716008

Example service pack 2018

Index	Explanation	Index	Explanation
1	Dynamic Stability Control (DSC)	2	Central information display (CID)
3	Control unit transfer box (VTG)	4	Front power distribution
5	Body Domain Controller (BDC)	6	Crash Safety Module (ACSM)
7	Head unit		

The VTG control unit regulates the locking torque at the multidisc clutch in the transfer box in response to the following factors:

- Demand for required locking torque (comes from the DSC control unit)
- Condition of the transmission oil (calculated in the VTG control unit).
- Multidisc clutch wear (calculated in the VTG control unit).
- Load on servomotor (calculated in the VTG control unit)
- Transmission oil temperature (calculated in the VTG control unit).

The VTG control unit supplies the following information to the DSC control unit:

- The locking torque currently set
- All calculated data

All-wheel control with M xDrive

The innovative M xDrive drive system is used, which is optimized with respect to driving dynamics and traction.

The new M xDrive drive technology combines the typical M agility and precision of the standard drive with the traction advantages of all-wheel technology.

5 configurations cover a very broad range of dynamic driving situations. When the DSC control system is deactivated, 3 M xDrive modes permit individual configuration, even as far as rear-wheel drive only.

The agile rear-biased design is achieved as follows: M xDrive only gets the front axle involved when the rear wheels reach their limits for power transmission and additional tensile force is required. Even with a very sporty driving style and high performance, the vehicle behaves predictably with M xDrive and can be controlled effortlessly by the driver.

There are 5 different configurations available to the driver, which are based on combinations of the modes of the DSC (DSC on, M Dynamic Mode, DSC off) and the modes of M xDrive (all-wheel drive, all-wheel drive Sport Mode, rear-wheel drive).

As a result, the new drive technology offers driving dynamics that are unrivaled in this vehicle segment and that are correlated with unrestricted suitability for everyday use. This is made possible by central intelligence with M-specific software for the integrated control of longitudinal dynamics and transverse dynamics through Dynamic Stability Control (DSC). As a result, an optimum is reached in each of the different configurations. M xDrive allows the conventional qualities of the standard drive to be combined with the benefits of the sporty design of the BMW xDrive.

Note for service

The transfer box control unit and servomotor cannot be replaced individually. They must be replaced together.



Notice!

The diagnostic system makes a service function available for renewing the transfer box of the servomotor with the control unit for transfer box:

Path: Service functions > drive > transfer box VTC

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