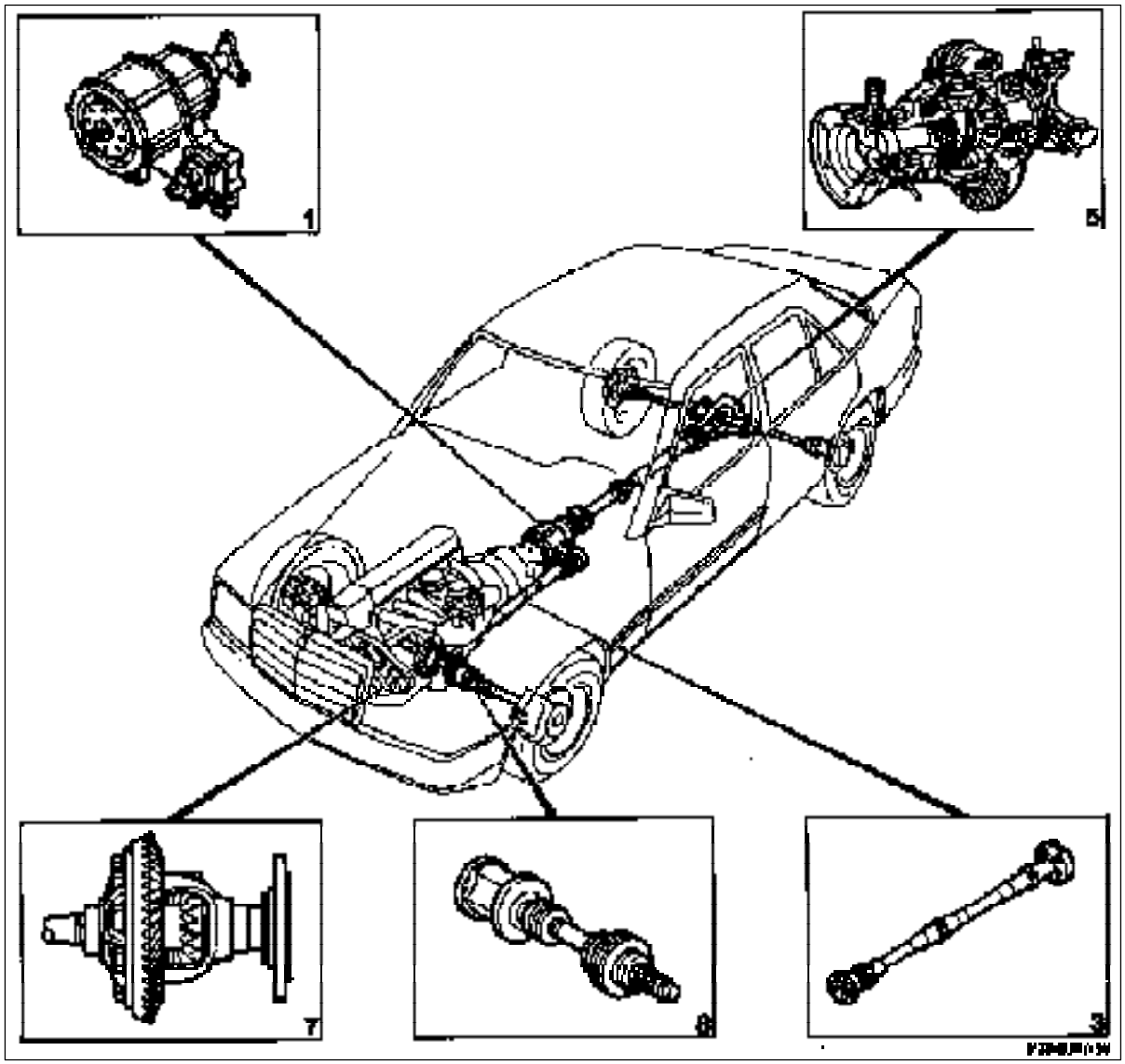
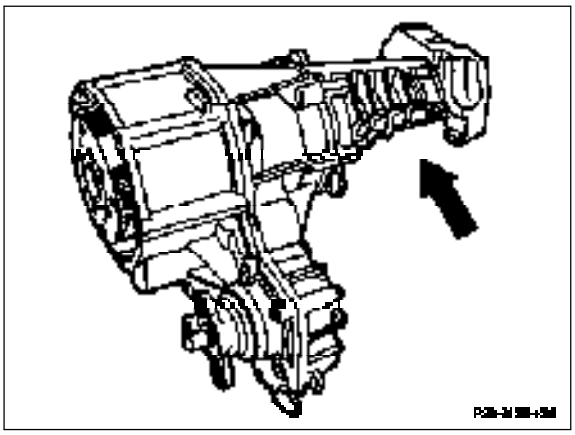
Mechanical components

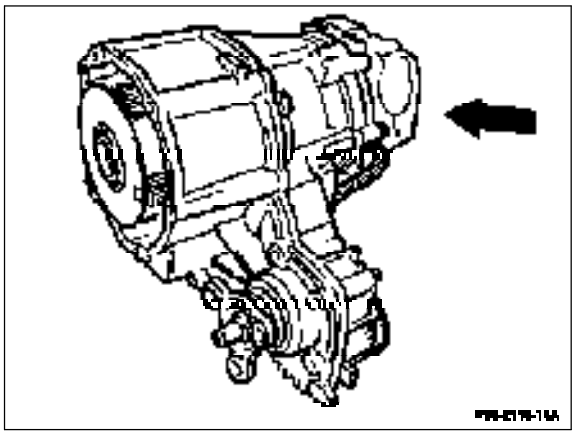


1	Transfer case	7	Front axle differential
3	Front-wheel drive propeller shaft	8	Front axle shaft
5	Rear axle differential (ASD)		

Function of mechanical components
Transfer case
The transfer case distributes the power flow to the front and rear axle. There are two versions:
For models with manual transmission: transfer case with long rear cover (arrow).



For models with automatic transmission: transfer case with short rear cover (arrow).

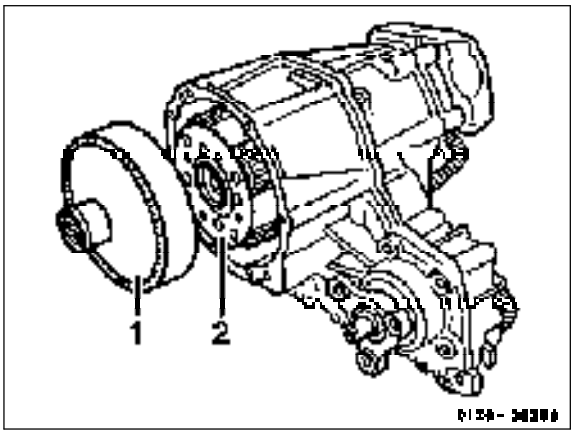


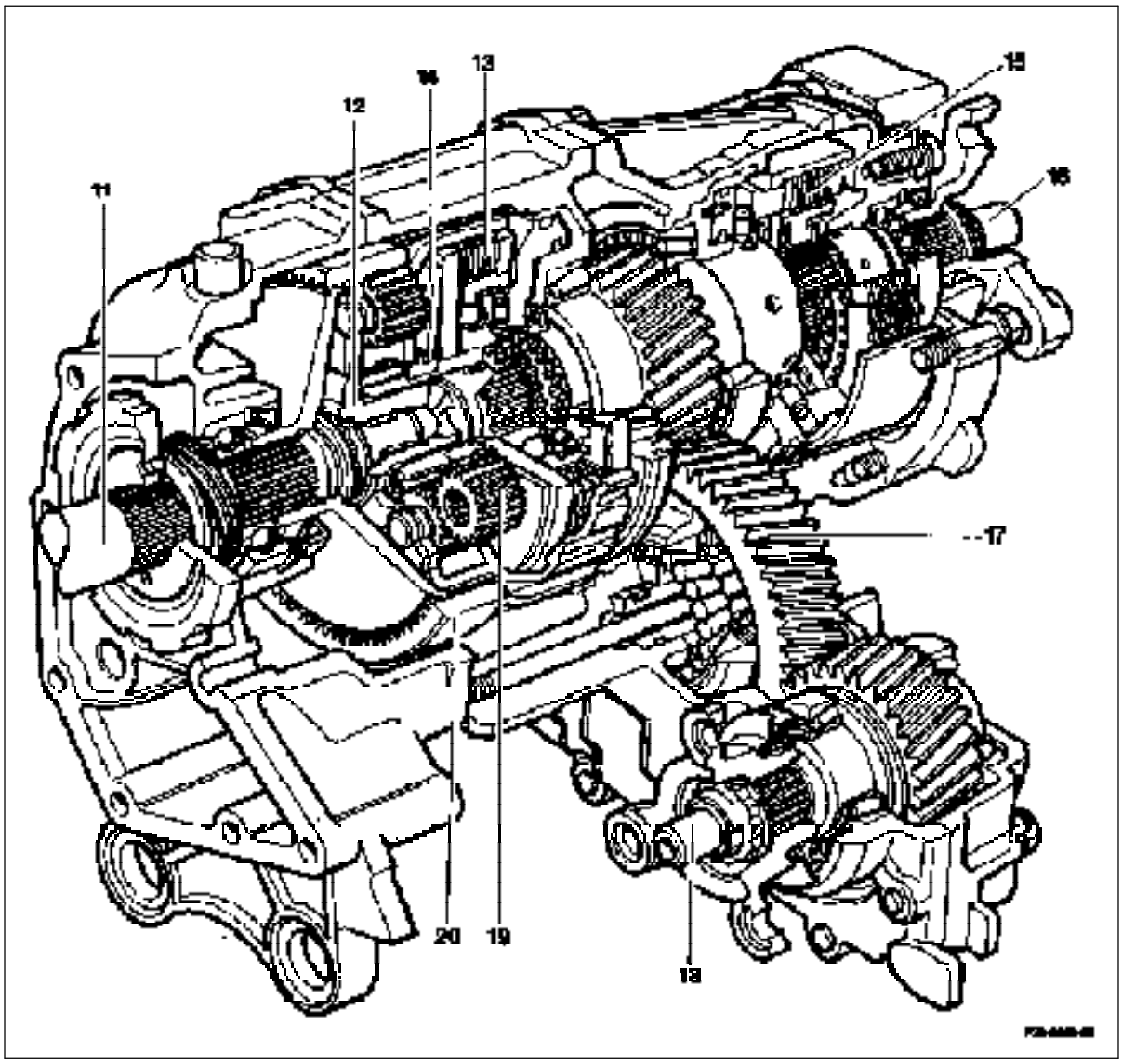
Note
As of transfer case no. 7 013 a center differential (2) with modified teeth (straight) has been installed in the transfer case. At the same time, the manual and automatic transmissions are fitted with a suitably modified internally-geared wheel (1).

As of transfer case no. 18 640, an helically geared planetary gear train (center differential and internally-geared wheel) has been installed on vehicles with automatic transmission.

For models 124.333 and 124.393:
Transfer case with short cover and 4-arm joint flange.

For description of shift processes, refer to section on power distribution in this chapter.





11	Transmission output shaft
12	Center differential
13	Multi-disk clutch - center differential lock (ZS)
14	Diaphragm spring
15	Multi-disk clutch - front axle drive train (AV)
16	Drive shaft - rear axle drive train
17	Auxiliary drive
18	Auxiliary drive shaft - front axle drive train
19	Planet gears - center differential
20	Internal-geared wheel - center differential

Center differential (12)

Drive moment reaches from the transmission output shaft (11) via toothing to the internal-geared wheel of the center differential (20). The planetary gear train of the center differential (12) distributes the drive moment to the front and rear wheels depending on the shift condition of the multi-disk clutches of the center differential lock (ZS) (13) and front axle drive train (AV) (15).

Multi-disk clutch of center differential lock (ZS) (13)

The multi-disk clutch of center differential lock (ZS) (13) brakes the planet carrier of the center differential (12), so this is directly driven by the internal-geared wheel. The planet carrier is connected rigidly to the output shaft of the rear axle drive train (16).

The multi-disk clutch is held in the closed position (engaged by friction) by a stiff diaphragm spring (14). It is released by oil pressure.

Through this design of multi-disk clutch it is ensured that the vehicle can be driven by rear-wheel drive even in the event of a fault.

Multi-disk clutch, front axle drive train (AV) (15)

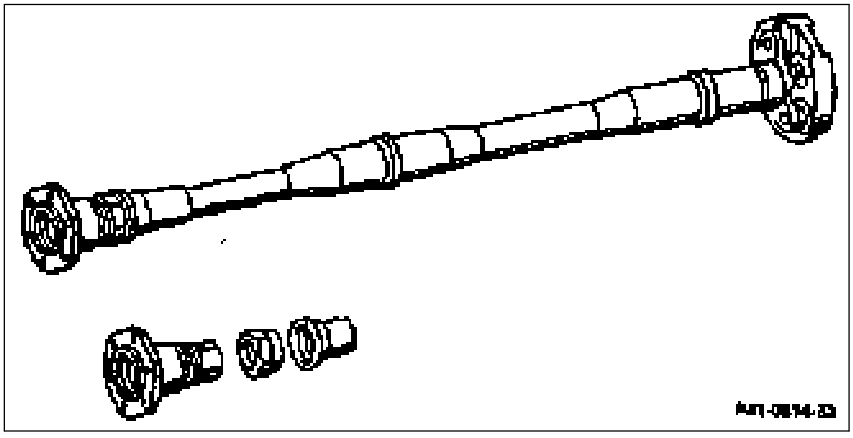
The multi-disk clutch for the front axle drive train (AV) (15) is closed by oil pressure. In this way the drive moment is led to the auxiliary drive (17).

Front-wheel drive and oil supply

The transfer case has its own oil supply for lubrication and heat transfer.

The two gears (lower) for power transmission to the front-wheel drive also operate as an oil pump. They supply the oil from the oil pan beneath the auxiliary drive through an outer oil line on the transfer case to the bearing points and to lubricate the multi-disk clutches.

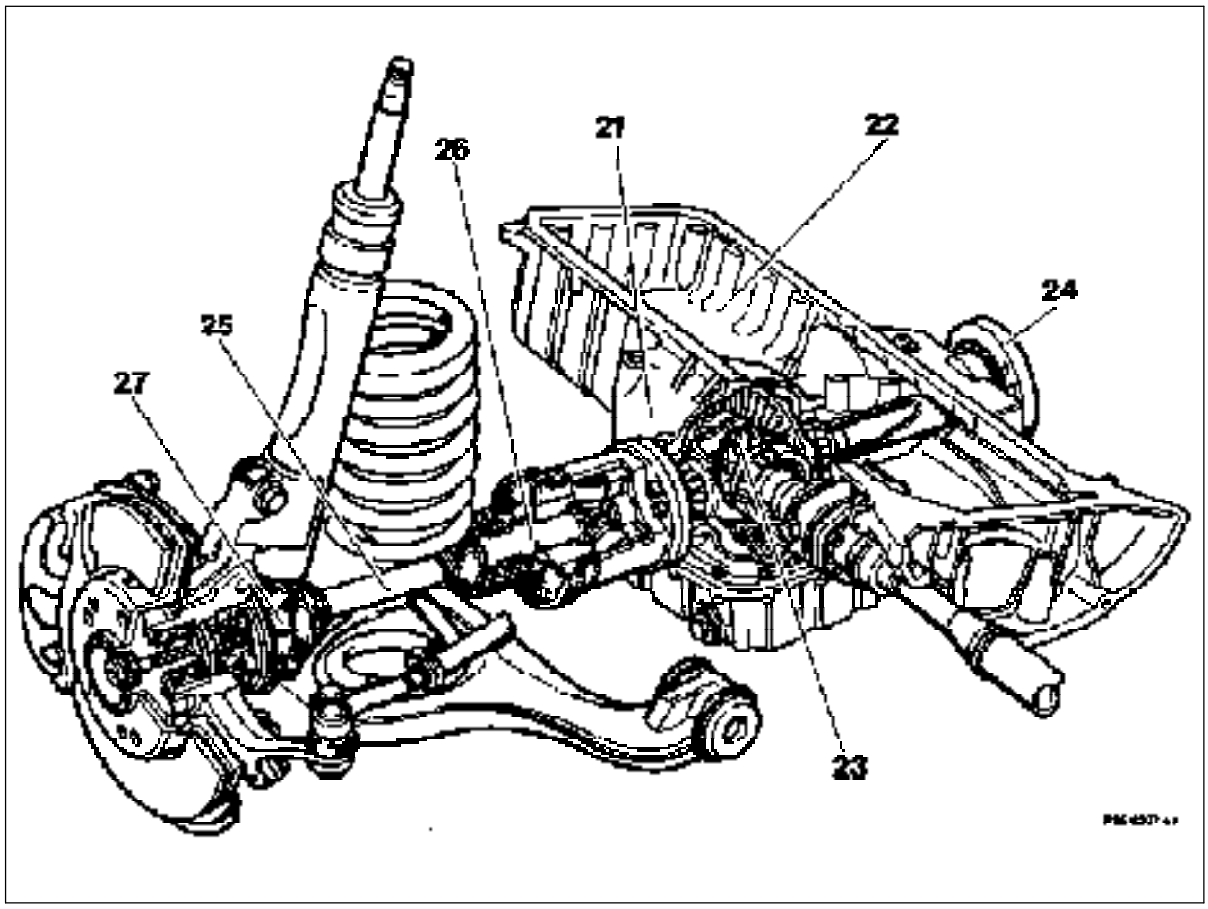
Propeller shaft to front-wheel drive



The propeller shaft connects the transfer case to the front axle differential.

The length of the propeller shaft differs for manual and automatic transmission.

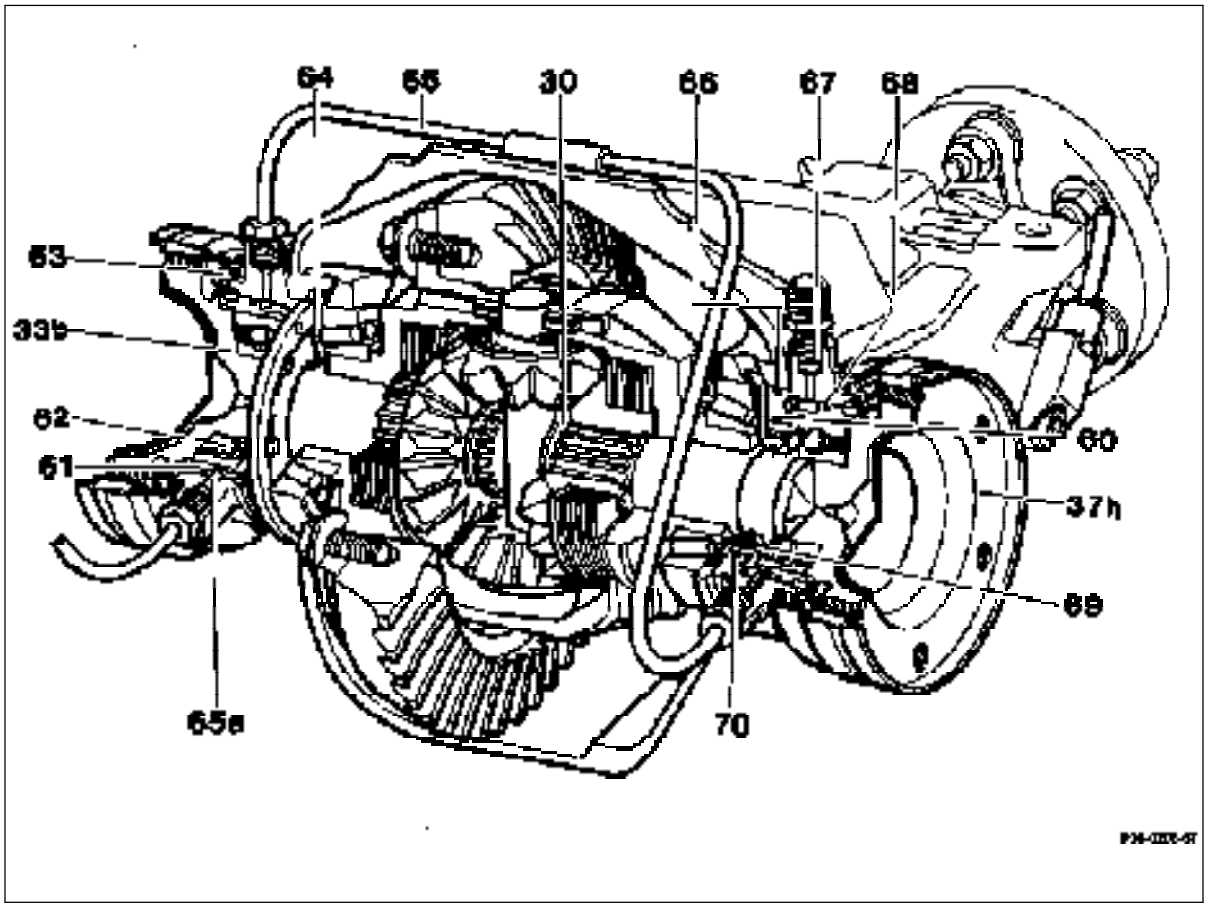
It is secured on the transfer case by a flexible disk and on the front axle differential by a sliding part for the length differential.



21	Front axle casing	25	Front axle shaft
22	Engine oil pan	26	Inner joint
23	Wheel set with differential	27	Outer joint
24	Connecting flange		

The front axle casing (21) and the engine oil pan (22) form one unit. The front axle casing contains the gear set with differential (23). The oil compartments are separated from the differential and engine. The shaft to the right connecting flange (24) leads through the engine oil pan and is partitioned off at this oil compartment by a protecting tube. The front axle shafts (25) have a different length on the left and the right. The inner joint (26) is a sliding joint (tripod joint), which compensates for axial displacements and angle changes during suspension compression. The outer joint (27) is a rigid joint (Rzeppa joint), which permits steering lock and jount changes; in addition this joint secures the front axle shaft in the axial direction. The damper strut front axle has been retained in principle. Parts of the wheel control have been revised for front-wheel drive. Two of the lower coils on the front springs are fully extended. The front axle shafts lead to the front wheels through the resultant space.

Automatic locking differential of rear axle (ASD)



30	Circlip
33b	Connecting flange
37h	Closing plate for H shaft
60	Ring cylinder
61	Annular piston
62	Grooved ball bearing
63	Cup seal
64	Oil baffle
65	Hydraulic line
65a	Clamping sleeve
66	O-ring (80 x 2)
67	Breather
68	O-ring (72 × 3)
69	Radial sealing ring
70	O-ring (63 × 2,5)
71	Rear axle casing
72	Multi-disk stack

O-rings (66) provide the sealing between the rear axle casing (71) and ring cylinders (60). The connecting flanges (33b) are sealed in the ring cylinders (60) via radial sealing rings (69). The grooved ball bearings (62) in the annular pistons (61) are sealed laterally and filled with long-life lubricant.

To ensure a reliable oil supply to the taper roller bearings of the differential and the connecting flange (33b) in the differential, an oil baffle (64) is installed on each side.

Connecting flange (33b)

The connecting flange (33b) had to be extended due to accommodating the grooved ball bearing (62) in the ring cylinder. The grooved ball bearing is pressed on to the connecting flange (33b).

Rear axle shaft

The rear axle shafts are shorter than on vehicles without ASD due to the arrangement of the ring cylinders and connecting flange.

Ring cylinder (60)

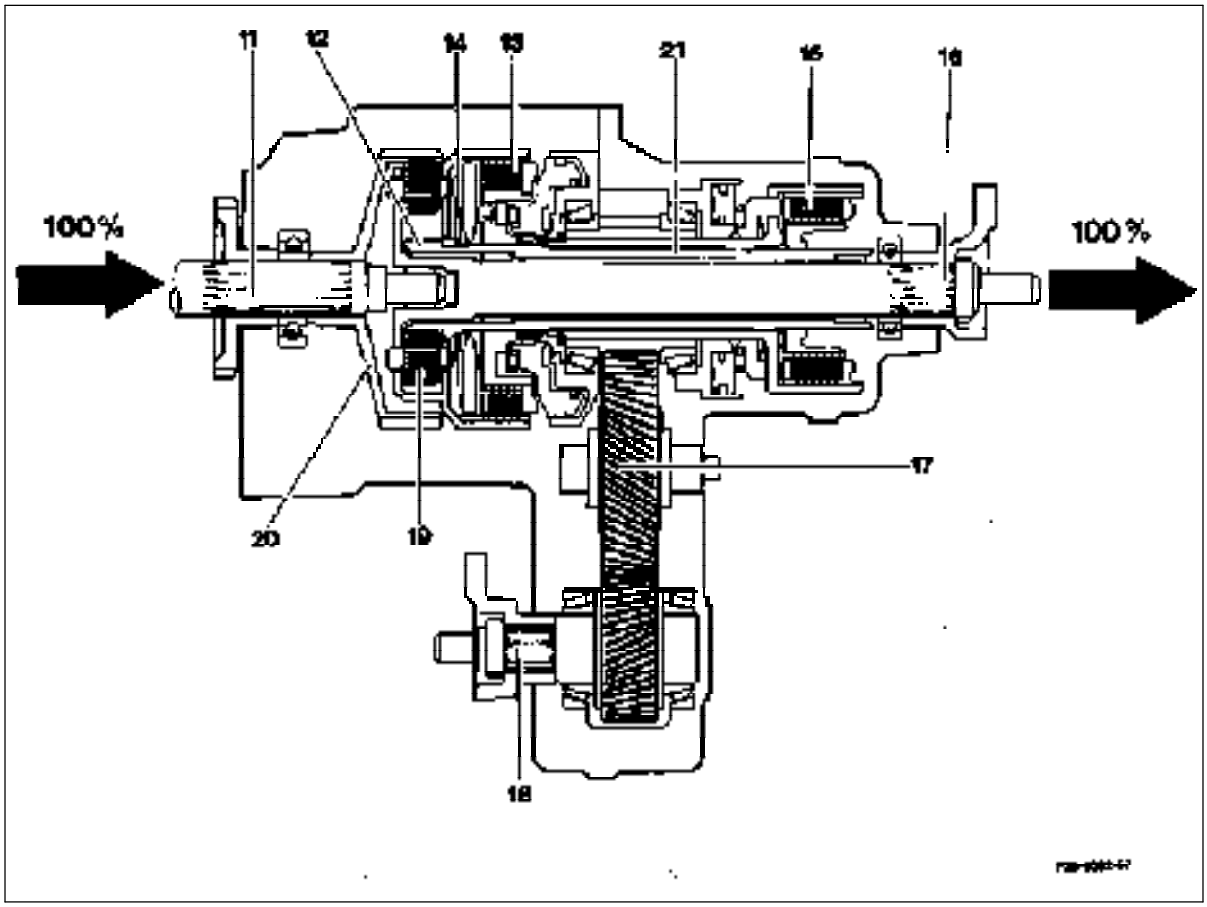
The ring cylinders (60) are secured laterally on the rear axle casing (71) with two M8 hexagon socket bolts. The annular piston (61) is sealed at the ring cylinder housing by two O-rings (68 and 70). To protect against dust and moisture, the annular piston (61) is protected at the ring cylinder housing by a pressed-on cup seal (63).

Method of operation of ring cylinders (60):

By applying hydraulic pressure to the annular piston (61) in the ring cylinders (60), the two annular pistons (61) move upwards simultaneously. The resultant force is transmitted to the differential side gears via the grooved ball bearing (62), connecting flange (33b) and the circlips (33) and compresses the multi-disk stack (72).

Power flow distribution

Shift stage 0 - rear-wheel drive

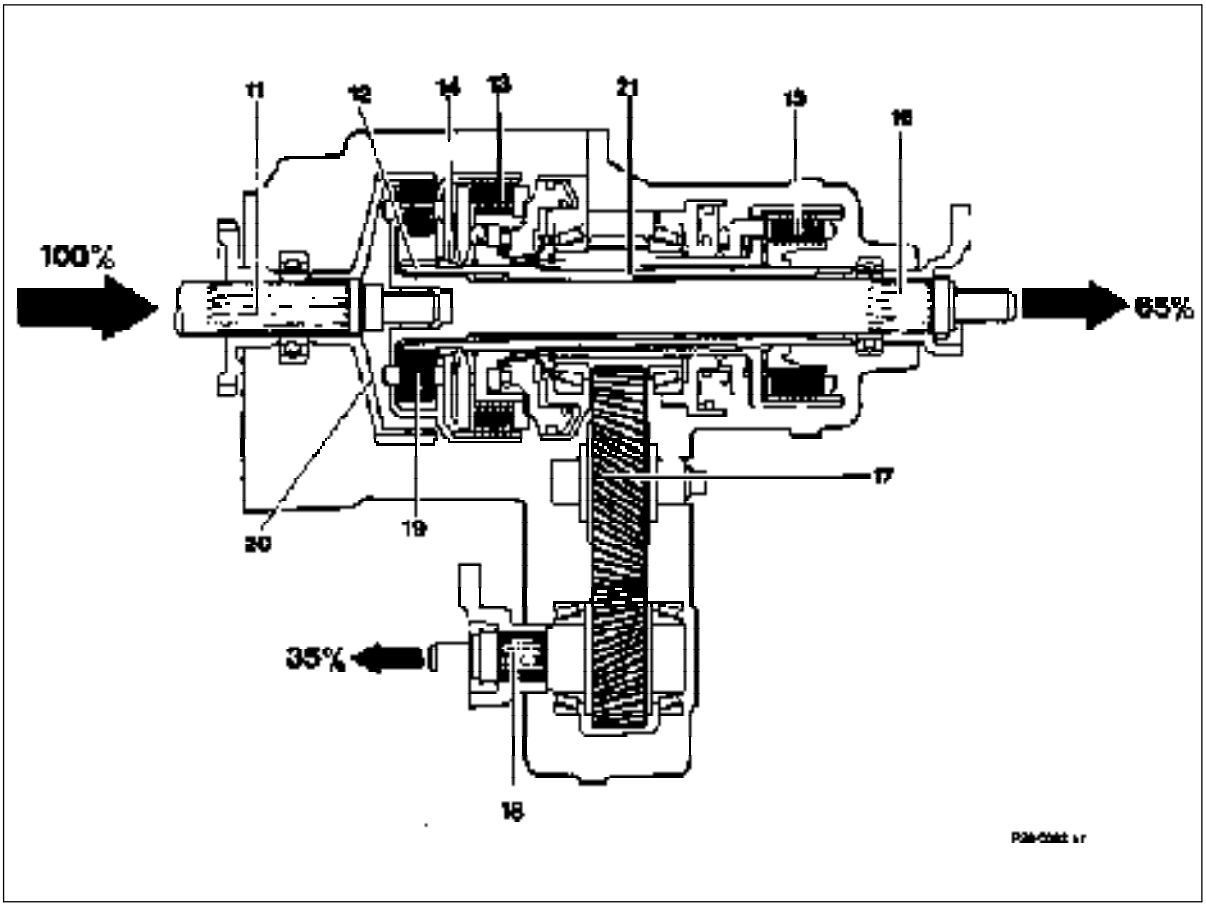


11	Transmission output shaft
12	Center differential
13	Multi-disk clutch - center differential lock (ZS)
14	Diaphragm spring
15	Multi-disk clutch - front axle drive train (AV)
16	Output shaft, rear axle drive train
17	Auxiliary drive
18	Auxiliary drive shaft, front axle drive train
19	Planet gears - center differential
20	Internal-geared wheel, center differential
21	Intermediate shaft

The multi-disk clutch of the center differential lock (ZS) (13) is closed. In this way the planet carrier is connected to the sun gear and the differential is locked. The planet gears of the center differential (19) circulate without differential movement. The entire drive output is transmitted to the output shaft of the rear axle drive train (16), to which the planet carrier is rigidly connected.

The multi-disk clutch of the front axle drive train (AV) (15) is released, thus the intermediate shaft (21) connected to the sun gear cannot transmit any torque to the auxiliary drive shaft of the front axle drive train (18). A pilot pressure of approx. 1.3 bar on the multi-disk clutch of the front axle drive train (AV) (15) ensures a rapid operation when the multi-disk clutch is engaged.

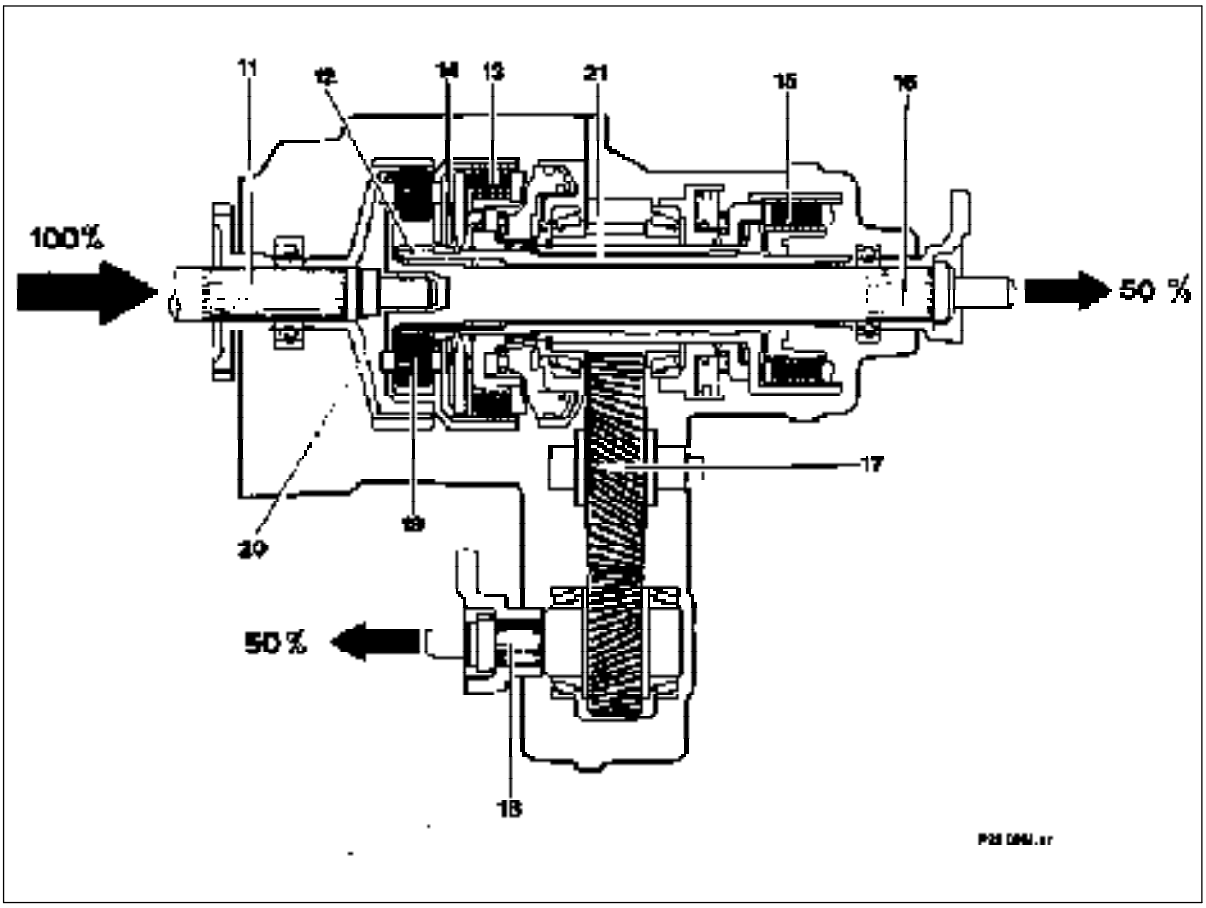
Shift stage 1 - compensated four-wheel drive



11	Transmission output shaft	16	Output shaft, rear axle drive train
12	Center differential	17	Auxiliary drive
13	Multi-disk clutch - center differential lock (ZS)	18	Auxiliary drive shaft, front axle drive train
14	Diaphragm spring	19	Planet gears - center differential
15	Multi-disk clutch - front axle drive train (AV)	20	Internal-geared wheel, center differential
		21	Intermediate shaft

The multi-disk clutch of the center differential lock (ZS) (13) is open. The planet gears of the center differential (19) are free and can act as a differential. The multi-disk clutch of the front axle drive train (AV) (15) is closed and the drive moment reaches the auxiliary drive (17) via the intermediate shaft (21). The drive moment is branched via the center differential (12). The ratio is selected so that in the case of compensated four-wheel drive, 65% of the drive output is transmitted to the rear-wheel drive and 35% to the front-wheel drive. To improve driving stability and to prevent the engine overspeeding when the system engages, the inter-axle locked condition (shift stage 2) is engaged briefly by the multi-disk clutch of the front axle drive train (AV) (15) closing, shortly before the multi-disk clutch of the center differential lock (ZS) (13) opens.

Shift stage 2 - four-wheel drive locked inter-axle



11	Transmission output shaft	16	Output shaft, rear axle drive train
12	Center differential	17	Auxiliary drive
13	Multi-disk clutch - center differential lock (ZS)	18	Auxiliary drive shaft, front axle drive train
14	Diaphragm spring	19	Planet gears - center differential
15	Multi-disk clutch - front axle drive train (AV)	20	Internal-geared wheel, center differential
		21	Intermediate shaft

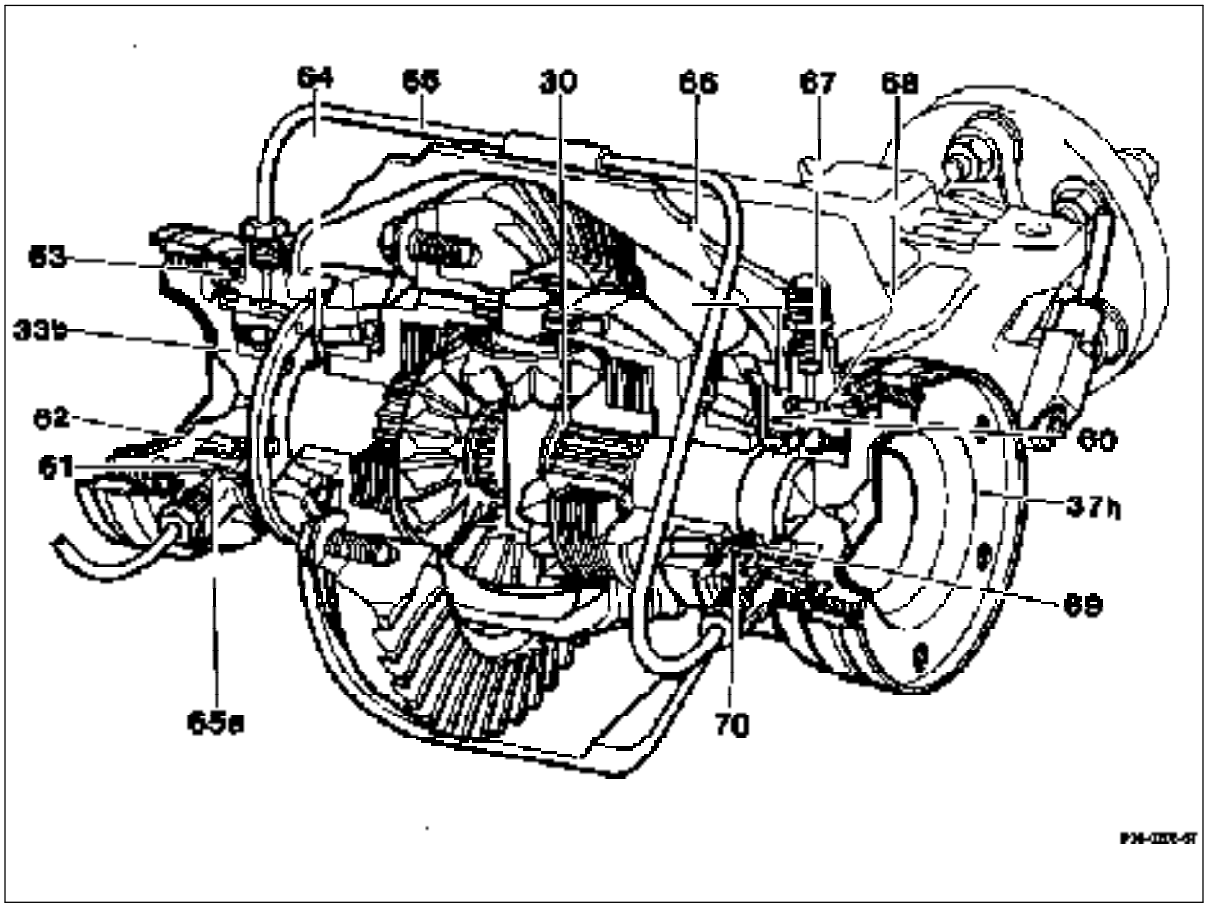
The multi-disk clutches of the center differential lock (ZS) (13) and the front axle drive train (AV) (15) are closed.

The center differential (12) is locked.

The drive moment of the transmission output shaft (11) is transmitted to the output shaft of the rear axle drive train (16) via the planet carrier and to the auxiliary output shaft of the front axle drive train (18) via the sun gear.

The torque distribution corresponds to the instantaneous traction conditions at the front and rear wheels. Thus a maximum of 50% of the drive output can be transmitted to the front-wheel drive.

Shift stage 3 - four-wheel drive locked inter-axle and inter-wheel



30	Circlip	65a	Clamping sleeve
33b	Connecting flange	66	O-ring (80x2)
37h	Closing plate for H shaft	67	Breather
60	Ring cylinder	68	O-ring (72x3)
61	Annular piston	69	Radial sealing ring
62	Grooved ball bearing	70	O-ring (63x2,5)
63	Cup seal	71	Rear axle casing
64	Oil baffle	72	Multi-disk stack
65	Hydraulic line		

The multi-disk clutches of the center differential lock (ZS) and the front axle drive train (AV) are closed. The automatic locking differential of the rear axle is engaged.

In addition to shift stage 2, oil pressure is applied to the two annular pistons (61) of the automatic locking differential of the rear axle. With the connecting flanges (33b) they draw the differential side gears outwards. The contact force on the multi-disk stack (72) is thus increased. These connect the differential side gears to the differential and thus prevent a speed difference between the left and right rear wheel.

Testing mechanical components

Refer to Diagnosis Manual Chassis Volume 2 - 8.1, 4MATIC