

**Service Manual  
Maintenance, Tuning, Unit Replacement  
Passenger Cars Starting August 1959**



Mercedes-Benz  
**service**

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Service

Service Manual  
Maintenance, Tuning, and Adjustment  
Fastener Torque Specifications

W116

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## Springs and Shock-Absorbers - Group 32

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# Springs and Shock-Absorbers

General Data, Dimensions, and Tolerances

Job No.

32-0

Modification: Models as from August 1965 added. Other Modifications are marked \*

## A. Tables Showing Permissible Combinations of Front Springs — Rear Springs — Compensating Spring — Shock Absorbers

### Cars with 1st Version Front Axle Support

Model 220 b up to Chassis End No. 023 660  
Model 220 Sb up to Chassis End No. 049 855

Model 220 SEb Sedan up to Chassis End No. 016 975  
Model 220 SEb Coupé up to Chassis End No. 016 938

Model	Front Spring Part No.	Associated front shock absorber Designation Part No.	Rear Spring Part No.	Compensating Spring Part No.	Associated rear shock absorber Designation Part No.
<b>Standard Springs</b>					
220 b	111321 09 04	Bilstein Type B 36 111 323 19 00 <sup>6)</sup>	110 324 10 04	110 329 04 01	Bilstein Type B 46 111 326 03 00 <sup>*</sup> 108 326 00 00 <sup>6)</sup> *
220 Sb	111 321 08 04 <sup>1)</sup>				
	111 321 09 04 <sup>2)</sup>				
220 SEb Sedan	111 321 11 04 <sup>3)</sup>				
	111 321 12 04 <sup>4)</sup>				
220 SEb Coupé	111 321 13 04 <sup>5)</sup>				
<b>Harder Shock-Absorbers (only for Subsequent Installation)</b>					
220 b 220 Sb 220 SEb	standard	Bilstein Type B 36-001 111 323 18 00 <sup>*</sup> 108 323 00 00 <sup>6)</sup> *	standard	standard	Bilstein Type B 46 111 326 02 00 <sup>*</sup> 108 326 01 00 <sup>6)</sup> *
<b>Special Version: Harder Springs for Bad Road Conditions</b>					
220 b 220 Sb 220 SEb Sedan and Coupé	111 321 10 04	Replacement Bilstein Type B 36 111 323 18 00 <sup>*</sup> 108 323 00 00 <sup>6)</sup> *	110 324 12 04	110 329 05 01	Bilstein Type B 46 111 326 02 00 <sup>*</sup> 108 326 01 00 <sup>6)</sup> *
<b>Special Version: Harder Springs for Police Radio Cars (For Ordinary Conditions)<sup>7)</sup></b>					
220 b 220 Sb 220 SEb Sedan	111 321 10 04	Bilstein Type B 36 111 323 10 00 Replacement 111 523 18 00 108 323 00 00 <sup>6)</sup> *	110 324 12 04	110 329 05 01	Bilstein Type B 46 111 326 02 00 <sup>*</sup> 111 326 01 00 <sup>6)</sup> *

Note: When installing the springs, please check with the tables "Springs, Corresponding Color Code".  
For footnotes see page 31-0/2.

32-0/1

Footnotes to Table on page 32-0/1

1) 1st version; installed as standard part up to Chassis End No. 017 497.

2) 2nd version; installed as standard part as from Chassis End No. 017 498.

These front springs can be installed subsequently in cars up to Chassis End No. 017 497 if a slightly harder spring system is required. If 1st or 2nd version front springs are installed (see Table "Test Values"), it is necessary to increase the height of the specified rubber washer (see Table "Front Springs, Corresponding Color Code") by installing a rubber washer of 3 mm thickness. This is necessary in order to obtain a correct control arm position of the front axle.

Since it is not permissible for the rubber washer to exceed a height of 12 mm, the following instructions for the subsequent installation of 1st and 2nd version springs must be observed: In the case of Sedans and Sedans with sliding roof use only springs with red and blue color code, and in the case of Sedans with sliding roof and automatic clutch use only springs with a blue color code.

When 3rd version springs (see Table "Test Values") are used, the rubber washers specified in the Table "Front Springs, Corresponding Color Code" can be used.

On Model 220 Sb the front springs Part No. 111 321 09 04 should be installed subsequently only together with the 2nd or 3rd version shock-absorbers. (Part Nos. 111 323 08 00 or 111 323 09 00).

3) 1st version; installed as standard part up to Chassis End No. 001 938.

4) 2nd version; installed as standard part from Chassis End Nos. 001 939 to 003 029.

5) 3rd version; installed as standard part as from Chassis End No. 003 030.

6) Replacement shock-absorbers for the previous versions with the color codings 1 green line, 2 green lines and 1 red line.

7) This combination can also be used for special purposes when the car is regularly driven with a very high trunk compartment load.

Cars with 2nd Version Front Axle \*

Model 220 b as from Chassis End No. 023 661  
 Model 220 Sb as from Chassis End No. 049 856

Model 220 SEb, Sedan as from Chassis End No. 016 976  
 Model 220 SEb, Coupé as from Chassis End No. 016 939

Model	Front Spring Part No.	Associated front shock-absorber Designation Part No.	Rear Spring Part No.	Compensating Spring Part No.	Associated rear shock-absorber Designation Part No.
<b>Standard Springs</b>					
190 c	110 321 08 04 <sup>1)</sup>	Bilstein Type B 36 111 323 19 00	110 324 10 04 <sup>1)</sup> 110 324 26 04 <sup>1)</sup> 110 324 30 04 <sup>2)</sup>	110 329 04 01 or 111 320 01 99 <sup>2)</sup>	Bilstein Type B 46 111 326 03 00 <sup>1)</sup> 108 326 00 00 <sup>2)</sup>
190 Dc	111 321 15 04				
200	110 321 08 04 <sup>1)</sup>				
200 D	111 321 15 04				
220 b	111 321 15 04	Bilstein Type B 36 111 323 18 00 <sup>1)</sup> 108 323 00 00 <sup>2)</sup>	110 324 10 04 <sup>1)</sup> 110 324 26 04 <sup>1)</sup> 110 324 30 04 <sup>2)</sup> 108 324 02 04 <sup>2)</sup>	110 329 04 01 or 111 320 01 99 <sup>2)</sup>	Bilstein Type B 46 111 326 02 00 <sup>1)</sup> 108 326 00 00 <sup>2)</sup>
220 Sb	111 321 15 04 <sup>1)</sup> 111 321 18 04 <sup>2)</sup>				
220 SEb Sed.	108 321 03 04 <sup>2)</sup>				
220 SEb/C	111 321 16 04 <sup>1)</sup> 111 321 18 04 <sup>2)</sup> 118 321 03 04 <sup>2)</sup>				
230	110 321 08 04 111 321 15 04 <sup>1)</sup>	Bilstein Type B 36 111 323 19 00	111 324 30 04 108 324 02 04 <sup>2)</sup>	111 320 01 99 <sup>2)</sup>	Bilstein Type B 46 111 326 03 00 <sup>1)</sup> 108 326 00 00 <sup>2)</sup>
230 S	111 321 15 04 108 321 03 04 <sup>2)</sup>				
250 S	108 321 03 04	Bilstein Type B 36 111 323 19 00	108 324 01 04 <sup>1)</sup> 108 324 02 04 <sup>2)</sup>	111 320 03 99 <sup>2)</sup>	Bilstein Type B 46 111 326 03 00 <sup>1)</sup> 108 326 00 00 <sup>2)</sup>
250 SE Sed.	103 321 03 04				
250 SE Cp.	108 321 01 04 <sup>1)</sup>				
250 SE Cb					
300 SEb	108 321 01 04	Bilstein Type B 36 111 323 18 00 <sup>1)</sup> 108 323 00 00			Bilstein Type B 46 111 326 02 00 <sup>1)</sup> 108 326 01 00 <sup>2)</sup>
230 SL	110 321 08 04 <sup>1)</sup> 113 321 04 04 <sup>2)</sup>	Bilstein Type B 36 113 323 00 00 <sup>1)</sup> 113 323 02 00 <sup>2)</sup>	113 324 03 04 <sup>1)</sup> 113 324 04 04 <sup>2)</sup>	113 329 03 01	Bilstein Type B 46 113 326 00 00 <sup>1)</sup> 113 326 02 00 <sup>2)</sup>
250 SL	113 321 04 04				
<b>Special Version: Harder Springs for Subsequent Installation</b>					
190 c to 250 SE	standard	Bilstein Type B 36 111 323 18 00 <sup>1)</sup> 108 323 00 00 <sup>2)</sup>	standard	standard	Bilstein Type B 46 111 326 02 00 <sup>1)</sup> 108 326 01 00 <sup>2)</sup>
<b>Special Version: Harder Springs for Bad Road-Conditions (higher car level)</b>					
190 c	110 321 10 04 <sup>1)</sup>	Bilstein Type B 36 111 323 18 00 <sup>1)</sup> 108 323 00 00 <sup>2)</sup>	110 324 12 04 110 324 33 04 <sup>1)</sup>	110 329 05 01 or 111 320 02 99 <sup>2)</sup>	Bilstein Type B 46 111 326 02 00 <sup>1)</sup> 108 326 01 00 <sup>2)</sup>
190 Dc	111 321 17 04 <sup>1)</sup>				
220 b	111 321 19 04 <sup>1)</sup>				
220 Sb	110 321 09 04 <sup>2)</sup>				
220 SEb Sed.	108 321 04 04 <sup>2)</sup>				
220 SEb/C	111 321 17 04 <sup>1)</sup> 111 321 19 04 <sup>1)</sup> 108 321 04 04 <sup>2)</sup> 108 321 02 04 <sup>2)</sup>			110 329 05 01 or 111 320 04 99 <sup>2)</sup>	

When installing the springs, please check with the tables „Springs, Corresponding Color Code“.

For footnotes see page 32-0/5

Model	Front Spring Part No.	Associated front shock-absorber Designation Part No.	Rear Spring Part No.	Compensating Spring Part No.	Associated rear shock-absorber Designation Part No.	
<b>Special Version: Harder Springs for Bad Road Conditions (higher car level)</b>						
200	110 321 10 04*)	Bilstein Type B 36 111 323 18 00*) 108 323 00 00*)	110 324 12 04 110 323 33 04*)	110 329 05 01 or 111 320 02 99*)	Bilstein Type B 46 111 326 02 00*) 108 326 01 00*)	
200 D	110 321 09 04 108 321 04 04*)					
230	110 321 10 04 110 321 09 04*)					
230 S	110 321 09 04 108 321 04 04*)					
250 S 250 SE Sed. 250 SE Cp	108 321 04 04 108 321 02 04*)			110 324 12 04*) 110 324 33 04*)		111 320 04 99*)
250 SE Cb. 300 SEb	108 321 02 04 108 321 06 04*)					
230 SL	113 321 05 04			standard		113 324 02 04
250 SL	113 321 08 04					
<b>Special Version: Harder Springs for Police Radio Cars and Special Purposes (higher car level)</b>						
190 c	110 321 10 04*)	Bilstein Type B 36 111 323 18 00*) 108 323 00 00*)	110 324 12 04*) 110 324 32 04*)	110 329 05 01 or 111 320 02 99*) or 111 320 04 99*)	Bilstein Type B 46 111 326 02 00*) 108 326 01 00*)	
190 Dc 220 b 220 Sb 220 SEb Sed.	111 321 17 04*) 111 321 19 04*) 110 321 09 04*) 108 321 04 04*)					
200	110 321 10 04					
200 D 230 230 S	110 321 09 04*) 108 321 04 04			110 324 32 04		111 320 02 99*) or 111 320 04 99*)
250 S 250 SE	108 321 04 04 108 321 02 04*)			110 324 21 04		111 320 04 99*)
<b>Special Version: Springs for Station Wagons</b>						
190 c	110 321 10 04*)	Bilstein Type B 36 111 323 18 00*) 108 323 00 00*)	110 324 22 04*) 110 324 28 04*)	110 329 06 01 or 111 320 04 99*)	Bilstein Type B 46 110 326 14 00*) 110 326 15 00*)	
190 Dc	110 321 09 04					
200	110 321 10 04*)					
200 D 230	110 321 09 04		110 324 32 04*)	111 320 04 99*)		
230 S	110 321 09 04 108 321 04 04*)					

When installing the springs, please check with the tables "Springs, Corresponding Color Code".

For footnotes see page 32-0/5.



Model	Front Spring Part No.	Associated front shock-absorber Designation Part No.	Rear Spring Part No.	Compensating Spring Part No.	Associated rear shock-absorber Designation Part No.
<b>Special Version: Springs for Ambulances</b>					
190 c	110 321 10 04 <sup>1)</sup>	Bilstein Type B 36 111 323 18 00 <sup>1)</sup> 108 323 00 00 <sup>2)</sup>	110 324 21 04	110 329 C5 C1 or 111 320 04 99 <sup>3)</sup>	Bilstein Type B 46 110 326 10 00 <sup>1)</sup> 110 326 12 00 <sup>1)</sup> 110 326 14 00 <sup>1)</sup> 110 326 15 00 <sup>2)</sup>
190 Dc 220 b 220 Sb	110 321 09 04				
200	110 321 10 04 <sup>1)</sup>			111 320 04 99 <sup>3)</sup>	Bilstein Type B 46 110 326 14 00 <sup>1)</sup> 110 326 15 00 <sup>2)</sup>
200 D 230 230 S	110 321 09 04				

When installing the springs, please check with the tables "Springs, Corresponding Color Code".

Footnotes to tables on pages 32-0/3, 4 and 5

- 1) Previous version.
- 2) Present-day version and replacement for previous versions.
- 3) Hydropneumatic compensating spring.
- 4) These springs should be used when the car is equipped with several optional extras such as sliding roof, power steering, automatic transmission and air-conditioning system (see Tables "Adjustment of Front Springs").
- 5) On cars with hydropneumatic compensating spring.
- 6) On cars with a rear axle load (curb condition) above 720 kg install these longer rear springs.
- 7) On cars with a rear axle load (curb condition) above 830 kg install the longer rear springs, Part No. 110 324 21 04.
- 8) These front springs can also be used on Models 190 Dc, 200 D and 230 if the original springs result in too high a control arm position.
- 9) When a hydropneumatic compensating spring is installed subsequently, these harder springs can be replaced by the present-version type, Part No. 110 324 32 04.

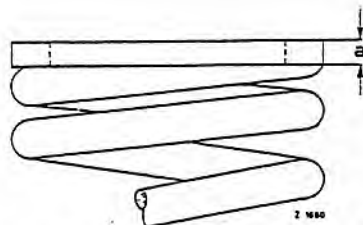
#### Cars with Air Suspension \*

Model	Front Bellows Designation Part No.	Associated front shock-absorber Designation Part No.	Rear Bellows Designation Part No.	Associated rear shock-absorber Designation Part No.
<b>Standard Springs</b>				
300 SE Sed. 300 SE/C	Phoenix-Harburg Type 1 A 04 Z 112 320 00 17	Bilstein Type B 36-006 112 323 08 00 <sup>1)</sup> 109 323 00 00 <sup>1)</sup>	Phoenix-Harburg Type 1 A 05 Z 112 320 00 21	Bilstein Type B 46-011 112 326 02 00 <sup>1)</sup> 109 326 00 00 <sup>1)</sup> 109 326 02 00 <sup>2)</sup>
300 SEL		109 323 00 00 <sup>1)</sup>		109 326 00 00 <sup>1)</sup> 109 326 02 00 <sup>2)</sup>
280 SEL				109 326 02 00

- 1) Previous version.
- 2) Present-day version and replacement for previous versions.

## B. Adjustment of Springs

### a) Adjustment of Front Springs for Cars with 1st Version Front Axle



Associated front springs with faced upper coil end (Fig. 32-0/1)

Fig. 32-0/1

a = Thickness of rubber washer

### Standard and Harder Springs

Models 220 b, 220 Sb, 220 SEb Sedan and Coupé

Color code of front springs	Thickness "a" of rubber washer					
	Car version with or without optional extras such as sliding roof and automatic clutch					
	no optional extra		one optional extra		two optional extras	
Part No.	Thickness "a"	Part No.	Thickness "a"	Part No.	Thickness "a"	
white	111 322 02 84	8	111 322 03 84	10	111 322 04 84	12
red	111 322 01 84	5.5	111 322 02 84	8	111 322 03 84	10
blue	120 322 00 84	3	111 322 01 84	5.5	111 322 02 84	8

Note: By using the rubber washers between front axle support and spring which are specified in Table "Front springs, corresponding color code" the prescribed control arm position of the front axle will usually be obtained under test load.

In certain cases it may be necessary to use thicker rubber washers; it should be noted, however, that the total thickness of the rubber washers must not exceed 12 mm. Measurement procedure and adjustment values for the control arm position of the axle are given in Job Nos. 40-0 and 40-3.

b) Adjustment of Front Springs for Cars with 2nd Version Front Axle \*

Cars without Air-Conditioning System

Model	Front Spring Part No.	Car version with or without optional extras such as sliding roof, automatic clutch or automatic transmission, power steering			
		no optional extra	one optional extra	two optional extras	three optional extras
<b>Standard Springs</b>					
190 c, 200	110 321 08 04	I	II	III	IV
190 Dc, 200 D	111 321 15 04	VII	I	II	III
220 b	111 321 15 04	I	II	III	IV
220 Sb	111 321 15 04	II	III	IV	V
	111 321 18 04	VII	I	II	III
	108 321 03 04	—	VII	I	II
220 SEb Sedan	111 321 15 04	III	IV	V	VI
	111 321 18 04	I	II	III	IV
	108 321 03 04	VII	I	II	III
220 SEb Coupé	111 321 18 04	I	II	III	IV
	108 321 03 04				
220 SEb Convertible	111 321 18 04	IV	V	VI	—
	108 321 03 04				
230	110 321 08 04	III	IV	V	VI
	111 321 15 04	—	VII	I	II
230 S	111 321 15 04	II	III	IV	V
	108 321 03 04	—	VII	I	II
230 SL	113 321 04 04	VII	I	II	—
250 SL	113 321 04 04	I	II	III	—
250 S	108 321 03 04	VII	I	II	III
250 SE Sedan	108 321 03 04	II	III	IV	V
	108 321 01 04	—	—	VII	I
250 SE Coupé	108 321 03 04	III	IV	V	VI
	108 321 01 04	—	—	—	VII
250 SE Convertible	108 321 01 04	VII	I	II	—
300 SEb	108 321 01 04	II	III	IV	—
<b>Special Version: Harder Springs for Bad Road Conditions, Police Radio Cars and Station Wagons</b>					
190 c, 200	110 321 10 04	I	II	III	IV
190 Dc, 200 D	110 321 09 04	I	II	III	IV
220 b	110 321 09 04	II	III	IV	V

Cars without Air Conditioning System (contd.)

Model	Front Spring Part No.	Car version with or without optional extras such as sliding roof, automatic clutch or automatic transmission, power steering			
		no optional extra	one optional extra	two optional extras	three optional extras
<b>Special Version: Harder Springs for Bad Road Conditions, Police Radio Cars and Station Wagons</b>					
220 Sb	110 321 09 04	III	IV	V	VI
	108 321 04 04	—	VII	I	II
220 SEb Sedan	110 321 09 04	IV	V	VI	VI
	108 321 04 04	VII	I	II	III
220 SEb Coupé	111 321 19 04	I	II	III	IV
	108 321 04 04	II	III	IV	V
220 SEb Convertible	111 321 19 04	IV	V	VI	—
	108 321 02 04	VII	I	II	—
230	110 321 10 04	III	IV	V	VI
	110 321 09 04	VII	I	II	III
230 S	110 321 09 04	III	IV	V	VI
	108 321 04 04	—	VII	I	II
230 SL	113 321 05 C4	III	IV	V	—
250 SL	113 321 05 04	IV	V	VI	—
	113 321 08 C4	I	II	III	—
250 S	108 321 04 04	VII	I	II	III
250 SE Sedan	108 321 C4 C4	II	III	IV	V
	108 321 02 04	—	—	—	VII
250 SE Coupé	108 321 04 04	II	III	IV	V
	108 321 02 04	—	—	—	VII
250 SE Convertible	108 321 02 04	VII	I	II	—
300 SEb	108 321 02 04	II	III	IV	—
<b>Special Version: Harder Springs for Model 200 D Sedan with Long Wheel Base</b>					
200 D	108 321 04 04	III	IV	V	VI
<b>Special Version: Harder Springs for Ambulances</b>					
190 c, 200	110 321 10 04	IV	V	—	—
	110 321 09 04	VII	I	II	—
190 c, 200 D, 230	110 321 09 04	II	III	IV	—
	108 321 04 04	—	—	VII	—
200 D long	108 321 C4 C4	I	II	III	—

Cars without Air-Conditioning System (contd.)

Model	Front Spring Part No.	Car version with or without optional extras such as sliding roof, automatic clutch or automatic transmission, power steering			
		no optional extra	one optional extra	two optional extras	three optional extras
220 b	110 321 09 04	III	IV	V	—
	108 321 04 04	—	VII	I	—
220 Sb, 230	111 321 09 04	IV	V	VI	—
	108 321 04 04	I	II	III	—

Cars with Air-Conditioning System \*

Model	Front Spring Part No.	Car version with or without optional extras such as sliding roof, automatic clutch or automatic transmission, power steering			
		no optional extra	one optional extra	two optional extras	three optional extras
<b>Standard Springs</b>					
200	110 321 08 04	III	IV	V	VI
	111 321 15 04	VII	VII	I	II
200 D	111 321 15 04	II	III	IV	V
	108 321 03 04	—	VII	I	II
230	111 321 15 04	I	II	III	V
	108 321 03 04	—	—	VII	I
230 S	111 321 15 04	IV	V	VI	—
	108 321 03 04	I	II	III	IV
250 S	108 321 03 04	II	III	IV	V
	108 321 01 04	—	—	—	VII
250 SE Sedan	108 321 03 04	IV	V	VI	—
	108 321 01 04	—	—	VII	I
250 SE Coupé	108 321 03 04	V	IV	—	—
	108 321 01 04	VII	VII	I	II
250 SE Convertible	108 321 01 04	I	II	III	—
300 SEb	108 321 02 04	IV	V	VI	—
		III	VI	V	—
230 SL	113 321 04 04	II	III	IV	—
250 SL		III	IV	V	—

Note: The 5 mm thick rubber spacer, Part No. 113 322 00 84, can be used in addition to the rubber mounting if this is no longer sufficient to compensate for the difference in height after subsequent installation of an air-conditioning system.

Cars with Air-Conditioning System (Contd.)

Model	Front Spring Part No.	Car version			
		no optional extra	one optional extra	two optional extras	three optional extras
with or without optional extras such as sliding roof, automatic clutch or automatic transmission, power steering					
<b>Special Version: Harder Springs for Bad Road Conditions</b>					
200	110 321 10 04	III	IV	V	VI
	110 321 09 04	I	II	III	IV
200 D	110 321 09 04	III	IV	V	VI
	108 321 04 04	VII	I	II	III
230	110 321 09 04	II	III	IV	V
	108 321 C4 04	—	VII	I	II
230 S	108 321 C4 04	I	II	III	IV
250 S	108 321 C4 04	II	III	IV	V
	108 321 02 C4	VII	I	II	III
250 SE Sedan	108 321 C4 04	III	IV	V	VI
	108 321 C2 04	I	II	III	IV
250 SE Coupé	108 321 02 C4	VII	I	I	II
250 SE Convertible		I	II	III	—
300 SEb	108 321 C2 04	IV	V	VI	—
	108 321 C6 04	VII	I	II	—
230 SL	113 321 05 C4	V	VI	—	—
	113 321 08 04	II	III	IV	—
250 SL	113 321 08 04	III	IV	V	—

Note: The 7 mm thick rubber spacer, Part No. 113 322 00 84, can be used in addition to the rubber mounting if this is no longer sufficient to compensate for the difference in height after subsequent installation of an air-conditioning system.

Adjustment Tables for Pages 32-0/7 to 10

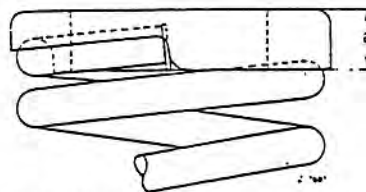


Fig. 32-0/2

a = Height of rubber mounting

Table	Color Code of front springs	Rubber mountings	
		Part. No.	Height "a" mm
I	white	111 322 05 85	25
	red	111 322 04 85	22.5
	blue	111 322 03 85	20
II	white	111 322 06 85	27.5
	red	111 322 05 85	25
	blue	111 322 04 85	22.5
III	white	111 322 07 85	30
	red	111 322 06 85	27.5
	blue	111 322 05 85	25
IV	white	111 322 08 85	32.5
	red	111 322 07 85	30
	blue	111 322 06 85	27.5
V	white	Springs must not be used!	
	red	111 322 08 85	32.5
	blue	111 322 07 85	30
VI	white	Springs must not be used!	
	red	Springs must not be used!	
	blue	111 322 08 85	32.5
VII	white	111 322 04 85	22.5
	red	111 322 03 85	20
	blue	Springs must not be used!	

c) Adjustment of Rear Springs\*

Model	Rear spring Part No. <sup>1)</sup>	For adjustment table see page 32-0/11
<b>Standard Springs</b>		
190 c, 190 Dc, 200, 200 D, 220 b, 220 Sb, 220 SEb Sedan, 220 SE Coupé, 230	110 324 30 04 108 324 02 04 <sup>2)</sup>	I
230 S, 250 S, 250 SE Sedan, 250 SE Coupé, 300 SEb	108 324 02 04	
220 SEb Convertible	110 324 30 04 108 324 02 04 <sup>2)</sup>	II
250 SE Convertible	108 324 02 04	
230 SL	113 324 04 04	I
250 SL		V
<b>Special Version: Harder Springs for Bad Road Conditions</b>		
190 c, 190 Dc, 200, 200 D, 220 b, 220 SEb Sedan, 220 SEb Coupé, 230, 230 S	110 324 12 04 110 324 33 04	I
250 S, 250 Sedan, 250 SE Coupé, 300 SEb	110 324 12 04	
220 SEb Convertible, 250 SE Convertible	110 324 33 04 <sup>2)</sup>	II
230 SL	113 324 02 04	I
250 SL		II
<b>Special Version: Harder Springs for Police Radio Cars</b>		
190 c, 190 Dc, 220 b, 220 Sb, 220 SEb	110 324 12 04 <sup>3)</sup>	III
200, 200 D, 230, 230 S	110 324 32 04	I
250 S, 250 SE	110 324 21 04	IV
<b>Special Version: Harder Springs for Station Wagons</b>		
190 c, 190 Dc, 220 b, 220 Sb	110 324 28 04 <sup>5)</sup>	I
200, 200 D, 230, 230 S	110 324 32 04 <sup>6)</sup>	
<b>Special Version: Harder Springs for Ambulances</b>		
190 c, 190 Dc, 200, 200 D, 220 b, 220 Sb, 230, 230 S	110 324 21 04	I
200, 200 D, 230, 230 S with longer wheel base		III

<sup>1)</sup> Present-day version and replacement of previous versions (see also tables "Combination Springs — Shock-Absorbers")

<sup>2)</sup> Only in connection with a hydropneumatic compensating spring.

<sup>3)</sup> When a hydropneumatic compensating spring is installed subsequently, use the longer rear springs Part No 110 324 32 04.

<sup>4)</sup> In combination with a hydropneumatic compensating spring for rear axle loads (curb condition) over 720 kp.

<sup>5)</sup> On cars with hydropneumatic compensating springs the softer springs Part No. 110 324 32 04 can be used.

<sup>6)</sup> In special cases, e. g. for higher rear axle load, install the longer rear springs No. 110 324 21 04.



Adjustment Tables for Page 32-0/12

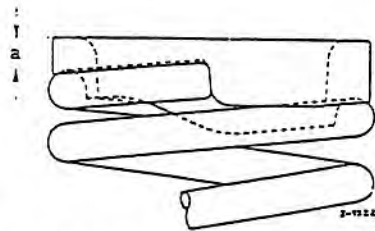


Fig. 32-0/3

"a" = Height of rubber mounting

Table	Color code of rear springs	Notch position of spring retainer	Upper rubber mounting	
			Part No.	Height "a" mm
I	white	1 line	110 325 02 85	20
		2 lines		
		3 lines		
	red	1 line	110 325 03 85	14
		2 lines		
		3 lines		
	blue	1 line	110 325 04 85	8
		2 lines		
		3 lines		
II	white	Springs must not be used!		
	red	1 line	110 325 02 85	20
		2 lines		
		3 lines		
	blue	1 line	110 325 03 85	14
		2 lines		
3 lines				
III	white	Springs must not be used!		
	red	Springs must not be used!		
	blue	1 line	110 325 02 85	20
		2 lines		
3 lines				

Continued Next Page

Adjustment Table for Page 32-0/12 (Continued)

Table	Color code of rear springs	Notch position of spring retainer	Upper rubber mounting		
			Part No.	Height "a" mm	
IV	white	1 line	3	110 325 02 85	20
		2 lines	1	110 325 03 85	14
		3 lines	2		
	red	1 line	3	110 325 04 85	8
		2 lines	1		
		3 lines	2		
	blue	1 line	3	Springs must not be used!	
		2 lines			
		3 lines			
V	white	1 line	Springs must not be used!		
		2 lines	1	110 325 02 85	20
		3 lines	2		
	red	1 line	3	110 325 03 85	14
		2 lines	1		
		3 lines	2		
	blue	1 line	3	110 325 04 85	8
		2 lines	1		
		3 lines	2		

d) Adjustment of Compensating Spring on Rear-Axle

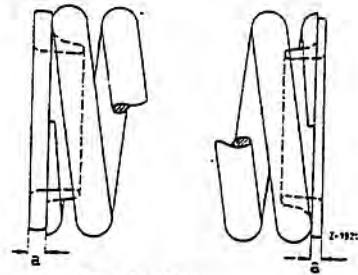


Fig. 32-0/4

a = Height of rubber ring

Steel Compensating Spring<sup>1)</sup>

Color code of compensating spring	Rubber ring			
	left		right	
	Part No.	Height "a" mm	Part No.	Height "a" mm
white	110 329 01 85	6	110 329 01 85	6
red	110 329 01 85	6	110 329 00 85	3
blue	110 329 00 85	3	110 329 00 85	3

<sup>1)</sup> In special cases the camber of both rear wheels can be increased by installing a compensating spring (blue) together with two 6 mm rubber rings.

Hydropneumatic Compensating Spring\*

Hydropneumatic compensating spring					associated left ball-joint		
With ball-joints Part No. <sup>1)</sup>	Length "L"	Without ball-joints Part. No.	Color code	Gas charging pressure atm	Part. No.	Length "L"	Color code
111 320 01 99	368 <sup>2)</sup>	000 320 00 13	none	60	000 329 01 30 <sup>3)</sup>	60.5	none
	371 <sup>4)</sup>				000 329 06 30 <sup>5)</sup>	63.5	
	374				000 329 02 30	66.5	
111 320 03 99	368 <sup>2)</sup>	000 320 04 13	1 horizontal line green	75	000 329 01 30	60.5	none
	371 <sup>4)</sup>				000 329 06 30 <sup>5)</sup>	63.5	red
111 320 04 99	374				000 329 02 30	66.5	white

- <sup>1)</sup> Total delivery including installation parts.
- <sup>2)</sup> Color dot on front face of threaded part.
- <sup>3)</sup> 1st version.
- <sup>4)</sup> 2nd version.
- <sup>5)</sup> Present-day version and replacement for the previous joint.

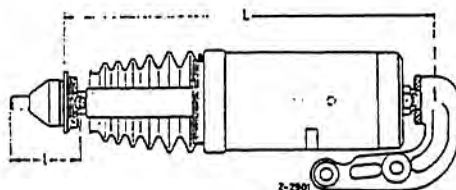


Fig. 32-0/5

## C. Shock-Absorbers

### Checking Oil Reserve in Shock-Absorbers\*

Part. No.	Designation	Shown in Fig.	Color code	Piston rod extrusion "a"¹) (see Figs. 32-0/7 and 32-0/8)		
				Value for new shock-absorber mm	Maximum value mm	
<b>Front Shock-Absorbers</b>						
110 323 04 00	Type B 36 Bilstein	"a"	1 red vertical line	$32,5 \pm 2$	63	
111 323 11 00			1 green vertical lines			
111 323 13 00			2 green vertical lines			
110 323 07 00			1 red vertical line	$5 \pm 2$	35	
111 323 19 00			1 green vertical line			
111 323 17 00			2 green vertical lines			
111 323 18 00			2 green vertical lines			
108 323 00 00			"b"	4 green vertical lines	$6 \pm 2$	35
113 323 00 00						
113 323 02 00						
112 323 07 00						
112 323 08 00						
109 323 00 00						
109 323 02 00						
<b>Rear Shock-Absorbers</b>						
001 326 00 00	Type B 46 Bilstein	"c"	1 red vertical line	$17,5 \pm 2$	48	
001 326 01 00			1 green vertical line			
001 326 05 00			2 green vertical lines			
110 326 11 00			1 red vertical line	$5 \pm 2$	30	
111 326 03 00			1 green vertical line			
108 326 00 00			2 green vertical lines			
111 326 01 00			2 green vertical lines			
111 326 02 00			"c"	4 green vertical lines	$0 \pm 2$	10
108 326 01 00						
113 326 00 00						
110 326 12 00			"c"	3 red vertical lines	$8 \pm 2$	26
113 326 02 00						
110 326 10 00						
110 326 10 00						
110 326 14 00						
110 326 15 00						
112 326 00 00						
112 326 02 00						
109 326 00 00						
109 326 02 00						

¹) In Bilstein shock-absorbers even a relatively high oil loss is evened out by the gas pressure (appr. 30 atm) acting on a compensator plunger. The shock-absorber becomes less effective, however, if the maximum piston rod extrusion value is exceeded.  
When measuring the oil reserve the shock-absorber temperature should be appr. 20° C.

## Upper Shock-Absorber Suspension

Bilstein Shock-Absorber with M10 X 1 Thread on Piston Rod (Present Version)

Models 190 c to 300 SEL	Part No.	Height mm	External dia mm	Rubber hardness ° Shore
<b>Front Shock-Absorbers (Fig 32-0/9)</b>				
Upper rubber ring (3)	180 326 01 68	19+0.5	40	57±5
Lower rubber ring (5)	000 323 12 85	16±0.25	27	70±3
Protective rubber sleeve (4)	111 323 01 38	7	46	80±5
Initial stress for rubber rings appr. 9 mm; limited by thread on piston rod				
<b>Rear Shock-Absorbers (Figs. 32-0/10 and 11)</b>				
Upper rubber ring (3)	180 326 01 68	19+0.5	40	57±5
Lower rubber ring (4)	110 323 05 85		35	64±5
Initial stress for rubber rings appr. 7 mm; limited by thread on piston rod				

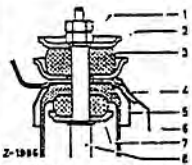


Fig. 32-0/9

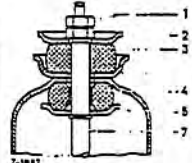


Fig. 32-0/10  
For normal roads

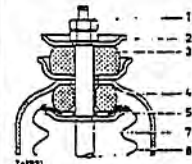


Fig. 32-0/11  
For bad roads

Lower Shock-Absorber Suspension

Model	Rubber Mounting					Shock-absorber eye internal dia. mm
	Part No.	Length (pressed in) mm	Internal dia. mm	External dia <sup>1)</sup> mm	Rubber hardness ° Shore	
<b>Front Shock-Absorbers (Figs. 32-0/12 and 13)</b> (rubber mounting not replaceable)						
190 c to 250 SE 300 SEb	—	34	15	30	65±5	30+0.2
					75±5	
300 SE 300 SEL	—	32.5		26	65±5 75±5	26+0.2
<b>Rear Shock-Absorbers (Fig. 32-0/14)</b> (rubber mounting replaceable)						
190 c to 300 SEL	111 326 02 81	42	16	30 <sup>1)</sup>	75±5	$\frac{30.000}{31.130}$
Free bolt length "a" of pivot pin (13) on rear axle tube			46—0.5 mm			
Installed length "b" of rubber mounting (11)			40—0.5 mm (Deviations from the free bolt length "a" or the installed length "b" can be compensated by adding a shim (16 mm internal dia. and appr. 23 mm external dia.) between the rear washer (8) and the cup (9))			
Depth of cup (9) for fastening the shock-absorber			3.0 mm			

<sup>1)</sup> The rubber mounting must be firmly seated in the shock-absorber eye.

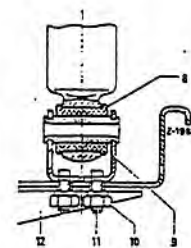


Fig. 32-0/12  
With steel springs

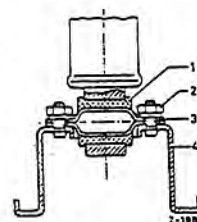


Fig. 32-0/13  
With air springs

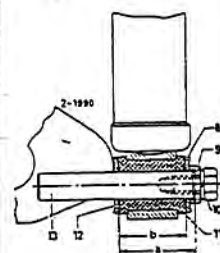


Fig. 32-0/14

## D. Torsion Bar

### Torsion Bar for Front Axle

Model	Torsion bar		Torsion bar mounting		Rubber hardness ° Shore
	Part No.	Diameter	Part No.	Bore $\phi$	
<b>Front Axle*</b>					
190 c, 190 Dc 200, 200 D	110 323 03 65	19.5	110 323 04 85	18—0.5	$60 \pm 5$
220 b, 220 Sb 220 SEb, 230, 230 S	111 323 14 65	21.5	111 323 09 85	20—0.5	
250 S, 250 SE 300 SEb	109 323 03 65 <sup>1)</sup> 108 323 02 65 <sup>2)</sup>	23.5	112 323 02 85	22—0.5	
300 SE Sedan 300 SE/C 1st version	112 323 04 65				
300 SE/C 2nd version 300 SEL station wagons and ambulances 200, 200 D 230, 230 S	109 323 04 65	24.5	109 323 00 85	23—0.5	
230 SL	113 323 01 65	22	113 323 01 85	21 + 0.5	
250 SL	113 323 02 65	20	110 323 04 85	18—0.5	
<b>Rear Axle*</b>					
300 SE Sedan, 300SE/C 300 SEL	112 326 08 65	19	112 326 01 81	18 + 0.5	$55 \pm 0.5$

<sup>1)</sup> 1st version    <sup>2)</sup> 2nd version

### Torsion Bar Fastening on Lower Control Arm

Models 190 c to 300 SEL

Part No.	Rubber buffer Height mm	Rubber hardness ° Shore
11323 00 44	28	$50 \pm 5$
Hexagon screw length		200 mm
Spacer tube length		68 mm
Distance "a" from screw end to upper edge of upper hexagon nut (see Figs. 32-6/2 and 32-6/5).		$23 \pm 1$ m <sup>1)</sup>

<sup>1)</sup> The proper distance is obtained by tightening the lower nut as far as the end of the thread.

### E. Additional Rubber Buffers

Front Axle

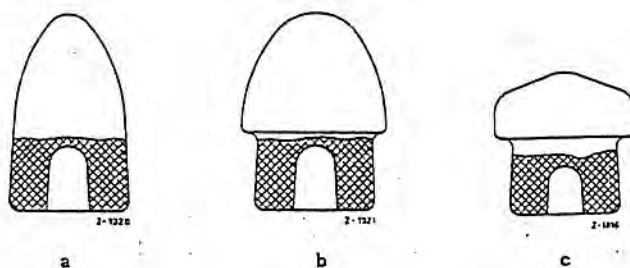


Fig. 32-0/15

Model	Rubber buffer		Height mm	Shown in Fig.	Remark
	Part No.	Rubber hardness ° Shore			
190 c to 250 SL and 300 SEb	111 333 02 65	65±5	76	a	For normal road conditions
	111 333 07 65	70±5	79	b	For bad road conditions
300 SE 300 SEL	112 333 02 65	65±5	59	c	

Rear Axle

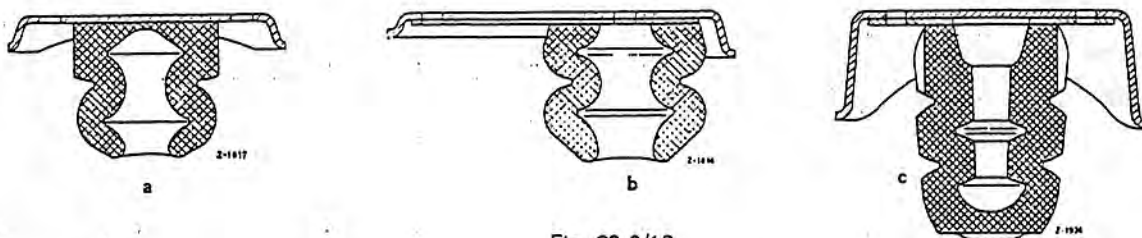


Fig. 32-0/16

Model	Rubber buffer		Shown in Fig.
	Part No.	Rubber hardness ° Shore	
190 c, 190 Dc, 200, 200 D 220 b, 220 Sb, 220 SEb, 230, 230 S 250 S, 250 SE, 230 SL, 250 SL	110 320 05 44 <sup>1)2)</sup> *	45±3	a
300 SE, 300 SEL	112 320 09 44 <sup>3)</sup>		b
Station wagons and ambulances 190 c, 190 Dc, 200, 200 D, 220 b, 220 Sb, 250, 230 S	110 320 06 44 <sup>4)</sup>		c

<sup>1)</sup> Rubber buffer with cup firmly connected.

<sup>2)</sup> On Models 230 SL and 250 SL with 7 mm additional spacer.

<sup>3)</sup> Associated stop plate Part No. 112 325 04 43.

<sup>4)</sup> Associated cup Part No. 110 325 01 42.



## F. Air Suspension System

### Air Chambers with Bellows

Models 300 SE, 300 SEL

	Front axle	Rear axle
Air capacity	2.8 l	3.6 l
Working pressure according to car load	6.0 to 7.5 atm	5.5 to 8.0 atm
Test pressure for leak test with air under water	3.5 atm	

### Leak Test of Air Suspension System

Models 300 SE, 300 SEL

Permissible decline of working pressure with the vehicle in "rest" position	1 atm within 24 hours
---	--------------------------

### Air Compressor

Models 300 SE, 300 SEL

Designation	Knorr LP 1004/050 (1st version) Knorr LP 1062/050 (2nd version)	
Piston $\phi$ /Stroke	50/26 mm	
Stroke capacity	50 cc	
Maximum speed	7000 rpm	
Maximum delivery pressure according to height above sea level	between 18 and 12 atm at $n = 2000$ rpm	
Delivery pressure check Time for pressure rise in air reservoir from 12 to 14 atm	max. 1 min. 30 sec. at $n = 2000$ rpm of engine <sup>1)</sup>	
Crankshaft bearings	front (drive side)	Anti-friction bearing
	rear	Plain bearing
Connecting rod bearing	Plain bearing	
Lubrication	Pressure oil from oil circulation of engine	
Transmission ratio V-belt drive crankshaft — air compressor	1.02 : 1	

<sup>1)</sup> For testing adjust engine speed with electrical revolution counter.

## Air Reservoir

Models 300 SE, 300 SEL

Capacity	approx. 7 l
Test pressure for leak test with air under water	approx. 8 atm
Non-return valve	Bosch LF/VB 2 A 1
Drain valve	Bosch LF/VE 1 A 1
Filler valve	Bosch SV 37/485 Z

## Vaporizer Jar

Models 300 SE, 300 SEL

Designation	Bosch LF/FA 1/400/1 <sup>1)</sup> Bosch LF/FA 1/400/2 <sup>2)</sup> Bosch LF/FA 1/400/4 <sup>3)</sup> *
Capacity	approx. 400 cc
Alcohol charge <sup>4)</sup>	Ethyl alcohol (Ethanol) (min. 96 %) (completely methylated) In case of emergency, fuel alcohol
Alcohol filling capacity	250 cc <sup>5)</sup>
Range of alcohol charge	approx. 3000 km
Intake valve nozzle	Solex main jet size 0100
Air cleaner <sup>6)</sup>	Bosch FJSJ 41 U 1 Z

1) 1st version (without air cleaner: suction air via air intake silencer of engine, installed on Model 300 SE up to chassis end No. 004 378).

2) 2nd version (with screwed-in air cleaner, installed on Model 300 SE as from chassis end No. 004 379).

3) 3rd version (with screwed-in air cleaner, installed on Model 300 SE as from chassis end No. 007 062).

4) Only at temperatures below + 5° C.

5) As far as the longitudinal groove on the container. Before filling up, drain condensed water at the air reservoir.

6) With paper element.

## Valve Unit

Model	300 SE Sedan, 300 SE/C <sup>7)</sup>	300 SEL, 300 SE/C <sup>8)</sup>
Designation	Bosch LF/EVA 1/1 (1st version) Bosch LF/EVA 1 A 1 (2nd version)	Bosch LF/EVB 1 A 2
Version	without level control	with level control
Pressure distribution to leveling valves	Front axle	limited by reducing valve
	Rear axle	full working pressure
Adjustment of reducing valve (for compressed air to front axle)	approx. 10.0 atm	
Adjustment of pressure valve (for exhaust air from front axle)	approx. 3.0 atm	
Adjustment of safety valve Escaping pressure	approx. 23 atm	
Adjustment of electrical pressure switch for warning lamp	8 ± 0.5 atm <sup>9)</sup> *	

7) Up to chassis end No. 008 908.

8) As from chassis end No. 008 909.

9) Previously 9 ± 1 atm and 10 ± 1 atm.

## Leveling Valves

Valves without level control

Models 300 SE, 300 SE/C up to chassis end No. 008 908	front axle	rear axle
Designation	left LF/VNB 3 A 2 (1st version) LF/VNB 3 B 2 (2nd version) right LF/VNB 1 A 1 (1st version) LF/VNB 1 B 1 (2nd version)	LF/VNB 2 A 1 (1st version) LF/VNB 2 B 1 (2nd version)
Throttle section for inlet and outlet valve	1.63/1.5 mm $\Phi$	1.73/1.5 mm $\Phi$
Lever length	110 mm	
Basic length of connecting rods for leveling valves <sup>1)</sup>	approx. 193 mm	approx. 143.5 mm <sup>2)</sup>

Valves with level control\*

Models 300 SEL, 300 SE/C as from chassis end No. 008 909	front axle	rear axle
Designation	left LF/VNC 3/2 right LF/VNC 3/1	LF/VNC 4/3
Throttle section for inlet and outlet valve	1.63/1.5 mm $\Phi$	1.73/1.5 mm $\Phi$
Lever length	85 mm	
Basic length of connecting rods for leveling valves <sup>1)</sup>	approx. 196 mm	approx. 143.5 mm <sup>2)</sup>

<sup>1)</sup> From center to center ball joint.

<sup>2)</sup> 2nd version arrangement of leveling valve (round hole in bracket on chassis base panel). On the 1st version arrangement of the levelling valve (two beads on bracket on chassis base panel) the connecting rod is approx. 156 mm long.

<sup>3)</sup> From center to center ball joint.

### G. Tightening Torques\*

Fastening attachment	Thread	Tightening torque in mkp
Models 190 c to 300 SEL		
Hexagon screws of the lower shock-absorber suspension on the rear-axle	M 10	appr. 5
Hexagon screws for fixing the right support for the compensating spring to the rear-axle tube	M 12 X 1.5	appr. 12
Hexagon socket screws for fixing the support of hydro-pneumatic compensating spring to the rear-axle tube	M 12 X 1.5	appr. 12
Hexagon nut for fixing the left ball joint of hydropneumatic compensating spring to the rear-axle housing	M 12 X 1.5	appr. 8
Ball joints of the hydropneumatic compensating spring	M 14 X 1.5	appr. 6
Models 300 SE Sedan, 300 SE/C, 300 SEL		
Threaded unions for air line connections	M 12 X 1.5	appr. 2
Cap screws of air lines and hoses	M 12 X 1 M 14 X 1	appr. 1.5
Phillips head countersunk screws of the air springs	M 8	appr. 2
Non-return valve on air reservoir	M 12 X 1.5	appr. 3

## Removal and Installation of Front Shock-Absorber

Job No.
32-2

*Modification: Shock-Absorber Suspension added as shown in Figs. 32-2/6 and 32-2/9*

**Note:** In the case of cars with air suspension see "General Instructions for Assembly Work"!  
(See Job No. 32-11)

### Removal:

1. Jack up the car at the front and remove the front wheel.
2. Detach the lower shock-absorber suspension. To do this, unscrew the two hexagon nuts from the lower control arm (Fig. 32-2/1).

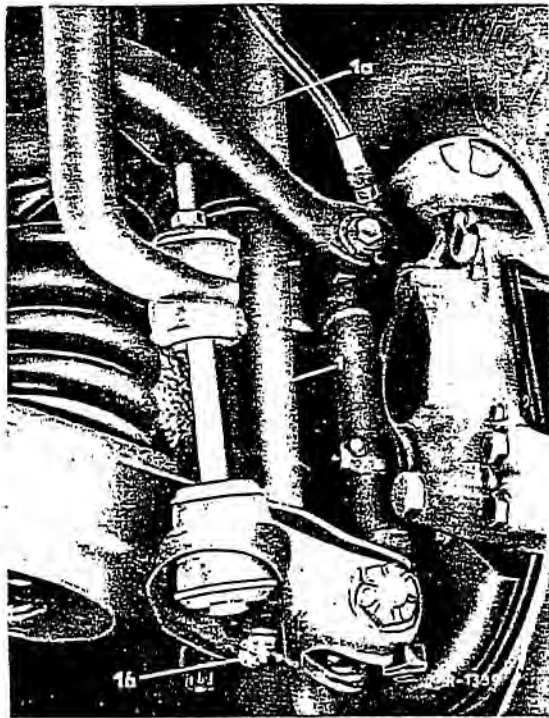


Fig. 32-2/1

- 1 Shock-absorber
- 1a Protective rubber sleeve
- 1b Lower shock-absorber suspension

**Note:** On cars with air suspension the hexagon nuts of the lower shock-absorber suspension are located within the lower control arm (Fig. 32-2/9).

3. Detach the upper shock-absorber suspension (1) and remove the components (Fig. 32-2/2).

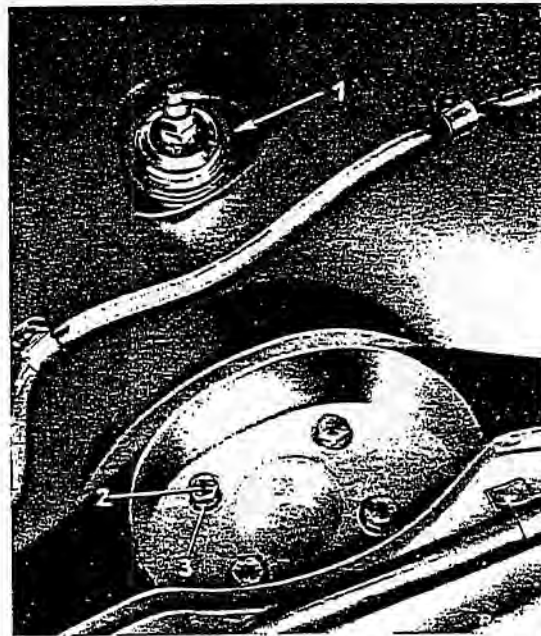


Fig. 32-2/2

- 1 Upper shock-absorber suspension
- 2 Hexagon screws and lock washers for fastening the rubber mounting for the front axle support
- 3 Washer

**Note:** a) The individual components of the shock-absorber suspension differ according to the various shock-absorber models (Figs. 32-2/4 to 9).

b) On the first cars the upper shock-absorber suspension can only be detached after removing the battery on the left and the air intake silencer on the right. On recent cars, however, the wheel arch is recessed so that these procedures are no longer necessary.

4. Compress the shock-absorber and install the tensioning fixture 111 589 03 61 (3). Then remove the shock-absorber and take off the tensioning fixture. Pull off the protective sleeve (2) and the upper suspension parts from the piston rod (Fig. 32-2/3).

**Note:** The tensioning fixture is not required for removing and installing Stabilus shock-absorbers for bad road conditions.

32-2/1



Fig. 32-2/3

- 1 Front shock-absorber
- 2 Protective sleeve
- 3 Tensioning Fixture 111 589 03 61

#### Installation:

5. Before re-installing, check the rubber bearing and the fixing plate of the lower suspension (Figs. 32-2/8 and 9).
6. Check the upper suspension components and rub the rubber parts with talc (Figs. 32-2/4 to 7).
7. Install the shock-absorbers (Figs. 32-2/4 to 9). Before installing Bilstein and Stabilus

gas pre-loaded shock-absorbers compress them by means of Tensioning Fixture 111 589 03 61 (3) (Fig. 32-2/3).

The following details require attention:

#### Upper Shock-Absorber Suspension

Screw the lower hexagon nut in completely, tighten it and lock it with the upper hexagon nut (Figs. 32-2/4 to 7).

Bilstein shock-absorbers with M 9 × 1 thread on piston rod:

Metal protective sleeves (7) are used in the 1st version upper suspension and protective rubber sleeves (5) in the 2nd version. If the metal sleeve rubs against the shock-absorber housing the rubber sleeve should be installed subsequently.

Use the right spacer tube for the rubber sleeve version (see Table in Job No. 32-0). The dish of the two cups (2) should point toward the rubber ring (Figs. 32-2/4 and 5).

Bilstein and Stabilus shock-absorbers with M 10 × 1 thread on piston rod:

The dish of the rubber cup should point upward. Push on the upper rubber ring with the rounded side pointing downward (Figs. 32-2/6 and 7).

Stabilus shock-absorbers for bad road conditions:

Push on the lower rubber ring (4) with the rounded side pointing upward and the lower rubber ring (3) with the rounded side pointing downward (Fig. 32-2/7). The dish of the upper cup should point upward.

## Upper Shock-Absorber Suspension

**Bilstein Shock-Absorber**  
Piston rod with thread M 9 × 1

1st version

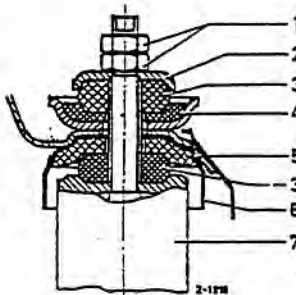


Fig. 32-2/4

- 1 Hexagon nuts
- 2 Upper cup
- 3 Upper and lower rubber ring
- 4 Upper rubber cup
- 5 Lower rubber cup
- 6 Protective cap at chassis base panel
- 7 Protective metal sleeve and spacer tube

2nd version

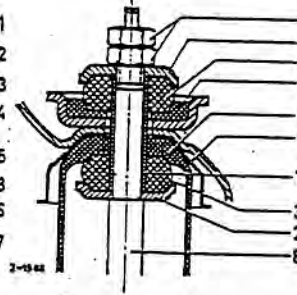


Fig. 32-2/5

- 1 Hexagon nuts
- 2 Cup
- 3 Upper and lower rubber ring
- 4 Upper rubber cup
- 5 Protective rubber sleeve
- 6 Protective cap at chassis base panel
- 7 Spacer tube (length 38 mm)
- 8 Piston rod

**Bilstein and Stabilus Shock-Absorber**

Piston rod with thread M 10 × 1

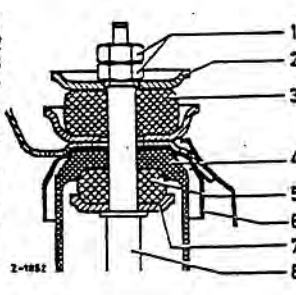


Fig. 32-2/6

- 1 Hexagon nuts
- 2 Upper cup
- 3 Upper rubber ring
- 4 Protective rubber sleeve
- 5 Lower rubber ring
- 6 Protective cap at chassis base panel
- 7 Lower cup (pressed onto piston rod)
- 8 Piston rod

**Stabilus Shock-Absorber for Bad Road Conditions**  
Piston rod with thread M 10 × 1

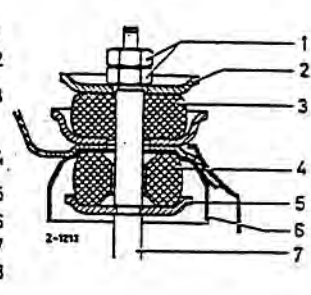


Fig. 32-2/7

- 1 Hexagon nuts
- 2 Upper cup
- 3 Upper rubber ring
- 4 Lower rubber ring
- 5 Lower cup (pressed onto piston rod)
- 6 Protective cap at chassis base panel
- 7 Piston rod

## Lower Shock-Absorber Suspension

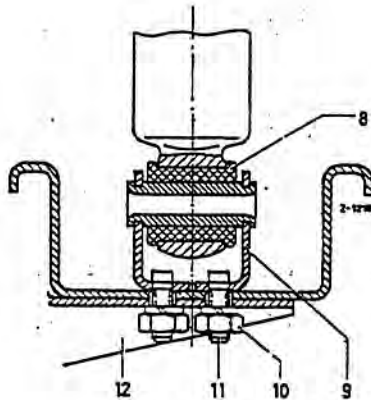


Fig. 32-2/8

Cars with steel spring suspension

- 8 Rubber mounting
- 9 Fixing plate
- 10 Hexagon nuts with lock washers
- 11 Threaded pin
- 12 Lower control arm

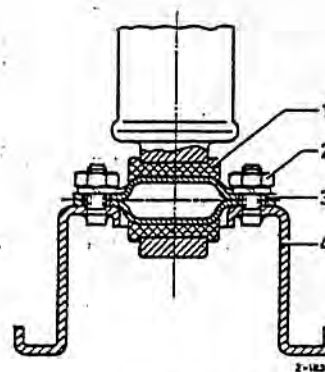


Fig. 32-2/9

Cars with air suspension

- 1 Rubber mounting
- 2 Hexagon nuts with lock washers
- 3 Fixing plate
- 4 Lower control arm

Job No.

32-3

## Removal and Installation of Rear Shock-Absorber

Modification: Model 230 SL and Shock-Absorber alignment added on page 32-3/4

**Note:** In the case of cars with air suspension see "General Instructions for Assembly Work" (See Job No. 32-11).

### Removal:

#### Note:

The rear shock-absorbers serve at the same time as spring stops for the rear wheels. It is necessary therefore when the car is jacked up, to support the appropriate axle tube before detaching the upper or lower shock-absorber suspension.

The jack can be placed either under the torque arm or, together with Flange 111 589 01 63, under the rear axle shaft (see Fig. 32-5/2).

When shock-absorbers are to be replaced it is advisable to put the rear wheels of the car over a pit.

1. Working from the trunk compartment, remove the upper shock-absorber suspension (1). Remove the hexagon nuts, the cup, and the upper rubber ring (Fig. 32-3/1).

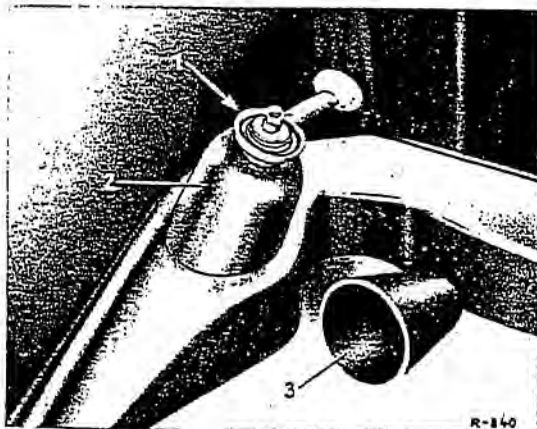


Fig. 32-3/1

- 1 Upper shock-absorber suspension
- 2 Dome on chassis base panel
- 3 Rubber protective cap

**Note:** On Model 230 SL the upper rear suspension is accessible from the top box when the roadster top is closed (Fig. 32-3/1a). On cars with a coupé top, the top must be removed.

2. Detach the lower shock-absorber suspension (8). Remove the hexagon nut or hexagon screw together with lock washer, cup,

and washer. Press the shock-absorber off the bolt and remove downward (Figs. 32-3/2, 6, and 7).

3. Remove the upper suspension components from the piston rod (Fig. 32-3/3 to 5).

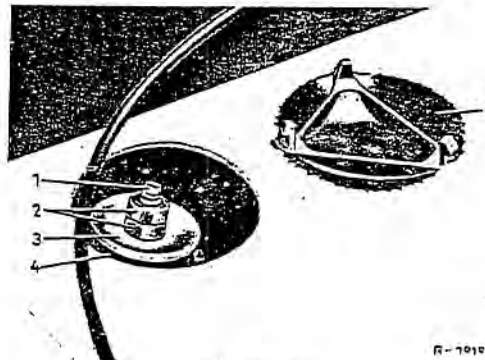


Fig. 32-3/1a

- 1 Piston rod
- 2 Hexagon screws
- 3 Upper cup
- 4 Upper rubber ring
- 5 Cover

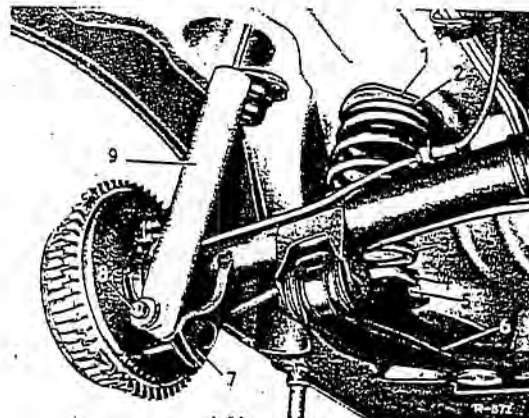


Fig. 32-3/2

- 1 Upper spring plate on chassis base panel
- 2 Upper rubber mounting
- 3 Rear spring
- 4 Lower rubber mounting
- 5 Lower spring plate
- 6 Torque arm
- 7 Support for lower shock-absorber suspension
- 8 Lower shock-absorber suspension
- 9 Rear shock-absorber

**Note:** The individual parts of the upper suspension differ in the various shock-absorber models (Figs. 32-3/3 to 5).

### Installation:

4. Before reinstalling, check the rubber mounting (1.1) of the lower suspension (Fig. 32-3/7).



Replace any rubber mounting showing signs of external or internal wear. The rubber mounting must be firmly seated in the shock-absorber eye. If the bore is larger than 30.2 mm dia. the shock-absorber must be replaced in any case, since there is no longer any guarantee that the rubber mounting will be firmly seated.

5. Check the spacer tube (6) on the 1st version of the upper suspension. If chafed spots are found on the side of the spacer tube, this is an indication that during normal running the spacer tube has fouled the dome on the chassis base panel (Fig. 32-3/3).

The through-bore in the shock-absorber dome has been enlarged from  $15.5+0.5$  mm dia. to  $16.5+0.5$  mm dia. If repairs are carried out on older models, the bore should be enlarged to 16.5 mm dia.

To do this, use an angular hand grinder or, if this is not available, a high-speed hand drill and a 15 mm dia. grinding cylinder to increase the bore, working from the trunk compartment.

6. Check the rubber rings of the upper suspension and rub them with talc.
7. Fit the shock-absorbers (Figs. 32-3 and 4).

Please note carefully the following points:

#### Lower Shock-Absorber Suspension

Check distance "a" of the pivot pin. It should be  $46-0.5$  mm. If the distance is larger, a corresponding shim with an internal diameter of 16 mm and an external diameter of 23 mm should be added between the washer (8) and the cup (9). This is necessary in order to ensure that the rubber mounting has the prescribed installed length "b" of  $40-0.5$  mm. It is not permissible to use a standard washer instead of the cup (9), since in that case the rubber mounting would no longer have the specified initial stress (Fig. 32-3/4).

When tightening the hexagon nut or the hexagon screw of the lower shock-absorber suspension pay attention to the specified tightening torque (see Job No. 32-0).

Fig. 32-3/6 shows the 1st version of the lower shock-absorber suspension and Fig.

32-3/7 shows the 2nd version which is also the repair version. For fastening the shock-absorber the 1st version pivot pin has a threaded part, whereas the 2nd version is provided with an internal thread. If on the 1st version pivot pin the threaded part has broken as a result of excessive tightening of the hexagon nut, the pivot pin can be made to correspond to the 2nd version (Fig. 32-3/7).

#### Upper Shock-Absorber Suspension

Push on the lower rubber ring (4) with the rounded side pointing upward and the upper rubber ring (3) with the rounded side pointing downward. Make sure that the correct cups and for the piston rod with an M 9 X 1 thread the correct spacer tube (length 36 mm) are fitted (Fig. 32-3/3). Shock absorbers with a piston rod thread M 10 X 1 have no spacer tube. The dish of the upper cup must point upward.

For piston rod threads M 10 X 1 use only 8 mm high hexagon nuts.

In order to obtain the correct initial stress of the rubber rings, the lower hexagon nut should be screwed on up to the end of the thread, while the piston rod is being held steady at the top with a wrench.

In the case of the piston rod with an M 9 X 1 thread the upper cup (2) must lie firmly against the spacer tube (6) in order to prevent rattling noises.

Screw on the upper hexagon nut and lock by means of the lower hexagon nut (Fig. 32-3/3).

Shock-absorbers  
for bad road conditions:

Shock-absorbers for bad road conditions are provided with a dust protector (8) in order to prevent damage by dust to the piston rod and its seals (Fig. 32-3/5). When installing the shock-absorber push the dust protector over the piston rod and attach it to the base of the shock-absorber housing by means of a hose clip (50 mm  $\phi$ ). Care should be used to ensure that, when the shock-absorber is fully extended, the dust protector is not stretched to its full extent, but remains rather slack.

## Upper Shock-Absorber Suspension

### Bilstein Shock-Absorber

**Bilstein Shock-Absorber**  
Piston rod with thread M9 × 1  
(previous version)

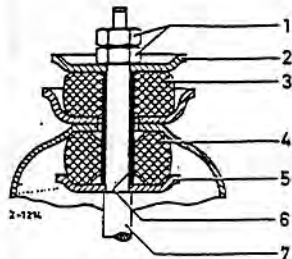


Fig. 32-3/3

**Bilstein and Stabilus Shock-Absorber**  
Piston rod with thread M10 × 1  
(present version)

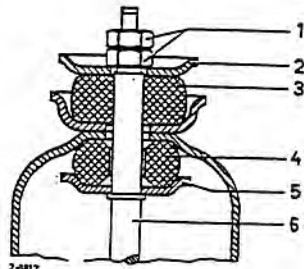


Fig. 32-3/4

**Bilstein Shock-Absorber and Stabilus Shock-Absorber for Bad Road Conditions (with dust protector)<sup>1)</sup>**  
Piston rod with thread 10 × 1

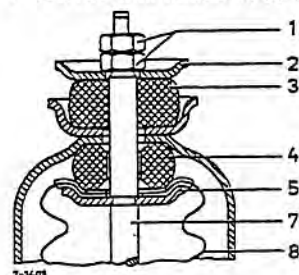


Fig. 32-3/5

- 1 Hexagon nuts (on M 10×1 threads use 8 mm high nuts)
- 2 Upper cup
- 3 Upper rubber ring
- 4 Lower rubber ring

- 5 Lower cup on the piston rod
- 6 Spacer tube (length 36 mm)
- 7 Piston rod
- 8 Dust protector

<sup>1)</sup> On Bilstein Shock-Absorber Part No. 001 326 05 00 install dust protector (8) also for normal road conditions.

## Lower Shock-Absorber Suspension

1st version

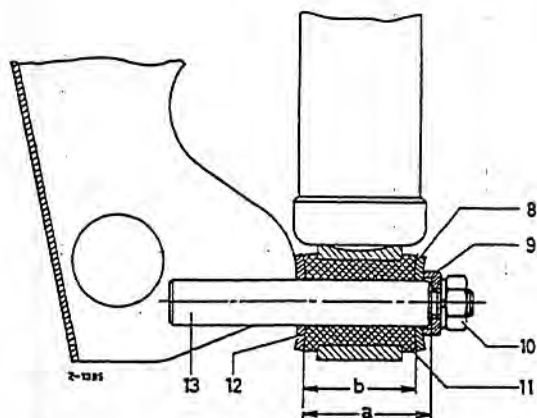


Fig. 32-3/6

2nd version and repair version

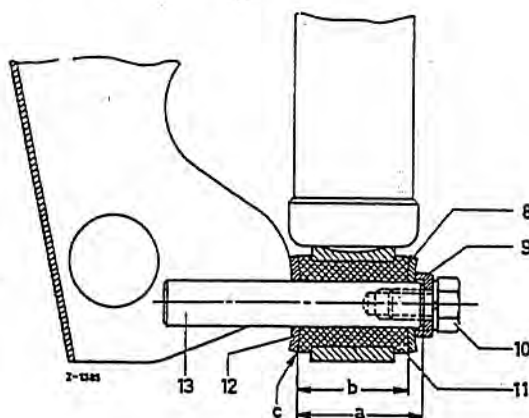


Fig. 32-3/7

- a Distance of pivot pin from inner washer (free length of bolt)
- 8 Washer
- 9 Cup
- 10 Hexagon nut and lock washer (on 2nd version and repair version hexagon screw and lock washer)

- b Installed length of rubber mounting
- 11 Rubber mounting
- 12 Washer on pivot pin
- 13 Pivot pin in the support on the axle tube

**\* Shock-Absorber Alignment**

The service life of a shock-absorber depends to a large extent on the proper alignment of the two suspension points. In order to check the alignment (e. g. when repairs are carried

out after an accident) remove the rear shock-absorbers and install the gage shown in Fig. 32-3/8. For this test the road wheels must be on the ground. The gage can be made in the shop in accordance with the measurements given below.

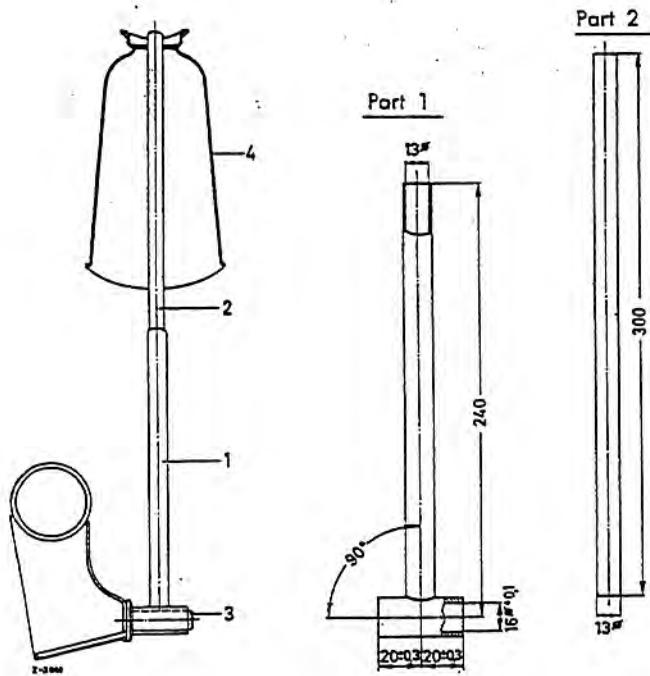


Fig. 32-3/8

- 1 Guide tube
- 2 Internal tube (sliding)
- 3 Pivot pin of the lower suspension in the rear wheel axle tube
- 4 Upper suspension dome on the chassis base panel

## Trouble-Shooting Hints for Shock-Absorber Noises

If there are noises proceeding from the rear axle, which are due to the shock-absorbers or their suspension, the following points should be given particular attention. As a general rule it can be assumed that the noises are due not to the shock-absorbers themselves but to their suspension.

### a) Rumbling Noises (on Bilstein and Stabilus shock-absorbers)

Check the upper shock-absorber suspension (see Job No. 32-3); in particular:

Cups (inside diameter) and spacer tube (length).

Rubber rings and cups for correct assembly.

Check the tightening torque and locking device of the hexagon nuts.

Check the diameter of the through bore in the shock-absorber dome on the chassis base panel.

Check the lower shock-absorber suspension (see Job No. 32-3):

Check the distance "a" of the pivot pin in the axle tube in relation to the inner cup (Fig. 32-0/14).

Check the installed length "b" of the rubber mounting (Fig. 32-0/14).

Check the internal diameter and the length of the rubber mounting.

Check the correct position of the rubber mounting in the shock-absorber eye.

Check the cups (depth) and the washers for the shock-absorber mounting.

### b) Knocking Noises (Bilstein shock-absorbers)

Check the oil reserve in the shock-absorber.

When oil loss is excessive, the shock-absorber shows a tendency to knock (see also Job No. 32-8).

### c) Hissing Noises (Bilstein shock-absorbers)

Bilstein shock-absorbers tend to produce hissing noises if the compensator plunger has a leak, since in this case part of the gas beneath the compensating plunger may get into the oil system. It may well be that such shock-absorbers function properly, but under the circumstances they should be replaced nevertheless.

If in special cases, after the shock-absorbers have been replaced and the upper and lower suspension have been checked, rumbling noises should persist, these may be transmitted by the rear axle. In this case remove the rear axle and check the axle tube mounting, the suspension, and the sliding joint.

# Removal and Installation of Front Spring

Job No.

32-4

*Modification: Cars with 2nd version front axle support (Addition)*

## A. Cars with 1<sup>st</sup> Version Front-Axle Support

### Removal:

1. Jack up the car at the front and remove the front wheel and on cars with drum brakes remove the brake drum.
2. Remove the front shock-absorber (see Job No. 32-2).
3. Detach the torsion bar at the lower control arm (see Job No. 32-6).
4. Unscrew the two outer of the hexagon screws (5) for attaching the pivot pin (6) for the lower control arm (19) to the front axle support (2) (Fig. 32-4/1).

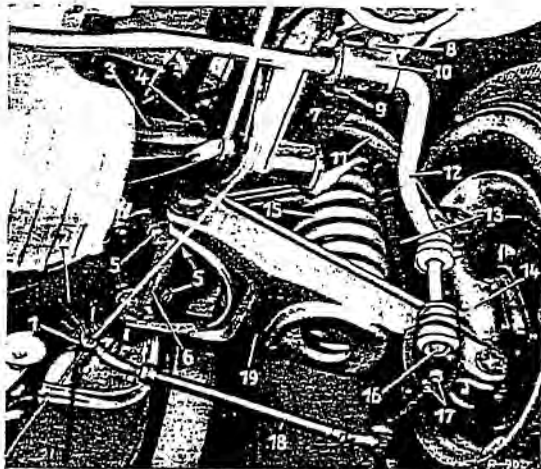


Fig. 32-4/1

- 1 Cable guide at front axle support
- 2 Front axle support
- 3 Engine support
- 4 Hexagon screw and spring washer
- 5 Hexagon screws with nuts and lock washers for fastening the pivot pin to the front axle support
- 6 Pivot pin for lower control arm
- 7 Flat spring supporting the front axle support
- 8 Hexagon screw (M 12X1.5X25) with lock washer
- 9 Hexagon screw (M 14X1.5X25) with lock washer
- 10 Rubber mounting for torsion bar
- 11 Upper control arm
- 12 Torsion bar
- 13 Front shock-absorber
- 14 Steering knuckle
- 15 Front spring
- 16 Hexagon screw for fastening the torsion bar to the lower control arm
- 17 Hexagon nuts with lock washers for fastening the lower shock-absorber suspension
- 18 Tie-rod
- 19 Lower control arm

5. Insert the two guide pins of Cradle 111 589 00 63 (3) in the eyes on the pivot pin (4) for the lower control arm. Then slide the jack under the car to fit the lower bolt of the cradle, and support the lower control arm (Fig. 32-4/2).
6. Unscrew the two inner of the four hexagon screws from the pivot pin (4). Now carefully lower the car jack and remove the front spring together with the rubber washer (Fig. 32-4/2).

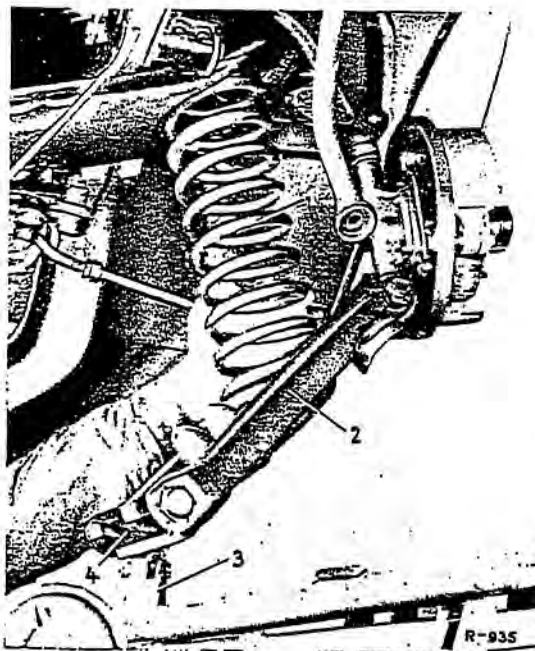


Fig. 32-4/2

- 1 Front spring
- 2 Lower control arm
- 3 Jack Cradle 111 589 00 63
- 4 Pivot pin for lower control arm

### Installation:

7. Rub the rubber washer (7) for the front spring with talc. Insert the spring together with the rubber washer (Fig. 32-4/3). The faced end of the spring must point upward.

32-4/1

**Note:** On cars with a 1st version front axle support, springs with faced upper coil ends and smooth rubber washers are used, whereas cars with the 2nd version front axle support have springs with non-faced coil ends and the springs are centered by rubber mountings fitting the coil end (see Job No. 32-0).

**Installation:**

7. Rub the rubber washer for the front spring with talc and attach it to the spring with masking tape (Fig. 32-4/3). Insert the spring in the lower control arm.

**Note:** The various spring lengths and trim dimensions of the front springs are compensated by rubber washers of different thickness (see Job No. 32-0).

8. Use the jack with Cradle 111 589 00 63 (3) to press the lower control arm (4) upward after having correctly positioned the pivot pin by means of the two Guides 120 589 01 31 (5) (Fig. 32-4/4).

Care must be taken to ensure that the spring is properly seated in the lower control arm and the rubber washer in the front axle support.

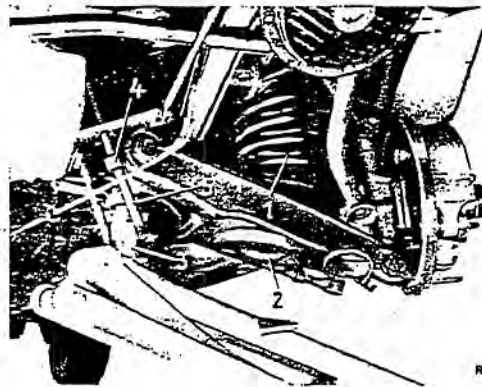


Fig. 32-4/4

- 1 Front spring
- 2 Lower control arm
- 3 Jack Cradle 111 589 00 63
- 4 Pivot pin for lower control arm
- 5 Guides 120 589 01 31

9. Now raise the lower control arm further, sliding the guide pins of Cradle 111 589 00 63 into the screw holes of the front axle support.

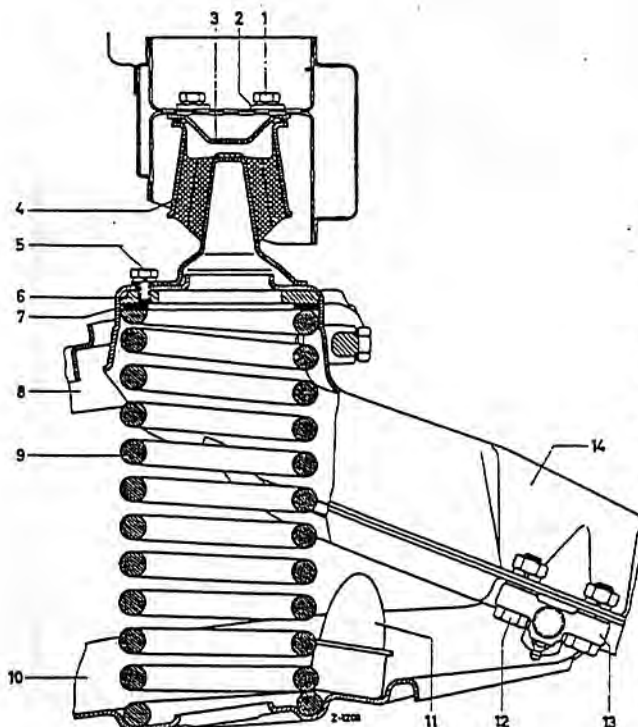


Fig. 32-4/3

- 1 Hexagon screws and lock washers for fastening the rubber mounting to the chassis base panel
- 2 Washers
- 3 Stop cup on chassis base panel
- 4 Rubber mounting for the front axle support
- 5 Hexagon screws and lock washers for fastening the rubber mounting to the front axle support
- 6 Threaded ring
- 7 Rubber washer
- 8 Upper control arm
- 9 Front spring
- 10 Lower control arm
- 11 Rubber buffer
- 12 Hexagon screws M 12x1,5x38 with nuts and lock washers
- 13 Pivot pin for lower control arm
- 14 Front axle support

When repairs are carried out, fit the hexagon screws (12) with the head upward. Use only specified screws and nuts (see Job No. 33-0).

Modification: Fig. 32-4/8 and mounting instruction added

10. Remove the two Guides (5) 120 589 01 31, since now the lower control arm pivot pin is properly centered through the two guide pins of the cradle.
11. Insert the two inner hexagon screws (12) from above and tighten with hexagon nut and lock washer.

**Note:** When repairs are carried out, the hexagon screws are fitted with the head upward and not as shown in Fig. 32-4/3 with the head downward.

12. Let down the jack and fit the two outer hexagon screws (see Job No. 33-0 for specified torque).

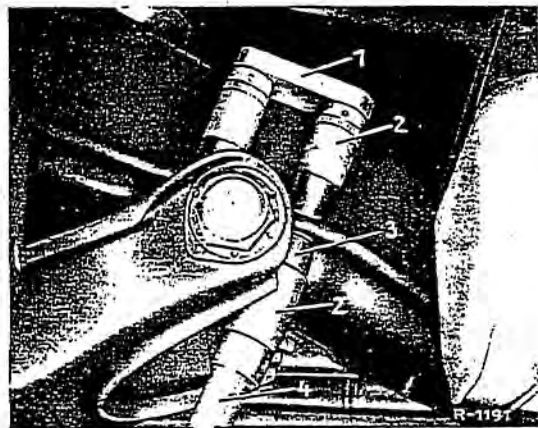


Fig. 32-4/5

- 1 Retaining plate
- 2 Socket 19 mm SW
- 3 Pivot pin for lever control arm
- 4 Torque wrench

**Note:** In order to prevent the hexagon screws from turning when being tightened, install two wrench sockets (2) (19 mm SW, 1/2"□) from above; the two sockets should be connected by a retaining plate (1) and two square adapters (Fig. 32-4/5).

The retaining plate can be made from flat steel in accordance with the sketch below (Fig. 32-4/6).

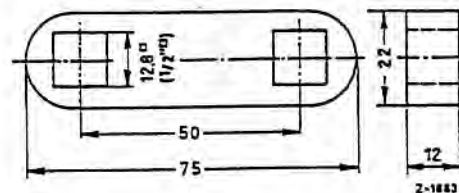


Fig. 32-4/6

13. Install the front shock-absorber (see Job No. 32-2).
14. Attach the torsion bar to the lower control arm (see Job No. 32-6).
15. Fit the front wheel, and the brake drum on cars with drum brakes, lower the car and tighten up the wheel nuts.
16. Check the front wheel camber and toe-in and if necessary correct (see Job No. 40-3).
17. Check the headlight adjustment (see Job No. 82-2).

## B. Cars with 2nd Version Front Axle Support

The removal and installation procedures for the front springs are the same as on cars with 1<sup>st</sup> version front axle support.

Whereas cars with 1<sup>st</sup> version front axle support have springs with faced upper coil ends and smooth rubber washers, cars with 2<sup>nd</sup> version front axle support have springs with non-faced upper coil ends and the springs are centered by rubber mountings fitting the coil end (Fig. 32-4/7).

32-4/3

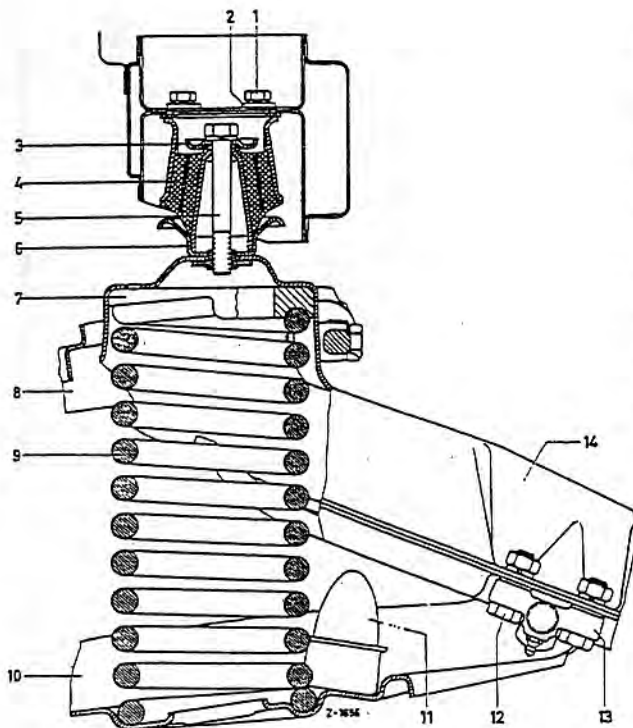


Fig. 32-4/7

- 1 Hexagon screws and lock washers for fastening the rubber mounting to the chassis base panel
- 2 Washers
- 3 Stop cup
- 4 Rubber mounting for the front axle support
- 5 Hexagon screw and lock washer for fastening the rubber mounting to the front axle support
- 6 Cup for rubber mounting
- 7 Rubber mounting
- 8 Upper control arm
- 9 Front spring
- 10 Lower control arm
- 11 Rubber buffer
- 12 Hexagon screws M 12X1.5X38 with nuts and lock washers
- 13 Pivot pin for lower control arm
- 14 Front axle support

When repairs are carried out, fit the hexagon screws (12) with the head upward.

Use only specified screws and nuts (see Job No. 33-0).

**Note:** The various spring lengths and trim dimensions of the front springs are compensated by rubber washers of different thickness (see Job No. 32-0).

\*) When mounting the spring pay attention to the difference between top and bottom coil ends (Fig. 32-4/8).



Fig. 32-4/8

top

bottom



# Removal and Installation of Rear Spring

Job No.

32-5

*Modification: a number of minor changes*

## Removal:

1. Support the car at the rear, and remove the rear wheel.
2. Slightly raise the axle tube by means of the jack (Fig. 32-5/2).

**Note:** When raising the axle tube, the jack can be placed either under the torque arm or, together with Flange 111 589 01 63 (5), under the rear axle shaft (Fig. 32-5/2).

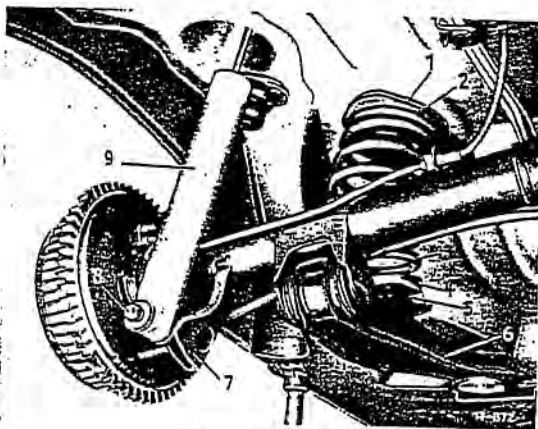


Fig. 32-5/1

- 1 Upper spring plate on chassis base panel
- 2 Upper rubber mounting
- 3 Rear spring
- 4 Lower rubber mounting
- 5 Lower spring plate
- 6 Torque arm
- 7 Support for lower shock-absorber suspension
- 8 Lower shock-absorber suspension
- 9 Rear shock-absorber

3. Install two Spring Tensioners 111 589 04 31 (Fig. 32-5/2). Then raise the axle tube further, taking care to ensure that the car is not lifted off the trestles. Then use the spring tensioners to compress the rear spring a little further.

4. Lower the axle tube with the jack, and remove the upper rubber mounting and the spring together with the spring tensioners (Fig. 32-5/3).

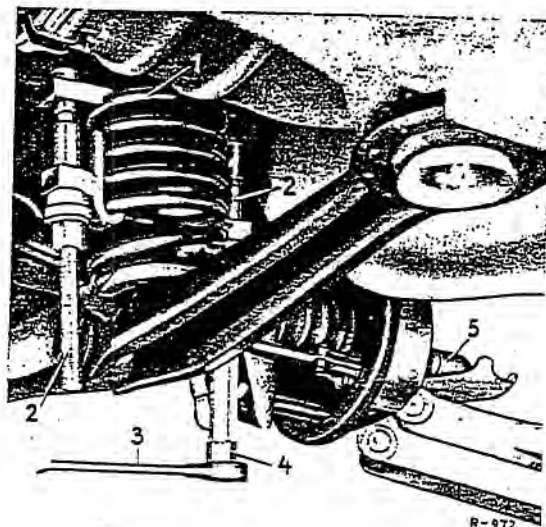


Fig. 32-5/2

- 1 Rear spring
- 2 Spring Tensioner 111 589 04 31
- 3 Rotchet  $\frac{1}{8}$ " square
- 4 Hexagon Special Socket 24 mm 111 589 01 09
- 5 Flange 111 589 01 63

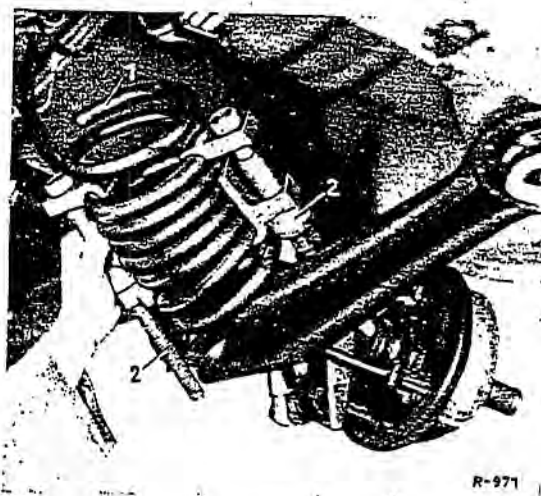


Fig. 32-5/3

- 1 Rear spring
- 2 Spring Tensioner 111 589 04 31

**Note:** The axle tube should only be lowered completely if the rear shock-absorber is installed, since the shock-absorber serves at the same time as a spring stop for the rear wheels. If the shock-absorber has been removed, the axle tube must be supported.

- If the rear spring is being replaced, put the top coil of the spring in a vise and release the spring tensioners evenly.

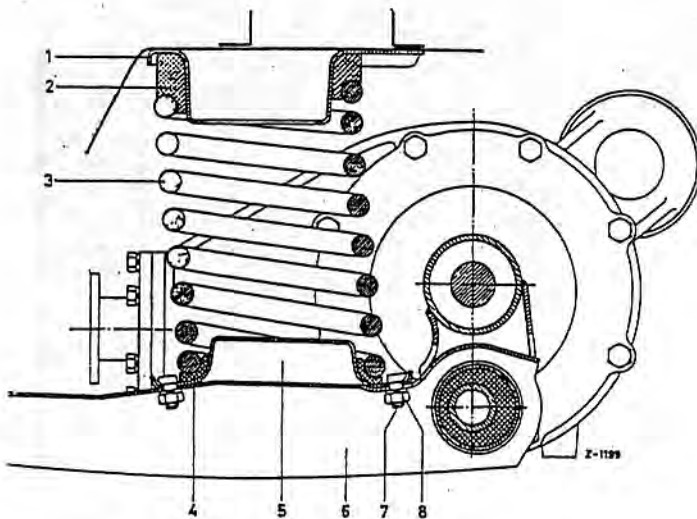
**Note: The left and right rear springs are exactly alike.**

**Installation:**

- Use the Spring Tensioners 111 589 04 31 to compress the rear spring in a vise, taking care to ensure that the spring tensioners are fitted so that they are not in the way when the spring is installed.
- Check the upper and lower rubber mountings and the upper spring plate at the chassis base panel and the lower spring plate at the torque arm. Make sure that the lower spring plate (5) is correctly positioned in accordance with the color code of the rear springs (Fig. 32-5/4). Rub talc on the rubber mountings.
- Place the lower rubber mounting (4) in the spring plate (5). Attach the upper rubber mounting (2) to the spring by means of masking tape. Install the rear spring in the tensioners (Fig. 32-5/4).

Corresponding to the color coding on the springs, the various trim dimensions of the rear springs are compensated by adjusting the lower spring plate and by installing different upper rubber mountings. For this purpose, three positions of the spring plate and three upper mountings of different height are available.

The numbers 1, 2, and 3 punched in at the screw holes in the lower spring plate indicate the individual positions of the spring plate (see Table "Color Code for Springs" in Job No. 32-0). Position 1 is the highest stage and position 3 the lowest stage. The various positions of the spring plate and the different upper rubber mountings serve the double purpose of correcting the differing trim dimensions of the rear spring and of adjusting the camber of the rear wheel (see Job No. 40-3).



**Fig. 32-5/4**

- Upper spring plate on chassis base panel
- Upper rubber mounting
- Rear spring
- Lower rubber mounting
- Lower spring plate
- Torque arm
- Screw for attaching the spring plate to the torque arm
- Hexagon nuts and lock washers

- Raise the axle tube, making sure that the ends of the spring are correctly seated at the top and the bottom. Then release the spring tensioners, lower the axle tube and remove the spring tensioners (Fig. 32-5/1).

- Fit the rear wheel, lower the car, and tighten up the wheel nuts.

- Check the rear wheel camber (see Job No. 40-3).

# Removal and Installation of Torsion Bar for Front Axle

Job No.
32-6

Modification: 2nd version front axle (Addition)

## A. 1st Version Front Axle

### Removal:

1. Detach the torsion bar (12) mounting from the lower control arm (19) at the right and at the left. Remove the hexagon nuts, pull out the hexagon screw (16), and remove the cup washers, the rubber buffers and the spacer tube (Figs. 32-6/1 and 32-6/2).

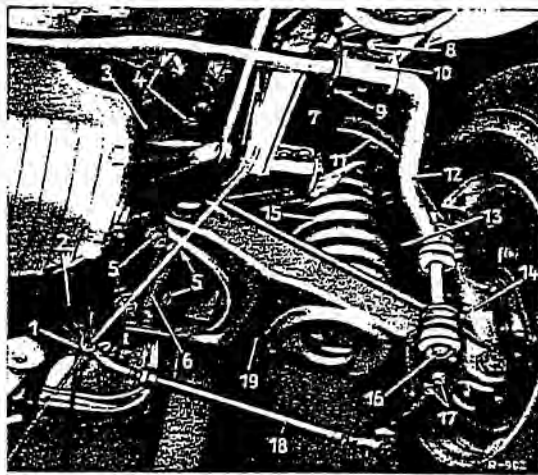


Fig. 32-6/1

- 1 Cable guide at front axle support
- 2 Front axle support
- 3 Engines support
- 4 Hexagon screw and spring washer
- 5 Hexagon screws with nuts and lock washers for fastening the pivot pin to the front axle support
- 6 Pivot pin for lower control arm
- 7 Flat spring supporting the front axle support
- 8 Hexagon screw (M 12X1.5X25) with lock washer
- 9 Hexagon screw (M 14X1.5X25) with lock washer
- 10 Rubber mounting for torsion bar
- 11 Upper control arm
- 12 Torsion bar
- 13 Front shock-absorber
- 14 Steering knuckle
- 15 Front spring
- 16 Hexagon screw for fastening the torsion bar to the lower control arm
- 17 Hexagon nuts with lock washers for fastening the lower shock-absorber suspension
- 18 Tie-rod
- 19 Lower control arm

2. Unscrew the hexagon screws (8) and (9) for fastening the rubber mountings (10) for the torsion bar (12) to the chassis base panel at the left and at the right and remove the torsion bar together with the brackets, the rubber mountings, and the locking plates (Fig. 32-6/1).

### Installation:

3. Check the two rubber mountings (12), the rubber buffers (3) and the hexagon screws (4) together with the cup washers (2) and the spacer tubes (5) (Fig. 32-6/2).
4. Slide the rubber mountings (12) over the torsion bar. Fix the torsion bar to the chassis base panel at the left and at the right together with the flat springs (Fig. 32-5/2). In doing this make sure that the rubber mountings are properly seated in the brackets. Tighten the hexagon screws with the specified tightening torque (see Job No. 33-0).

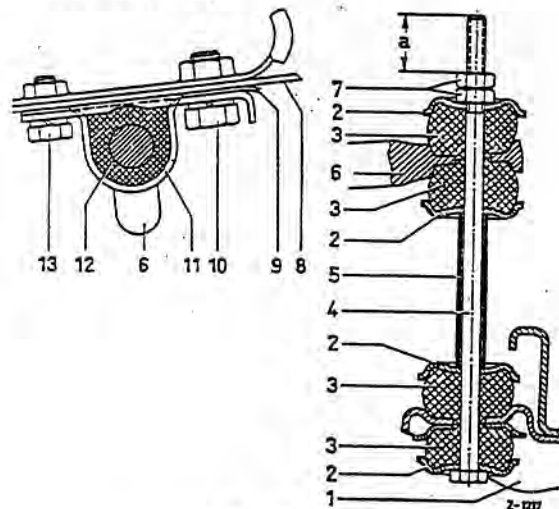


Fig. 32-6/2

5. Fasten the torsion bar to the lower control arm, taking care to ensure that the rubber buffers and the cup washers are properly arranged. Screw on the hexagon nuts (7) in such a way that the prescribed initial stress of the rubber buffers is obtained. For this purpose measure the distance "a" from the screw end to the upper hexagon nut. (For dimensions see Table in Job No. 32-0). Then lock the two hexagon nuts (Fig. 32-6/2).

## B. 2nd Version Front Axle

### Removal:

1. Detach the torsion bar mounting from the lower control arms. To do this unscrew the hexagon nuts, pull out the hexagon screw (16) and remove the cup washers, the rubber buffers, and the spacer tubes (Figs. 32-6/3 and 5).

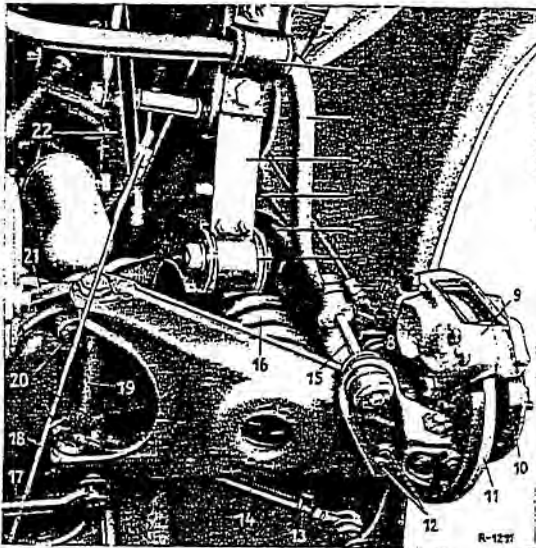


Fig. 32-6/3

- |  |  |
|--|--|
| 1 Torsion bar mounting and flat spring on chassis base panel | 12 Lower shock absorber suspension                                     |
| 2 Torsion bar  | 13 Tie-rod   |
| 3 Flat spring  | 14 Lower control arm   |
| 4 Shock absorber   | 15 Torsion bar mounting on lower control arm                           |
| 5 Upper control arm  | 16 Front spring  |
| 6 Flat spring mounting on front axle support                 | 17 Center tie-rod  |
| 7 Brake hose   | 18 Center brake cable  |
| 8 Steering knuckle   | 19 Pivot pin   |
| 9 Brake caliper  | 20 Hexagon screw for fastening the pivot pin for the lower control arm |
| 10 Front wheel hub   | 21 Engine support  |
| 11 Brake disk  | 22 Hand-brake lever  |

2. Use a scribe to mark the position of the flat springs on the chassis base panel left and right. Unscrew the flat springs from the chassis base panel together with the brackets for the rubber mountings of the torsion bar (Fig. 32-6/4). Remove the torsion bar.

### Installation:

3. Check the rubber mountings (10), the rubber buffers (3), and the hexagon screws (4) with the cup washers (2) and the spacer tubes (5) (Figs. 32-6/4 and 5).

4. Rub the rubber mountings (10) with talc and slide them over the torsion bar. Fix the torsion bar to the chassis base panel at the left and at the right together with the flat spring (Fig. 32-6/4). Pay attention to the positions marked during removal. For the specified tightening torque see Job No. 33-0.

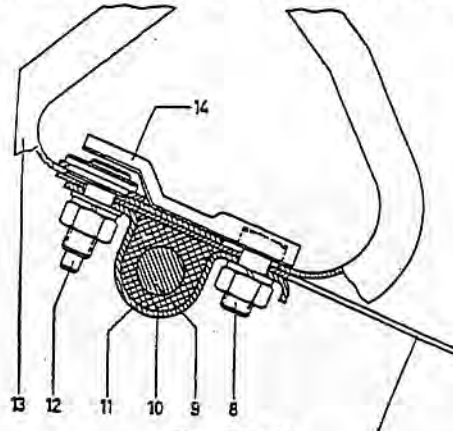


Fig. 32-6/4

- |   |   |
|---|---|
| 7 Flat spring for front axle longitudinal support | 11 Bracket for rubber mounting                |
| 8 Square screw with nut and lock washer           | 12 Eccentric with hexagon nut and lock washer |
| 9 Torsion bar                                     | 13 Bearing bracket on chassis base panel      |
| 10 Rubber mounting for torsion bar                | 14 Cage for square screw and eccentric        |

5. Fasten the torsion bar to the lower control arms taking care to ensure that the rubber buffers and the cup washers are properly arranged. Screw on the hexagon nuts (7) in such a way that the prescribed initial stress of the rubber buffers is obtained; for this purpose measure the distance "a" from the screw end to the upper hexagon nut. (For dimensions see Table in Job No. 32-0). Then lock the two hexagon nuts (Fig. 32-6/5).

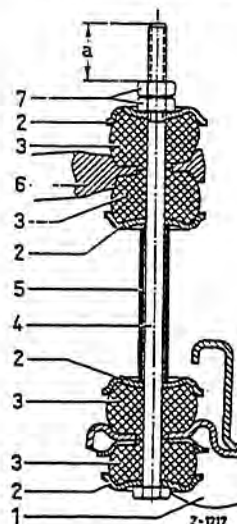


Fig. 32-6/5

- |                     |
|---------------------|
| 1 Lower control arm |
| 2 Cup washer        |
| 3 Rubber buffer     |
| 4 Hexagon screw     |
| 5 Spacer tube       |
| 6 Torsion bar       |
| 7 Hexagon nuts      |

# Removal, Installation and Checking of Compensating Spring

Job No.

32-7

## A. Steel Compensating Spring

*Modification: Hydropneumatic compensating spring added*

### Removal:

1. Support the car at the rear.

**Note:** The compensating spring should only be removed when there is no pressure on the two rear axle tubes.

2. Insert Spring Tensioner 111 589 00 31 (Fig. 32-7/2) and compress the compensating spring (3) until there is no pressure on the bracket (5) on the right axle tube (Fig. 32-7/1).

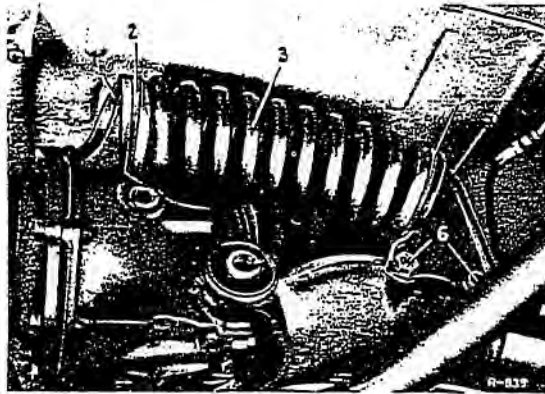


Fig.32-7/1

- |                                |   |
|--------------------------------|---|
| 1 Bracket on rear axle housing | 5 Bracket on right axle tube                                |
| 2 Rubber ring left             | 6 Hexagon screws for fastening the bracket to the axle tube |
| 3 Compensating spring          |   |
| 4 Rubber ring right            |   |

3. Unscrew the hexagon fixing screws (6) for the bracket. Then remove the bracket and the compensating spring (Figs. 32-7/1 and 32-7/2).

### Installation:

4. Check both rubber rings (2) and (4) and the bracket (5) (Fig. 32-7/1).

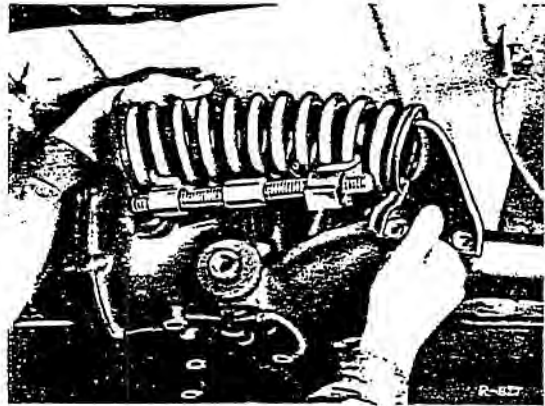


Fig. 32-7/2

**Note:** In the case of the compensating spring, the various trim dimensions are compensated by rubber rings of different height (see Job No. 32-0).

5. Flexibly mount the bracket with the inner of the two hexagon screws (6) and slightly move it to the outside. Insert the compensating spring with the tensioner installed, move the bracket to the inside and screw it on (for prescribed tightening torque of hexagon screws see Job. No. 32-0). Release and remove the spring tensioner, taking care that the spring is perfectly seated in the rubber rings.

**Note:** For the installation of the compensating spring on Models 230 SL and 250 SL it may be necessary to detach the lower suspension of the shock absorbers and slightly to lower the rear axle tubes. Make sure that the brake hoses are not stretched.

## B. Hydropneumatic Compensating Spring (Boge Compression Leg)

### Removal:

1. Support the car at the rear.

**Note:** The compensating spring should only be removed when both rear axle tubes are under no load.

2. Unscrew both hexagon socket screws (8) from the right ball joint (Fig. 32-7/3).
3. Unscrew hexagon nut (7), pull out compensating spring and remove bearing ring (5) (Fig. 32-7/4).

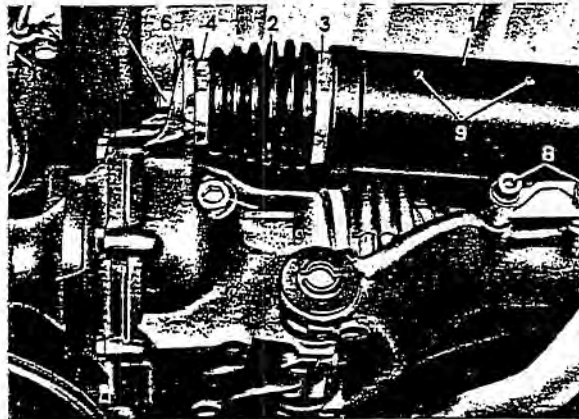


Fig. 32-7/3

### Installation:

4. Check whether bearing ring (5) is still serviceable and install it in the rear axle housing eye in such a way that it is flush with the left face of the eye (Fig. 32-7/5).
5. Install the compensating spring making sure that the washer (6) is properly seated. For tightening torque of polystop hexagon nut (7) see Job No. 32-0.

- |                       |                        |
|-----------------------|------------------------|
| 1 Compensating spring | 6 Washer               |
| 2 Cuff                | 7 Hexagon nut          |
| 3 Hose clamp          | 8 Hexagon socket screw |
| 4 Hose clamp          | 9 Filler screw         |

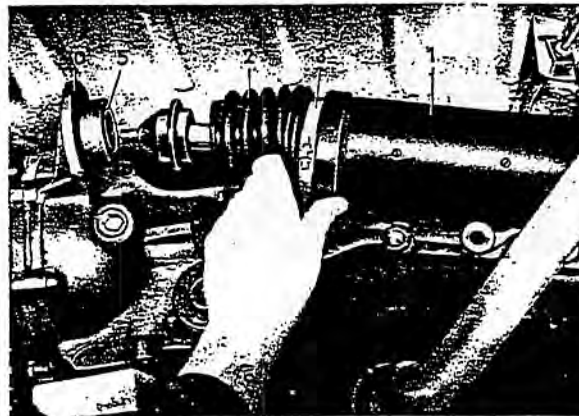
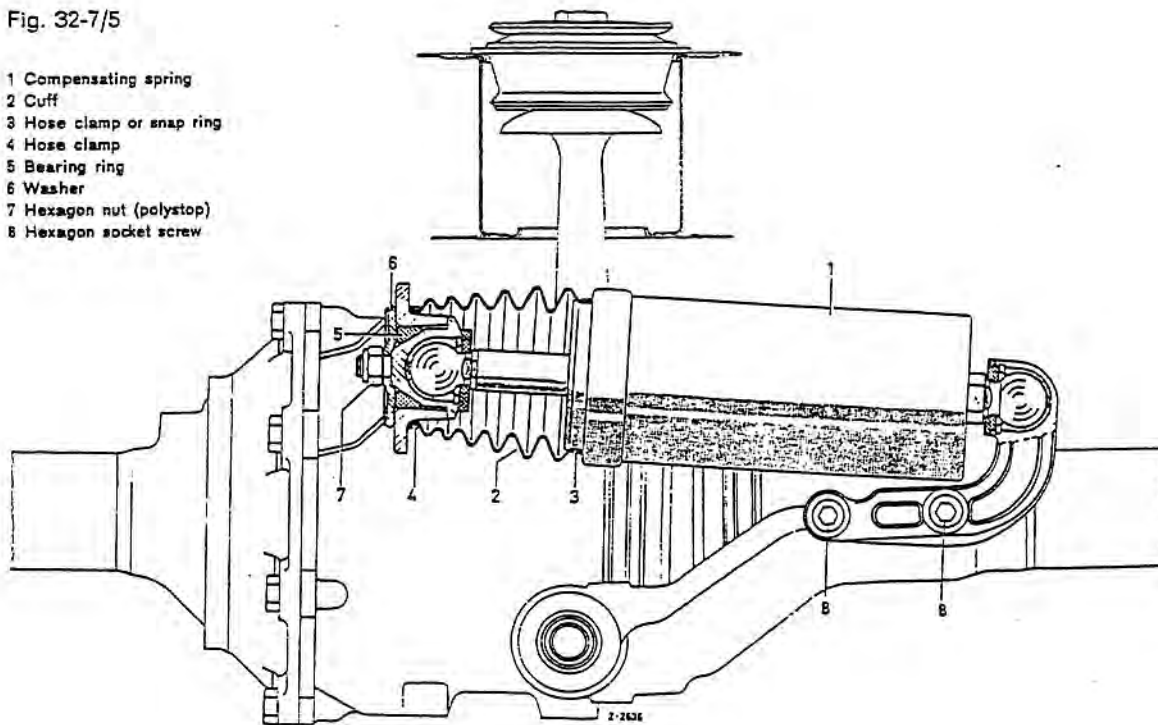


Fig. 32-7/4

- |                           |                             |
|---------------------------|-----------------------------|
| 1 Compensating spring     | 5 Bearing ring              |
| 2 Cuff                    | 10 Eye on rear axle housing |
| 3 Hose clamp or snap ring |                             |

Fig. 32-7/5

- 1 Compensating spring
- 2 Cuff
- 3 Hose clamp or snap ring
- 4 Hose clamp
- 5 Bearing ring
- 6 Washer
- 7 Hexagon nut (polystop)
- 8 Hexagon socket screw



6. Support the left torque arm or, together with flange 111 589 01 63 00 the rear axle shaft, with the car jack. Detach left shock-absorber from the lower suspension — in the case of compression legs with long left joint for higher car level detach both shock-absorbers (see Job No. 32-3).
7. Attach right ball joint by means of hexagon socket screws (8) and lock washers: lower left axle half as far as necessary for the inner screw to be screwed in, then lift it to provide access for the outer screw. Now tighten both hexagon socket screws (for tightening torques see Job No. 32-0).

When lowering the rear axle tubes take particular care to ensure that the brake hoses are not stretched.

8. Re-attach shock-absorber(s) to the lower suspension.
9. Jack down the car. Turn the compensating spring in such a way that the two filler screws (9) point toward the rear (Fig. 32-2/1).
10. Attach the cuff (2) to the rear axle housing by means of the hose clamp (4).

### Checking:

#### a) Rear Wheel Camber (Curb Condition)

For specified values see Job No. 40-0.

### Procedures

1. Lift rear end of car for about 15 seconds.
2. Put rear wheels on sliding plates or let car roll to a standstill. The measuring value is the average between left and right (the same applies to measuring under load).

### Correction

(see also Job No. 32-0).

1. Higher rubber mountings for rear springs.
2. Higher notch position of spring retainers.
3. If necessary, longer springs.

#### b) Rear Wheel Camber or Car Level Under Load (Design Position)

For specified values see Job No. 40-0.

### Procedures

1. Put a load of appr. 100 kp in trunk compartment.
2. Bounce the rear end of the car about 40 times or drive the car on an uneven road for about 1 km.
3. Measure the rear wheel camber.

### Correction

If on cars with standard springs (normal car level) the rear axle is lower by more than  $-1^{\circ} 15'$ , add the 3 mm Special Washer (12) Part No. 108 326 00 76 to the right ball joint (10) of the compensating spring (Fig. 32-7/6). Maximum camber increase about  $0^{\circ} 30'$ . Secure thread of ball joint with Loctite CVV.

Under normal circumstances this correction is only required in the case of previous version compensating springs with 60.5 mm left ball joint (dimension "a" = 2.5 mm) (Fig. 32-7/6). For the present version of the hydropneumatic compensating spring with a 63.5 mm left ball joint (distance "a" = 5.5 mm) the special washer is not required. It goes without saying that the car level can always be raised by installing the 63.5 mm left ball joint instead of adding the special washer.

On no account should the special washer be added in the case of a compensating spring for higher car level (left ball joint 66.5 mm long) since this would unduly limit the travel of the compensating spring and would subsequently destroy the unit.



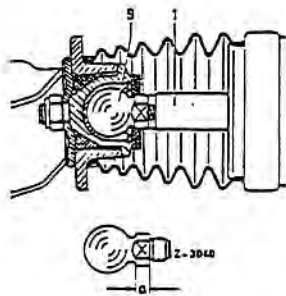
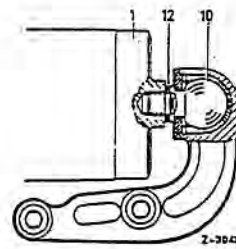


Fig. 32-7/6

- 1 Hydropneumatic compensating spring
- 9 Ball pin, left joint
- Collar length "a" of left ball pin
- 2.5 mm (standard ball pin, previous version)
- 5.5 mm (standard ball pin, present-day version)
- 8.5 mm (long ball pin for higher level)



- 1 Hydropneumatic compensating spring
- 10 Ball pin, right joint
- 12 Special washer (3 mm thick)

### c) Performance Test (at about Max. Axle Load)

For specified values see Job No. 32-0 (Section Hydropneumatic Compensating Spring)

#### Procedures

1. Put a load of approx. 200 kp in the trunk compartment.
2. Bounce the rear end of the car about 80 times or drive the car on an uneven road at least 2 km.  
(If the compensating spring was already pumped up at a 100 kp trunk compartment load for measuring the rear wheel camber (see Section b), it will now be sufficient to bounce the car about 40 times or to drive it 1 km).
3. Measure rear wheel camber:

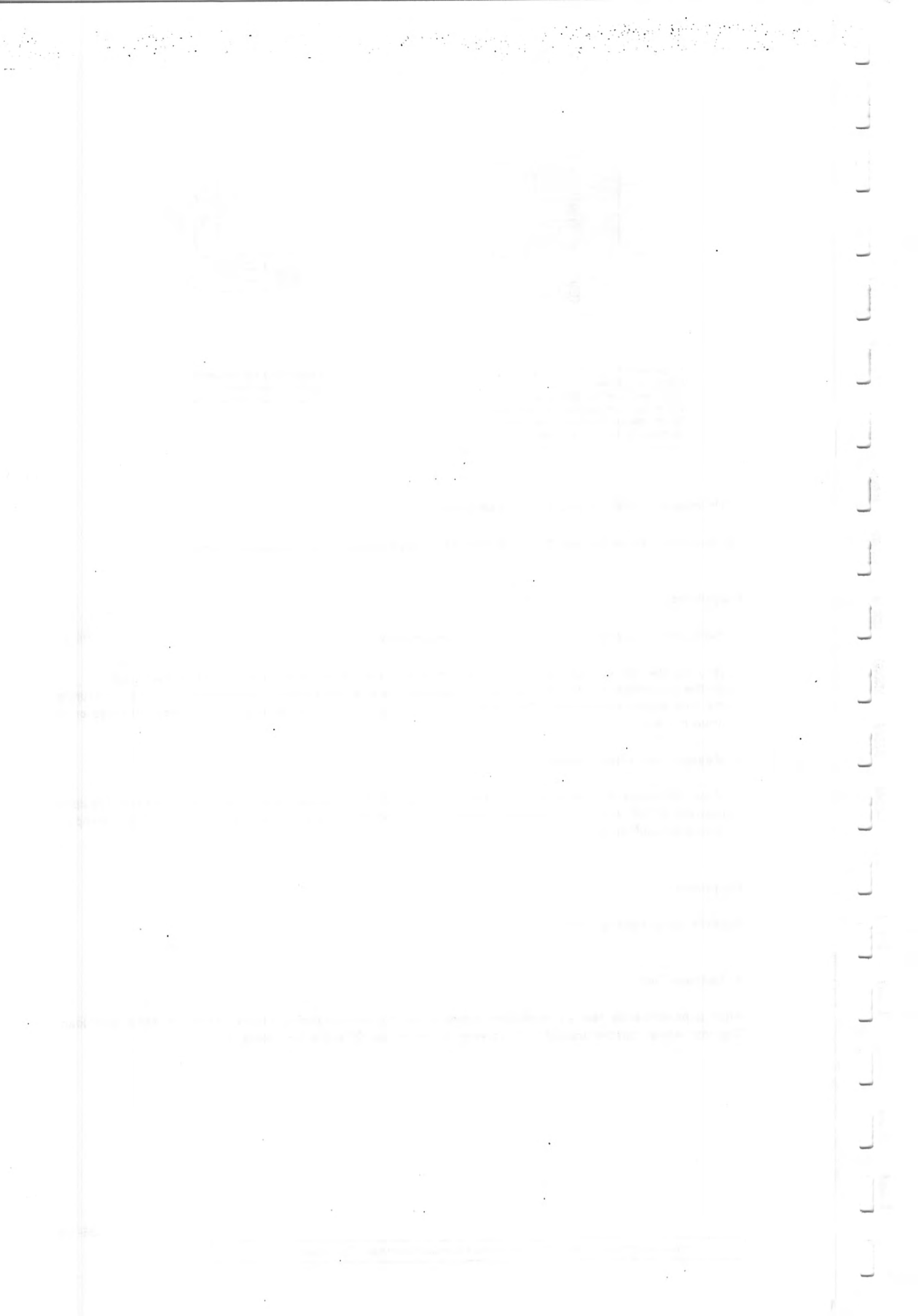
If the difference in camber between this measurement and the one carried out under a load of 100 kp is between  $0^{\circ} 30'$  and  $1^{\circ} 15'$  pumping action is satisfactory; if the difference is above  $1^{\circ} 15'$ , pumping action is insufficient.

#### Correction

Replace compensating spring

### d) Leakage Test

After a performance test as described above leave the car on sliding plates under the same axle load. The rear wheel camber should not decrease by more than  $2^{\circ}$  within two hours.



# Testing of Shock-Absorbers

Job No.
32-8

## A. General

If the riding properties of the car change and if there is a good reason for suspecting the shock-absorbers, these should be removed and tested on a testing machine.

The test values are given in the table in Job No. 32-0. Testing a shock-absorber by hand is an extremely inaccurate method and does not therefore permit any conclusions as to the condition and the adjustment of the shock-absorber.

If rattling noises are heard on the road at the front or rear axle, the suspension members of the shock-absorbers should be checked first of all (see Job Nos. 32-2 and 32-3).

If a grunting noise is heard when rocking the car, entering it or driving it at low speed, the piston rods are running dry. They should be cleaned and oiled.

**Note:** Shock-absorbers should be treated with great care to avoid any deformation of the housing or bending and damaging of the piston rod.

Shock-absorbers cannot be repaired with standard shop tools; repairs should not be attempted if the special tools and equipment required are not available.

**Because of the gas pressure obtaining inside the Bilstein shock-absorbers, they must under no circumstances ever be opened.**

As a safety precaution, unserviceable Bilstein shock-absorbers ready for scrapping should have a hole drilled into the lower end of the housing to release the gas.

## B. Checking the Oil Reserve in the Shock-Absorber

### Bilstein Shock-Absorbers

In the case of the gas-filled Bilstein shock-absorbers it is possible to make an accurate check on the oil reserve in the shock-absorber. To do this, fix the shock-absorber in a vise at the lower suspension element, depress the piston rod down to the stop and measure the distance between the collar on the piston rod and the shock-absorber housing (see Job 32-0).

The end position of the piston rod and the position of the compensating piston between gas pad and oil depends on the quantity of oil in the shock-absorber. If there is a loss of oil, the gas pressure forces the compensating piston outward which increases the piston rod extrusion.

The table in Job No. 32-0 lists the permissible values for new and for used shock-absorbers. Used shock-absorbers which exceed the maximum values given in the table must be replaced.

#### Note:

- a) When measuring the oil reserve, the shock-absorber temperature should be about + 20° C.
- b) If a shock-absorber is found to have an outside oil film, the oil reserve should be checked. If the piston rod extrusion is found to be within the permissible limits and the shock-absorber is working properly, it should be reinstalled after cleaning. There is no point in replacing a shock-absorber only because of a slight loss of oil.

- c) If the piston rod seizes when it is pressed down or if the piston rod does not automatically return to its initial position when the shock-absorber is compressed by hand, the shock-absorber is obviously not in proper working order and is no longer serviceable.
- d) The shock-absorber should be replaced if a whistling or clicking noise is heard during the last quarter of the working stroke before the bottom stop when the piston rod is pressed down. The same noise occurs when the piston rod extrusion exceeds the maximum permissible value.

#### **F. & S. Shock-Absorbers**

In the case of F. & S. shock-absorbers a major loss of oil is definitely established if there is non-productive travel of the piston rod in the upper quarter of the working stroke when the piston rod is moved up and down several times. In that case the shock-absorber is no longer fully serviceable.

#### **Stabilus Shock-Absorbers**

In the case of Stabilus shock-absorbers there is a loss of oil if the piston rod projects from the housing in the lower stop position when pressed down. Within certain limits, oil losses in these shock-absorbers are compensated by a pressure spring at the bottom of the housing which acts upon a compensating piston, with the result that small oil losses do not make the shock-absorber inoperative.

# Removal and Installation of Torsion Bar for Rear Axle

Job No.

32-9

Modification: Paras 1-3 new

## Removal:

1. Leave the valve knob in "driving position".
2. Jack up the car at the rear.
3. Check by finger pressure whether the rear bellows are deflated.
4. Detach the connecting rod (10) for the leveling valve (8) from the lever (7a) of the torsion bar (Fig. 32-9/1). Fix the leveling valve in its neutral position by means of a pin (see Fig. 40-5/4).

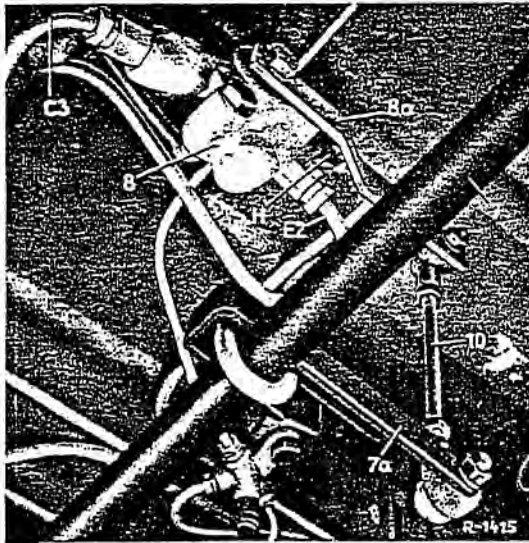


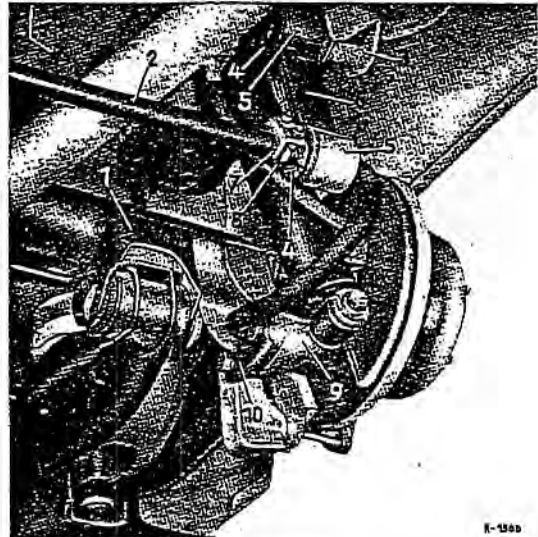
Fig. 32-9/1

- C3 Pressure line (full working pressure) from valve unit to rear leveling valve
- E2 Connecting line from rear leveling valve to air chamber
- H Exhaust line from rear leveling valve to valve unit
- 7 Torsion bar for rear axle
- 7a Lever on torsion bar
- 8 Rear leveling valve
- 8a Lever
- 10 Connecting rod

5. Detach lower clamp (5) from bracket (6) carrying the torsion bar on the chassis base panel at the left and right (Fig. 32-9/2).
6. Detach lower right shock-absorber suspension and remove shock-absorber from bearing bracket (Fig. 32-9/3). (See also Job No. 32-3).

**Note:** Make sure that the shock-absorber suspension is only detached when the bellows are deflated!

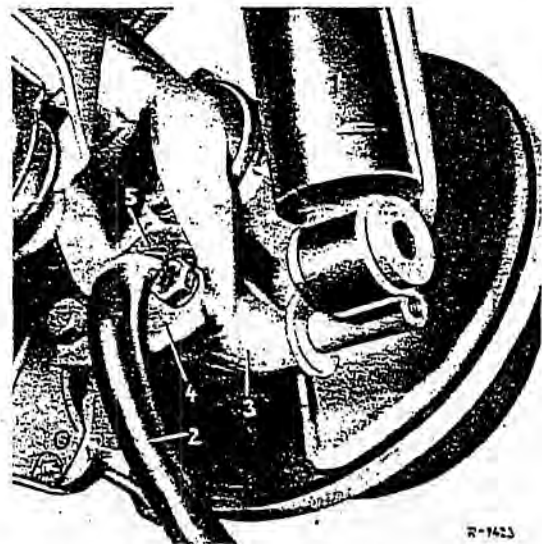
7. Unscrew the three hexagon screws fastening the bearing bracket (3) to the right axle tube and remove the connecting brace (4) (Fig. 32-9/3).



K-1566

Fig. 32-9/2

- 1 Axle tube of rear axle
- 2 Torsion bar
- 3 Bracket on chassis base panel
- 4 Rubber mounting
- 5 Clamp
- 6 Bracket
- 7 Retainer
- 8 Fixing strap
- 9 Bearing bracket
- 10 Connecting brace



R-1423

Fig. 32-9/3

- 1 Rear shock-absorber
- 2 Torsion bar
- 3 Bearing bracket
- 4 Connecting brace
- 5 Rubber mounting



Fig. 32-9/4

- |                                |                         |
|--------------------------------|-------------------------|
| 1 Right axle tube of rear axle | 3 Rubber mounting       |
| 2 Torsion bar                  | 4 Right bearing bracket |

8. Press the torsion bar off the right axle tube of the rear axle (Fig. 32-9/4).
9. Pull the torsion bar out of the rubber mounting in the left bearing bracket (6) and remove (Fig. 32-9/5). Remove the right bearing bracket (1) from the torsion bar.
10. If necessary, unscrew the lever (7a) for the leveling valve from the torsion bar (Fig. 32-9/1). Press the clamp (5) for the rubber mounting (4) on the chassis base panel off the torsion bar at the right and at the left and remove the rubber mounting. Remove the retainer (7) together with the fixing strap (8) (Fig. 32-9/2).

#### Installation:

11. Check the rubber mountings carrying the torsion bar for the rear axle. If necessary, press the rubber mountings off the bearing brackets and replace them.

**Note:** On installation make sure that the slot in the rubber mounting points either front or rear; in no case should it point up or down.

12. Check the rubber mountings carrying the torsion bar on the chassis base panel and, if necessary, replace them. Push the rubber mountings onto the torsion bar at the right and at the left and attach the clamps.
13. Insert the torsion bar in the rubber mounting in the left bearing bracket. Slide on the right bearing bracket and insert the torsion bar through the slot in the right axle tube (Figs. 32-9/4 and 5).
14. Screw the right bearing bracket together with the connecting brace (4) to the axle tube (Fig. 32-9/3). With the car jacked up slightly raise the right axle tube of the rear axle during the process.
15. Install the right lower shock-absorber suspension (see Job No. 32-3).
16. Attach the torsion bar to the bearing bracket on the chassis base panel. If the retainers (7) had been detached previously, align the torsion bar and mount the retainers and fixing straps in such a way that they rest against the inner side of the rubber mountings without any play (Fig. 32-9/2).
17. Attach the lever for the leveling valve to the torsion bar. Adjust the car level (see Job No. 40-5).

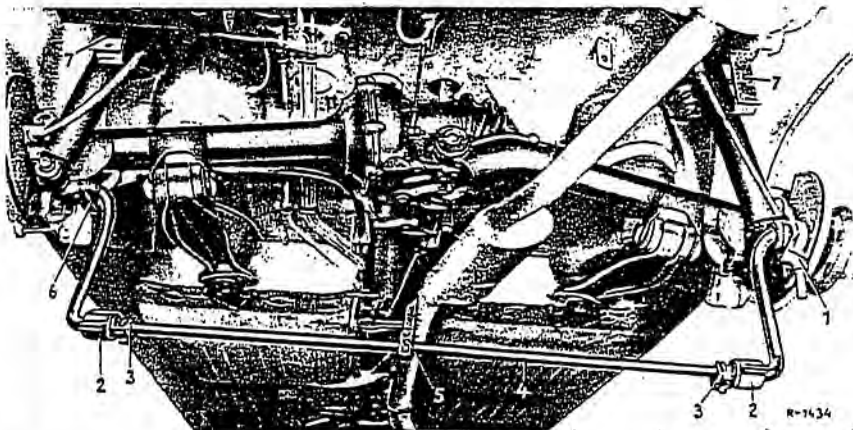


Fig. 32-9/5

- |  |
|--|
| 1 Right bearing bracket with rubber mounting |
| 2 Clamp with rubber mounting                 |
| 3 Retainer with fixing strap                 |
| 4 Torsion bar                                |
| 5 Lever for leveling valve                   |
| 6 Left bearing bracket                       |
| 7 Bracket                                    |

## Hints for Assembly Work on Cars with Air Suspension System

Job No.
---------

32-11'
--------

### A. Removal and Installation of Front Shock-Absorber

(see Job No. 32-2)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the front.
3. Replace shock-absorber.
4. Jack the car down (Caution! Car has very little ground clearance at the front).

### B. Removal and Installation of Rear Shock-Absorber

(see Job Nr. 32-3)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the rear.
3. Check by finger-pressure whether the rear bellows are evacuated.
4. Replace shock-absorber.
5. Jack the car down (Caution! Car has very little ground clearance at the rear).

### C. Removal and Installation of Front Axle Support with Front Axle Halves

(see Job No. 33-1)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the front.
3. Completely drain compressed air from the air reservoir.
4. Disconnect both compressed-air hoses at the left leveling valve.
5. Remove front axle support with front axle halves.

**Note:** The front axle has to be removed together with air chambers bellows, and spring pistons.

6. Install front axle support with front axle halves.
7. Connect compressed-air hoses.
8. Jack the car down (Caution! Car has very little ground clearance at the front).
9. Fill the system with compressed air (see Job No. 32-12).
10. Adjust car level at the front axle (see Job No. 40-5).

### D. Removal and Installation of Steering Knuckle

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the front.
3. Completely drain compressed air from the air reservoir.
4. Open screw plug 'V' at the valve unit and close after the air has been blown off.

32-11/1

5. Remove front shock-absorber (see Job No. 32-2).
6. Detach connecting rod for front leveling valve at the lower control arm.  
To do this, unscrew ball pin.
7. Replace steering knuckle.
8. Install front shock-absorber (see Job No. 32-2).
9. Attach connecting rod for front leveling valve.
10. Jack the car down (Caution! Car has very little ground clearance at the front).

### **E. Removal and Installation of Rear Axle**

(see Job No. 35-1)

1. Leave push-pull button for valve unit in 'Drive Position'.
2. Jack up the car at the rear.
3. Completely drain compressed air from the air reservoir.
4. Check by finger-pressure whether the rear bellows are evacuated.
5. Loosen the hexagon screws fastening the spring pistons to the torque arms.
6. Detach the connecting rod for the rear leveling valve from the lever of the torsion bar.  
To do this, unscrew ball pin.
7. Remove the torsion bar (see Job No. 32-9).
8. Remove the rear axle.

**Note:** When the rear axle is being removed, the spring pistons are left in the bellows.

9. Install rear axle.
10. Install torsion bar (see Job No. 32-9).
11. Fix the lever of the leveling valve in the neutral position.
12. Fill up the system with compressed air (see Job No. 32-12).
13. Fill the rear bellows (see Job No. 32-12).
14. Jack the car down (Caution! Car has not full ground clearance).
15. Adjust the car level at the rear axle (see Job No. 40-5).



# Maintenance and Assembly Work on Air Suspension System

Job No.
32-12

## A. General Instructions

### Jacking up of Car

Before the car is jacked up for a wheel change, for installing or removing snow chains, or for general maintenance and assembly operations, during which the shock absorbers are not removed, the push-pull button for the valve unit must be pulled out (position "Wheel Change"). This is necessary in order to prevent air loss. If the push-pull button is left in "Drive Position" (pushed in) the air is released from the bellows when the car is being jacked up so that as a result the ground clearance of the car will be **too low** after it has been jacked down.

When jacking up the car, place the jack as usual under the front axle support and at the rear under the rear axle housing. If the car is jacked down when the bellows are empty, do not pull out the jack before the standard design height of the car has been reached. This is particularly important for the rear axle since otherwise the leveling valve will be damaged.

When the car is being lifted on one side by means of the car jack or by a workshop jack, the hand brake must not be applied. The selector lever should be in position "P". The front wheel opposite the side which is being jacked up should be secured by chocks front and rear.

### Filling the System with Compressed Air

Connect the air reservoir via the filler valve (2) to the stationary workshop compressed-air system and fill up until a pressure of approx. 10 atm is reached (Fig. 32-12/1).

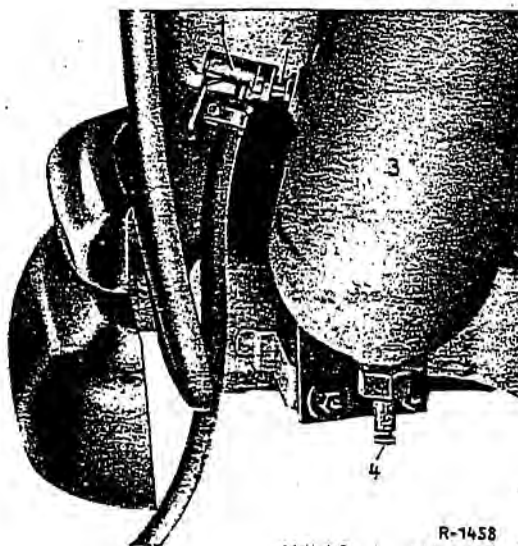


Fig. 32-12/1

- 1 Connecting piece on air hose
- 2 Filler valve
- 3 Air reservoir
- 4 Drain valve

**Note:** If there is a slight loss of air, fill up the air suspension system by running the engine at moderate speed ( $n$ =approx. 2000 rpm).

32-12/1

When filling up the air reservoir from the stationary compressed-air installation, make sure that no condensation enters the air suspension system.

### Checking Working Pressure

Connect a suitable pressure gage to measure the pressure on the filler valve of the air reservoir (Fig. 32-12/2).

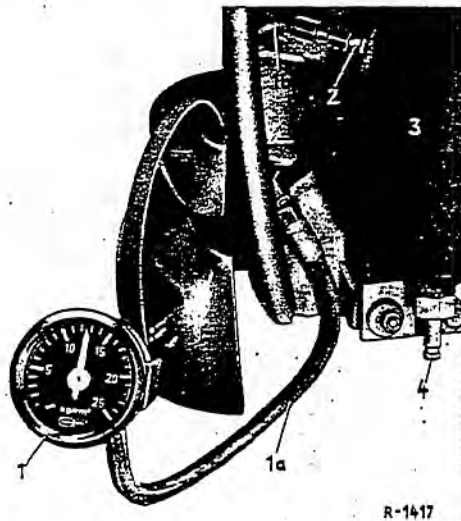


Fig. 32-12/2

- 1 Pressure gage
- 1a Connecting hose
- 1b Connecting piece
- 2 Filler valve
- 3 Air reservoir
- 4 Drain valve

### Assembly Work on Air Suspension Units

**Caution, compressed air is dangerous! High pressure!**

**To prevent accidents, the car should be jacked up before the air lines on the leveling valves and air chambers are disconnected!**

**Extreme cleanliness is absolutely essential for all assembly work!**

**On no account must dirt or water get into the units and lines of the air suspension system!**

**Dirty line connections must be cleaned before the lines are disconnected!**

**Lines, hoses and all other connections must be closed immediately after disconnection!**

**Carefully clean all lines with dry compressed air before reconnecting them and carefully clean new lines before connecting them!**

**Always use new rubber sealing rings for all line connections!**

Make sure that the rubber sealing rings for the air lines are properly seated in the threaded unions! (Fig. 32-12/3).

Tighten the cap screws of the lines with the prescribed torque! (see Job No. 32-0).

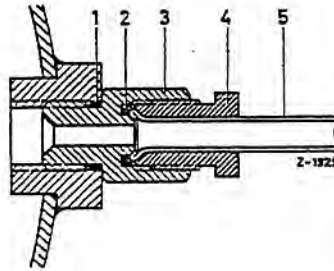


Fig. 32-12/3

Line connection

- 1 Rubber sealing ring for threaded union
- 2 Rubber sealing ring for air line
- 3 Threaded union
- 4 Cap screw
- 5 Air line

### Checking System for Leaks

After reassembly all connections should always be checked for leaks by spraying with a special solution as described below. Leaks will be indicated by the formation of bubbles (e.g. as shown in Fig. 32-12/4 – see Arrow). For spraying use an oil gun with plastic container.

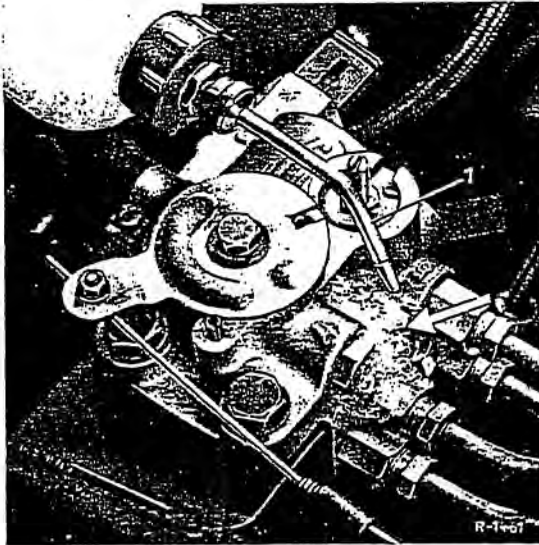


Fig. 32-12/4

- 1 Oil gun with plastic container

If there is any air loss all compressed-air connections should be checked in this way.

As a testing agent use water with the addition of Nekal BX Dry produced by the firm BASF, Ludwigshafen, according to their instructions. Maximum foam is produced at a concentration of two table-spoonfuls (approx. 12 to 15 gm.) of Nekal BX Dry to 1 liter of water.

To produce the mixture, dissolve the powder in  $\frac{1}{4}$  liter boiling water, stirring all the time until a clear liquid is produced. Then fill up the solution with the remaining  $\frac{3}{4}$  liters of cold water.

32-12/3

### Filling of Rear Bellows

The operations described below apply to repair cases where the spring piston was detached from the bellows. Any bellows detached from the spring piston should only be filled **according to instructions**, that is, in a **horizontal position of the rear axle tubes**, since otherwise the bellows would not be centered correctly on the spring piston.

1. Detach the connecting rod of the rear leveling valve. To do this, unscrew the ball pin from the lever on the torsion bar (Fig. 32-12/6).
2. Lift both axle tubes in order to get them into an approximately horizontal position (Fig. 32-12/5).

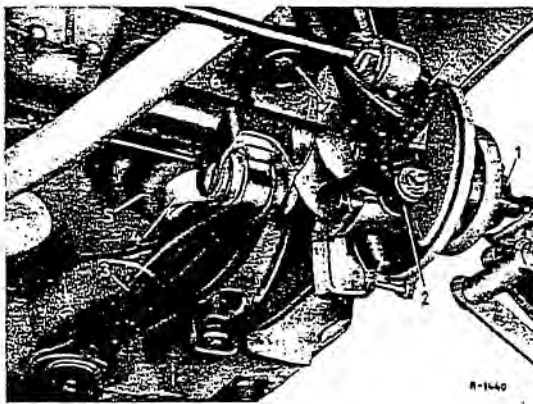


Fig. 32-12/5

- 1 Flange 111 589 01 63
- 2 Lower shock-absorber suspension
- 3 Torque arm
- 4 Spring piston
- 5 Bellows
- 6 Rear axle tube
- 7 Rubber buffer
- 8 Torsion bar

3. Fill up the air reservoir to a maximum of 8 atm.

The rear bellows should never be filled unless the cross strut of the rear axle has been mounted and the system has been adjusted to the center position (see Job Nos. 35-1, and 40-3, Section H).

4. Coat the spring piston with glycerin at the upper end.
5. Fill the bellows to approx. 3 atm by lifting the lever on the leveling valve, taking care that the bellows are properly centered on the spring piston (Fig. 32-12/6). When the assembly is properly mounted, the bellows must rest evenly on the whole circumference of the spring piston.

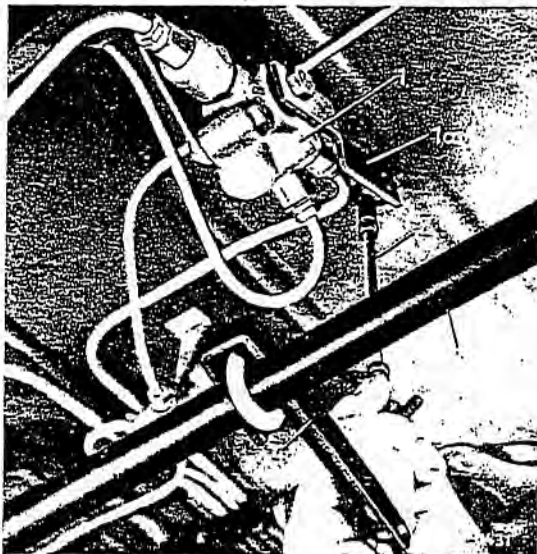


Fig. 32-12/6

- 1 Leveling valve
- 1a Lever
- 2 Connecting rod
- 3 Torsion bar
- 4 Lever on torsion bar

6. Pull the push-pull button for the valve unit to the position "Wheel Change" in order to ensure that during the jacking down of the car, air cannot escape from the bellows.
7. Jack car down (Caution! Car has not full ground clearance).
8. Attach the connecting rod of the leveling valve.
9. Press the push = pull button for the valve unit into "Drive Position".

### Driving with Empty Bellows

If the car has to be driven or towed for some time with a defect in the air suspension system, the standard rubber buffers on the front and rear axles should be increased in height by installing additional rubber buffers in order to increase ground clearance (Figs. 32-12/7 and 8). The additional rubber buffers can be obtained through normal channels under the part numbers listed below.

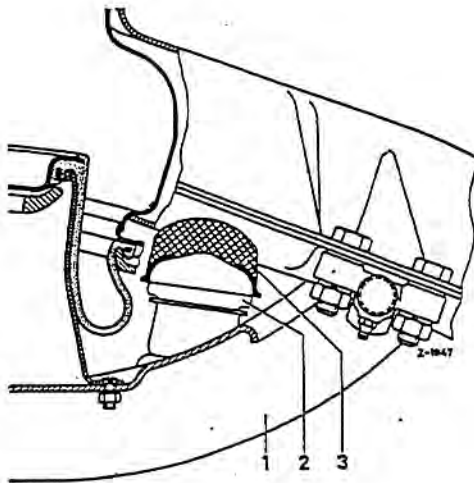


Fig. 32-12/7

Front axle

- 1 Lower control arm
- 2 Standard rubber buffer
- 3 Additional rubber buffer  
112 589 02 63 00

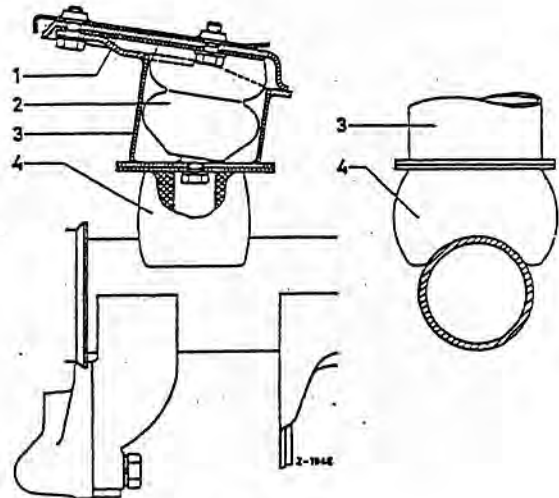


Fig. 32-12/8

Rear axle

- 1 Stop plate
- 2 Standard rubber buffer
- 3 Bracket on additional rubber buffer
- 4 Additional rubber buffer  
with bracket 112 589 03 63 00

For the installation of additional rubber buffers (4 buffers on the front axle, 2 buffers on the rear axle) the car must be jacked up.

For lifting the car, put a workshop jack as usual under the front axle support or the rear axle housing. It is advisable to push the car wheels on a slight elevation in order to increase their ground clearance.

**Note:** Before the additional rubber buffers can be installed, both wheels on the front axle must be under no load at the same time. When the car has been jacked up by the car jack, first lift one side and support the car by a trestle under the chassis base panel; then jack up the other side in order to relieve the left and right wheel.

32-12/5

## B. Maintenance Work

1. After 300 miles (Schedule A), 1900 miles (Schedule B), and Every 1900 miles (Schedules C, D and E) check the tension and the condition of the V-belt of the air compressor drive. If there is any wear, replace the belt. Belt pressure is correct when the belt with moderate thumb-pressure can be depressed by approx. 10-15 mm.  
To retension the V-belt, loosen the hexagon nut (4) on the bearing bracket (5) and tighten the tensioning screw (1) (Fig. 32-12/9). Afterwards tighten the lock nut of the tensioning screw and the hexagon nut on the bearing bracket.

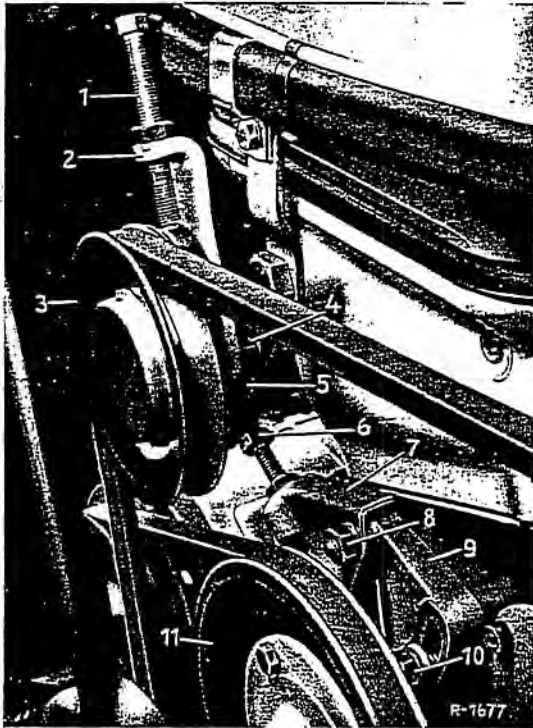


Fig. 32-12/9

- 1 Hexagon screw (tensioning screw) with lock nut
- 2 Tension bracket
- 3 V-belt pulley
- 4 Hexagon nut with lock washer
- 5 Bracket
- 6 Hexagon screw (tensioning screw) with lock nut
- 7 Retaining plate
- 8 Hexagon nut with lock washer
- 9 Fan bearing bracket
- 10 Hexagon nut with lock washer and washer
- 11 V-belt pulley for fan drive

2. After 300 miles (Schedule A), 1900 miles (Schedule B), and Every 1900 miles (Schedules C, D and E) drain condensation from the air reservoir. To do this, pull the drain valve (2) until there is no longer any condensation (approx. 2 sec.) (Fig. 32-12/10).

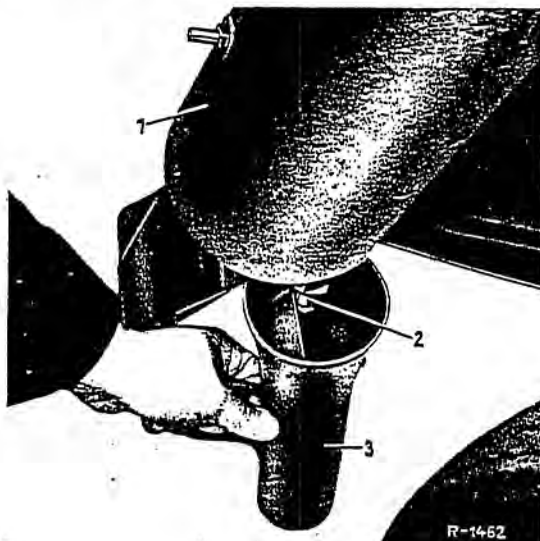


Fig. 32-12/10

- 1 Air reservoir
- 2 Drain valve
- 3 Container

3. Every 12 000 miles (Schedule E) check whether the hexagon socket screws for fastening the bracket (31) for the air compressor to the engine crankcase are firmly seated (Fig. 32-12/11).

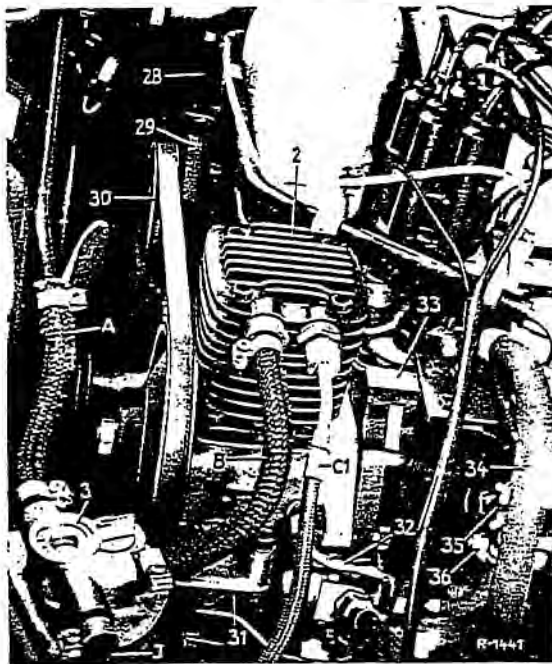


Fig. 32-12/11

- A Intake and exhaust line from air intake silencer to vaporizer jar
- B Intake line from vaporizer jar to air compressor
- C Pressure line from air compressor to air reservoir
- J Exhaust line from valve unit to vaporizer jar
- 2 Air compressor
- 3 Vaporizer jar
- 28 Tensioning screw
- 29 Support
- 30 Tension sprocket
- 31 Bracket for air compressor
- 32 Pressure oil line for lubrication of air compressor
- 33 High-pressure oil pump for power steering
- 34 Intake line
- 35 Pressure line
- 36 Strut

4. After 1900 miles (Schedule B) and every 1900 miles (Schedules C, D and E), during the winter season, when temperatures are below 5° C, fill the jar with 96 per cent. completely methylated ethyl alcohol (ethanol) up to the longitudinal groove. To do this, unscrew the screw plug (3b) (Fig. 32-12/12). Drain the condensation before filling up.

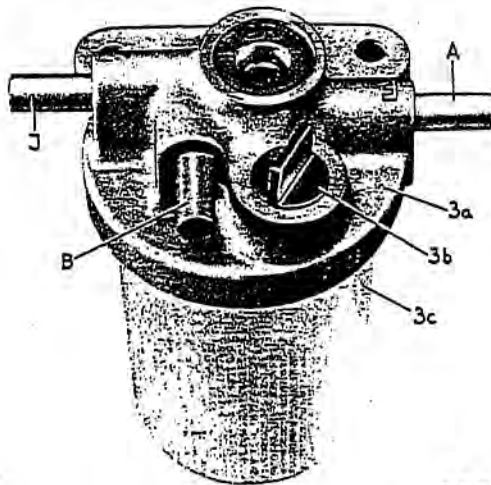


Fig. 32-12/12

- A Connection for intake and exhaust line from air intake silencer to vaporizer jar
- B Connection for intake line from vaporizer jar to air compressor
- J Connection for exhaust line from valve unit to vaporizer jar
- 3a Valve body
- 3b Screw plug with rubber sealing ring
- 3c Jar

5. Every 36 000 miles (Routine Service according to Schedule E), check spring bellows for cracks. Hair cracks are of no importance. If larger cracks are found, replace the bellows (see Job No. 32-13).

Replace rear leveling valve (see Job No. 32-19).

Replace air cleaner on vaporizer jar.

Check the car level (see Job No. 40-5).

32-12/7

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## Trouble Shooting Hints for Air Suspension System

Job No.

32-13

Cause	Remedy
<b>White Warning Lamp in Instrument Cluster Lights Up</b>	
<p>Push-pull button for valve unit pulled into position "Wheel Change".</p> <p>Electric pressure indicator in valve unit faulty.</p> <p>Pressure in air reservoir has dropped below minimum</p>	<p>Push button in</p> <p><b>Note:</b> The white warning lamp in the instrument cluster also lights up when the hand brake is pulled.</p> <p>Replace pressure indicator.</p> <p>Check pressure in air reservoir (see Job No. 32-12).</p>
<b>Pressure in Air Reservoir Too Low</b>	
<p><b>Car level remains unchanged</b></p> <p>Tension of V-belt for air compressor drive insufficient or V-belt broken</p> <p>Delivery of air compressor unsatisfactory.</p> <p>Leaky pressure line between air compressor and non-return valve.</p> <p>Non-return valve does not work.</p> <p>Non-return valve not properly closing, since connecting bore in cylinder head of air compressor clogged (only on first version — see Job No. 32-15).</p> <p>Leaky filler valve on air reservoir.</p> <p>Leaky drain valve on air reservoir.</p> <p>Valve unit leaks on electric indicator for warning lamp, on safety valve or on a screw plug.</p>	<p>Correct tension of V-belt or replace V-belt.</p> <p><b>Note:</b> The high-pressure oil pump for the power steering is flanged to the air compressor and is thus driven by the same V-belt.</p> <p>If the V-belt is loose or broken, this condition will be noticed at once because with the power steering out of action more effort will be required to turn the wheel.</p> <p>Check delivery (see Job No. 32-15). If necessary, repair or replace air compressor.</p> <p>Replace pressure line.</p> <p>Check non-return valve an, if necessary, replace as an assembly (see Job No. 32-16).</p> <p>Clean connecting bore (see Job No. 32-15).</p> <p>Check whether valve body and high-pressure valve insert are seated properly. If necessary, replace the filler valve as an assembly.</p> <p>Check whether drain valve is seated properly and, if necessary, replace.</p> <p>Check whether electric indicator, the safety valve and screw plugs are properly seated, and, if necessary, replace rubber sealing ring.</p>

32-13/1

Cause	Remedy
<b>Pressure in Air Reservoir Too Low</b>	
<p><b>Car level remains unchanged</b></p> <p>Leaky pressure reducing valve or pressure retaining valve in valve unit.</p> <p>Leaky pressure line connection in system between air reservoir and leveling valves.</p> <p>Leaky leveling valve on intake side.</p>	<p>Replace valve unit.</p> <p>Check all connections of pressure lines and hoses for leaks.</p> <p>Check leveling valves for leaks (see Job No. 32-19).</p>
<b>Car Level Too Low, Front or Rear</b>	
<p>Serious leak in pressure system to the bellows so that the working pressure is constantly below minimum.</p> <p>Leaky leveling valve.</p> <p>Leaky connection between leveling valve and air chamber.</p> <p>Leaky air chamber or bellows.</p>	<p>Remove leak.</p> <p>Check leveling valves for leaks in the car (see Job No. 32-19).</p> <p>Check all connections.</p> <p>Check air chamber and bellows for leaks (see Job No. 32-12). If necessary, unscrew bellows from air chamber and examine for cracks (see Job No. 32-14).</p>
<b>Car Level Too Low In Front</b>	
<p>Pressure reducing valve of valve unit not properly adjusted or leaky.</p>	<p>Check adjustment of pressure reducing valve (see Job No. 32-18).</p>

# Air Chamber with Bellows

Job No.

32-14

## Removal and Installation of Air Chamber and Bellows, Disassembly, Reassembly and Leak Test

### A. Removal and Installation of Air Chamber and Bellows, on Front Axle

#### Removal:

1. Jack up the car.  
Leave the push-pull button on the instrument panel in "Drive Position".
2. Exhaust the compressed air from the air reservoir.
3. Detach the connecting rod (10) for the leveling valve from the lower control arm; (Fig. 32-14/1). To do this, unscrew the ball pin.

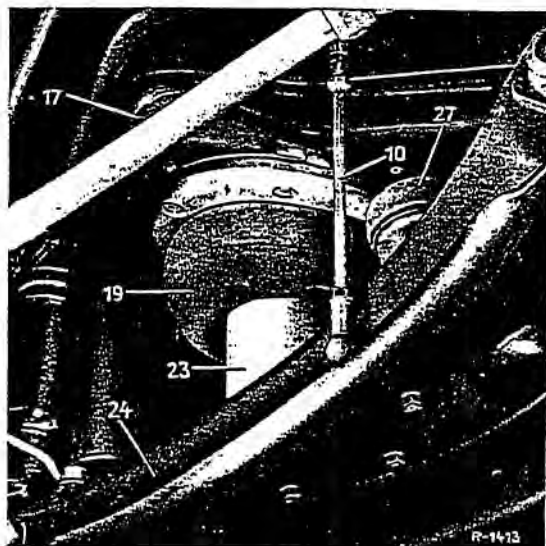


Fig. 32-14/1

- 10 Connecting rod for leveling valve
- 17 Air chamber
- 19 Bellows
- 23 Spring piston
- 24 Lower control arm
- 27 Rubber buffer

4. Detach the line (E1) from the air chamber (Fig. 32-14/2).

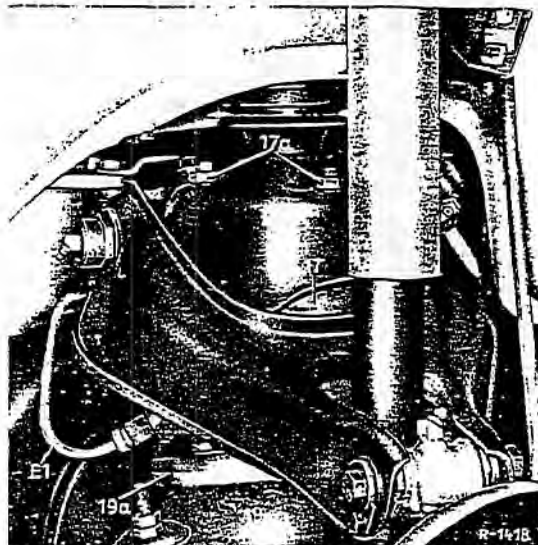


Fig. 32-14/2

- E1 Connecting line from leveling valve to air chamber
- 17 Air chamber
- 17a Threaded pin for attaching the air chamber to the front axle support
- 19 Bellows
- 19a Clamping ring

5. Detach the bellows from the spring piston by means of a hammer handle (Fig. 32-14/3).

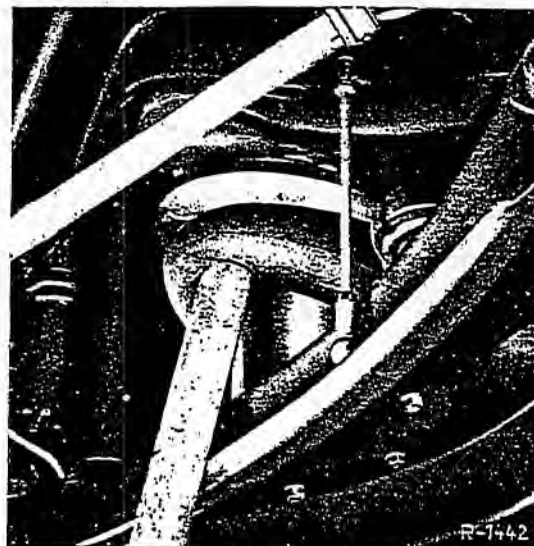


Fig. 32-14/3

32-14/1

- Detach the tie-rod from the steering knuckle arm (Job No. 46-9).
- Unscrew the spring piston from the lower control arm and remove (Fig. 32-14/4).



Fig. 32-14/4  
Spring piston

- Unscrew the three hexagon nuts for fastening the air chamber to the front axle support and remove air chamber with bellows (Fig. 32-14/5).

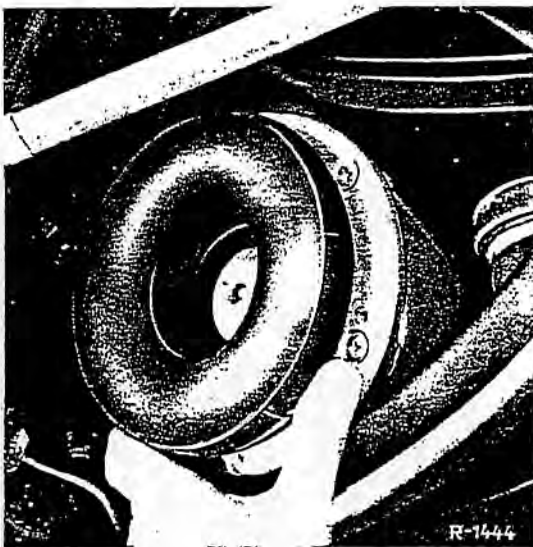


Fig. 32-14/5

#### Installation:

- Insert air chamber and bellows and attach them to the front axle support. Coat the upper end of the spring piston with gly-

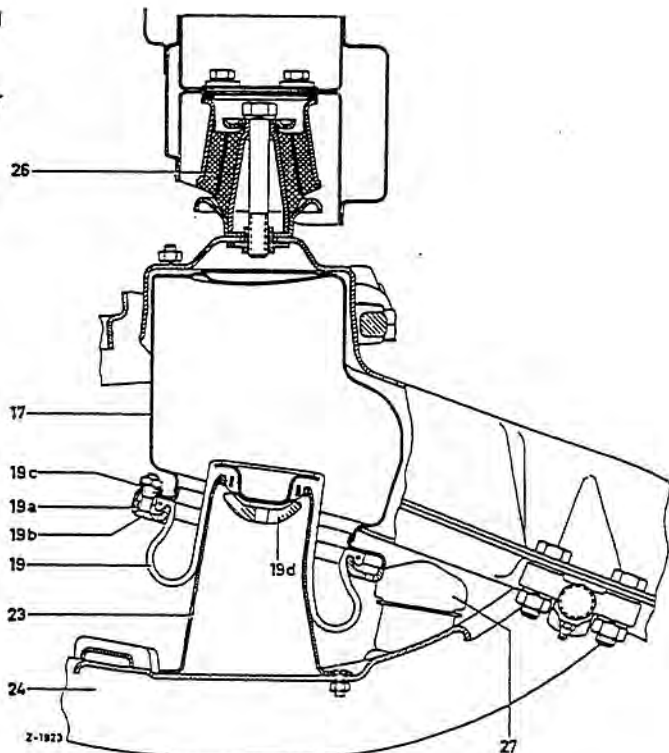


Fig. 32-14/6

#### Air chamber with bellows on front axle

- 17 Air chamber
- 19 Bellows
- 19a Clamping ring
- 19b Phillips head countersunk screw with hexagon nut and locking plate
- 19c Reinforcement plate
- 19d Centering piece on bellows
- 23 Spring piston
- 24 Lower control arm
- 26 Rubber mounting for suspension of front axle
- 27 Rubber buffer

erin, insert it and screw it to the lower control arm. (Fig. 32-14/6).

**Note:** Install the spring piston in such a way that the two faces of the attaching flange tally with the recess in the control arm.

- Attach the line to the air chamber.
- Attach the ball pin of the connecting rod for the leveling valve to the control arm.
- Jack down the car.

**Caution!** Car has only little ground clearance.

- Check the car level and, if necessary, correct (see Job No. 40-5).

## B. Removal and Installation of Air Chamber and Bellows on rear axle

### Removal:

1. Jack up the car.  
Leave the push-pull button on the instrument panel in 'Drive Position'.
2. Exhaust compressed air from reservoir.
3. Detach the connecting rod (10) for the leveling valve from the lever of the torsion bar (see Fig. 32-19/2). To do this, unscrew the ball pin.
4. Disconnect the lines (two on the left, one on the right) from the air chamber (Fig. 32-14/7).
5. Detach the bellows from the spring piston by means of a hammer handle (Fig. 32-14/8).

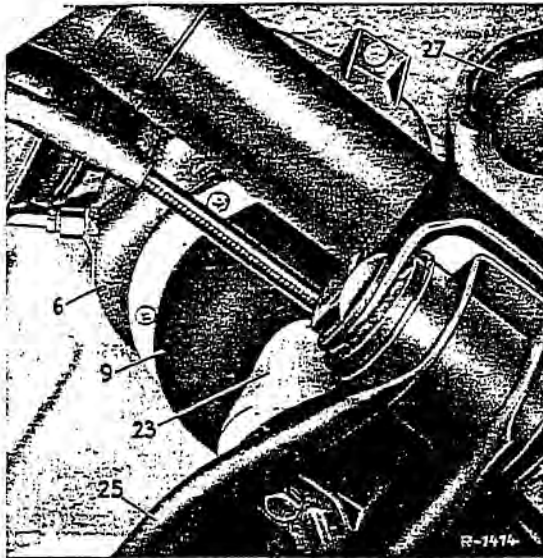


Fig. 32-14/7

6 Air chamber  
9 Bellows  
23 Spring piston

25 Torque arm  
27 Rubber buffer

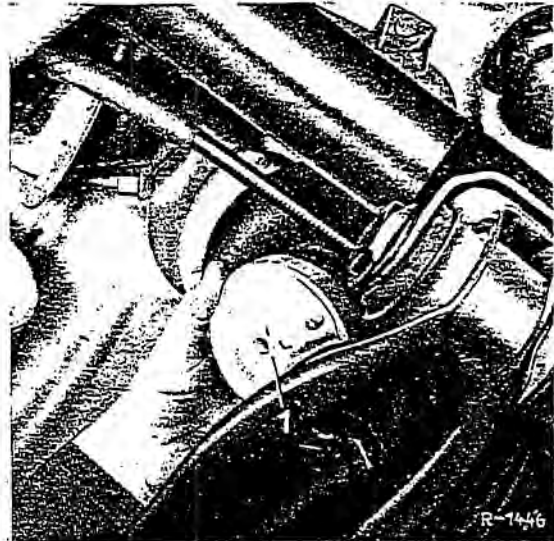


Fig. 32-14/9

1 Spring piston

6. Unscrew the spring piston (1) from the torque arm and remove (Fig. 32-14/9).
7. Unscrew the three hexagon nuts for fastening the air chamber to the chassis base panel and remove air chamber and bellows (Fig. 32-14/10).

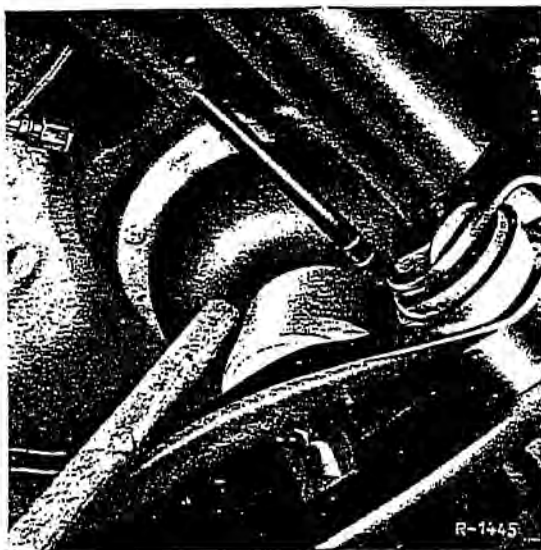


Fig. 32-14/8

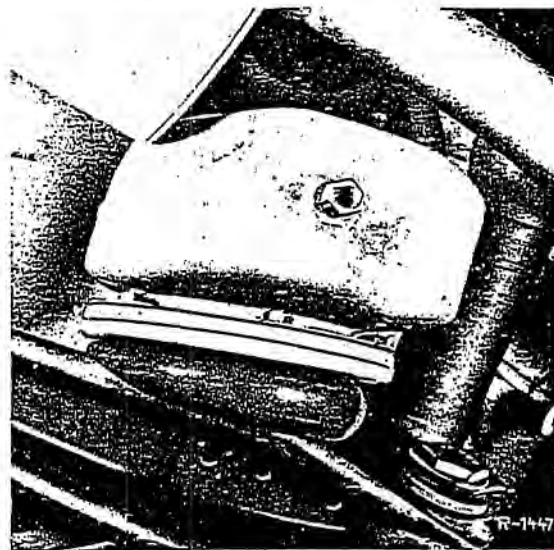


Fig. 32-14/10

32-14/3

**NOTE:** The two front hexagon nuts are accessible from the interior of the car after the

rear seat has been removed, and the rear hexagon nut is accessible from the trunk.

**Installation:**

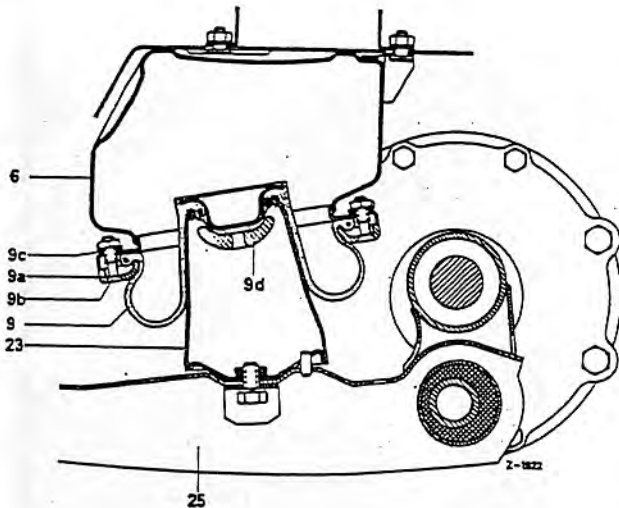


Fig. 32-14/11

Air chamber with bellows on rear axle

- 6 Air chamber
- 9 Bellows
- 9a Clamping ring
- 9b Phillips head countersunk screw with hexagon nut and locking plate
- 9c Reinforcement plate
- 9d Centering piece on bellows
- 23 Spring piston
- 25 Torque arm

8. Attach the air chamber to the chassis base panel. Coat the top end of the spring piston with glycerin, insert and screw to the torque arm (Fig. 32-14/11).

**Note:** The spring piston is fixed in position on the torque arm with a dowel pin (Fig. 32-14/11). Left and right spring piston are different.

9. Connect the lines to the air chamber.

10. Fix the lever of the leveling valve on the rear axle in its neutral position.

11. Fill up the system with compressed air (see Job No. 32-12).

12. Fill the rear bellows (see Job No. 32-12).

13. Jack down the car.

**Caution!** The car has only little ground clearance.

14. Check the car level and, if necessary, correct (see Job No. 40-5).

### C. Disassembly and Reassembly of Air Chamber with Bellows, Leak Test

#### Disassembly:

1. Put the air chamber on a mounting plate held in a vise (Fig. 32-14/12).

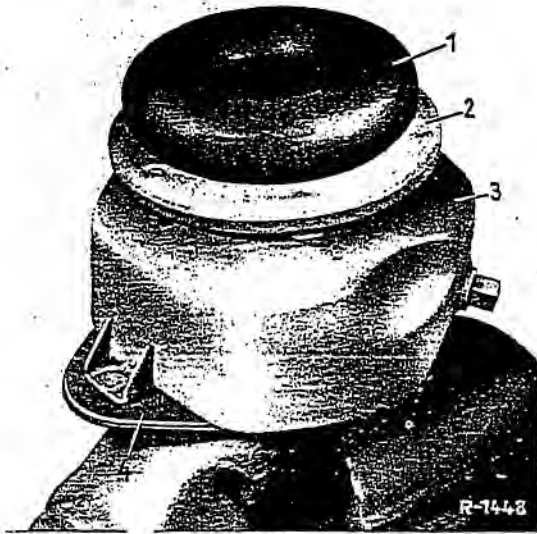


Fig. 32-14/12

- |                 |                  |
|-----------------|------------------|
| 1 Bellows       | 3 Air chamber    |
| 2 Clamping ring | 4 Mounting plate |

**Note:** The mounting plate can be made in the workshop according to the details given in Fig. 32-14/13.

2. After unscrewing the Phillips head screws, detach the bellows from the air chamber (Fig. 32-14/14).

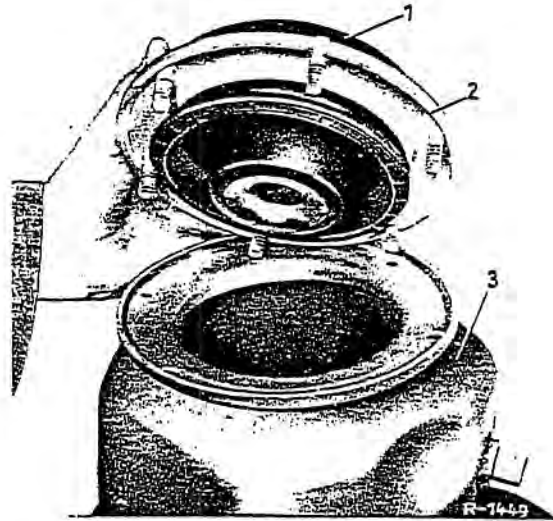


Fig. 32-14/14

- |           |                 |               |
|-----------|-----------------|---------------|
| 1 Bellows | 2 Clamping ring | 3 Air chamber |
|-----------|-----------------|---------------|

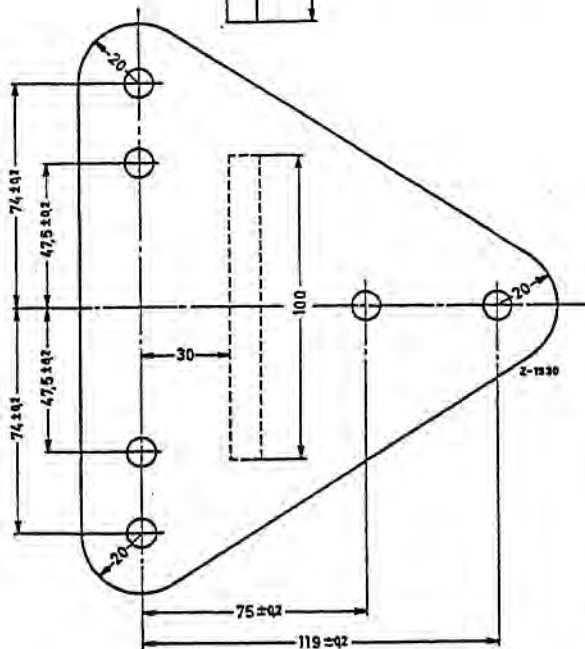
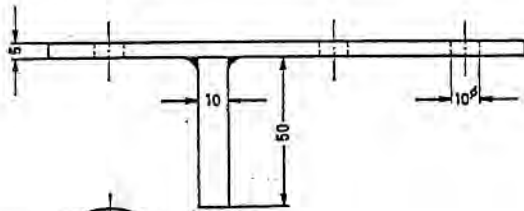
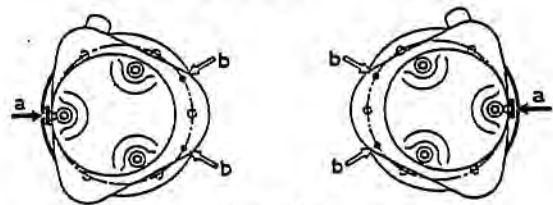


Fig. 32-14/13

#### Reassembly:

3. Mount new bellows in accordance with installation instructions (Fig. 32-14/15). See also Figs. 32-14/6 and 11.

Front axle



Rear axle

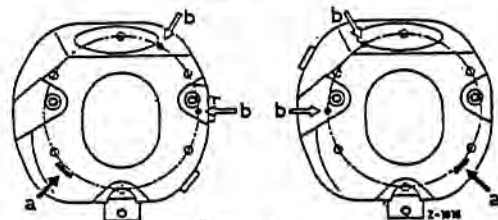


Fig. 32-14/15

- |  |
|--|
| a Location of trademark on bellows               |
| b Location of water drain holes in clamping ring |

**Prescribed Position of Trademark on bellows and Position of Clamping Ring.**

The clamping ring for the bellows should always be installed in such a way that the two water drain holes are opposite the trademark on the bellows, that is, always at the lowest point.

**Leak Test for Air Chamber and Bellows:**

4. Connect the air chamber to a stationary compressed-air installation and fill to prescribed testing pressure (see Job No. 32-0).
5. Check air chamber and bellows for leaks under water (Fig. 32-14/16).

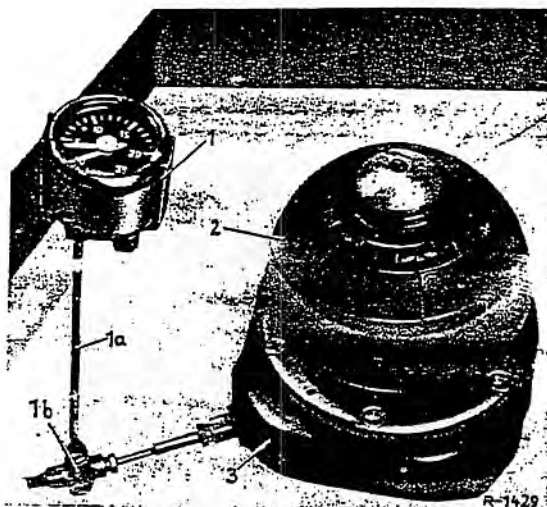


Fig. 32-14/16

- 1 Pressure gage
- 1a Connecting line
- 1b Connecting fitting with filler valve
- 2 Bellows
- 3 Air chamber



# Air Compressor

Job No.

32-15

## Removal and Installation of Air Compressor, Performance Test, Replacement of Valves

### Removal:

1. Disconnect hose lines (B) and (C 1) and the pressure oil line (32) from the air compressor (Fig. 32-15/1).

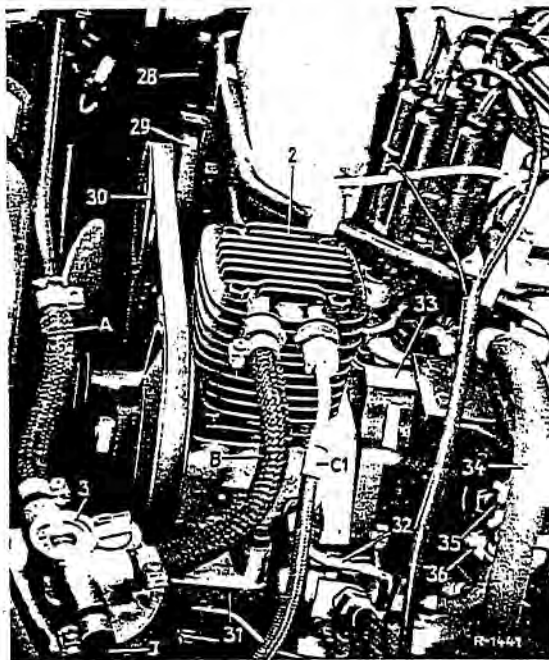


Fig. 32-15/1

- A Intake and exhaust line from air intake silencer to vaporizer jar
- B Intake line from vaporizer jar to air compressor
- C1 Pressure line from air compressor to air reservoir
- J Exhaust line from valve unit to vaporizer jar

- 2 Air compressor
- 3 Vaporizer jar
- 28 Tensioning screw
- 29 Support
- 30 Tension sprocket
- 31 Bracket for air compressor
- 32 Pressure oil line for lubrication of air compressor
- 33 High-pressure oil pump for power steering system
- 34 Intake line
- 35 Pressure line
- 36 Strut

2. Loosen the V-belt for the air compressor drive by turning out the tensioning screw (28) (Fig. 32-15/1).

3. Disconnect the hose lines (34) and (35) directly from the high-pressure oil pump (33) for the power steering. Unscrew the air compressor from the bearing bracket (31) and the strut (36) and remove together with high-pressure oil pump (Figs. 32-15/1 and 2).

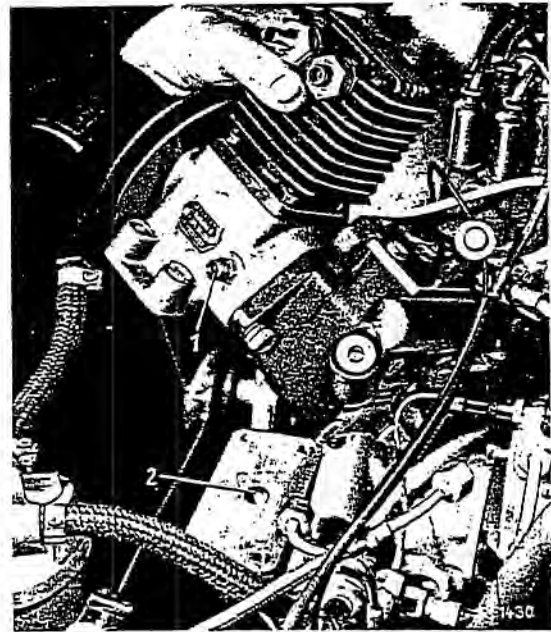


Fig. 32-15/2

- 1 Connection for pressure oil line
- 2 Oil return bore

4. Remove high-pressure oil pump from air compressor.

### Installation:

5. Attach the high-pressure oil pump for the power steering to the air compressor (see Job No. 46-26).
6. Attach the air compressor to the bearing bracket making sure that the rubber sealing ring for the oil return is properly seated.

7. Install the V-belt and tension as specified (see Job No. 32-12, Section B).

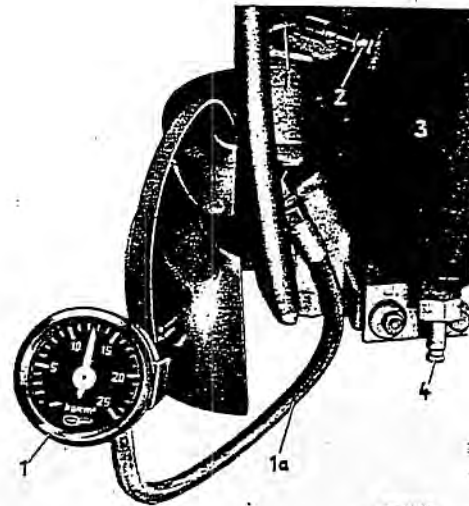
8. Connect the lines.

**Performance Test:**

**Note:** Performance has to be checked when the specified working pressure is no longer reached.

9. Connect a suitable pressure gage (1) to the filler valve (2) of the air reservoir (Fig. 32-15/3).

10. Reduce the pressure to 12 atm at the drain valve (4) of the air reservoir. Then run the engine at a speed of approx. 2,000 rpm. Measure the time required to raise the reservoir pressure from 12 atm to 14 atm (for values see Job No. 32-0).



R-1417

Fig. 32-15/3

- 1 Pressure gage
- 1a Connecting hose
- 1b Connecting fitting
- 2 Filler valve
- 3 Air reservoir
- 4 Drain valve

**Replacement of Valves:**

11. Disconnect the intake and pressure line from the cylinderhead. Loosen hexagon screws. Remove cylinder head and valve plate (8) (Fig. 32-15/4).

12. Check segment valves (11) and (12) and, if necessary, replace. Check and clean valve seats in the valve plate (8).

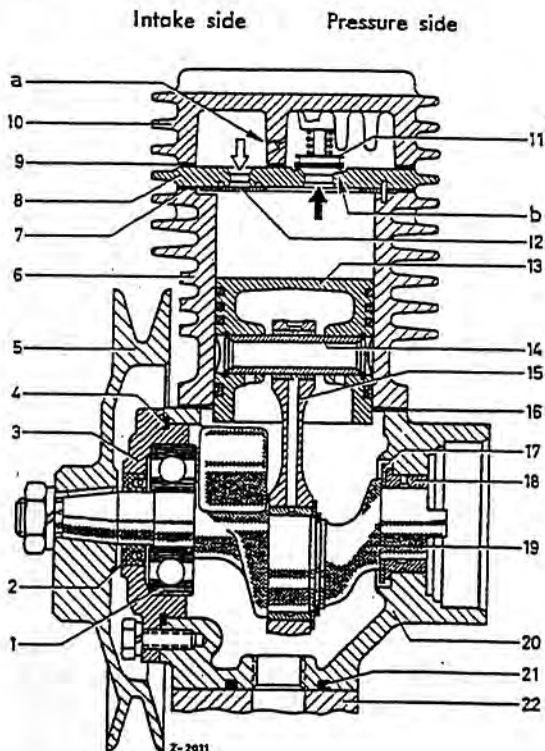


Fig. 32-15/4

**Section of air compressor**

- a = Connecting bore on 1st version air compressor
- b = Notch in valve seat on 2nd version air compressor

- 1 Annular grooved bearing
- 2 Sealing ring
- 3 Bearing cap
- 4 Rubber sealing ring
- 5 V-belt pulley
- 6 Cylinder
- 7 Gasket
- 8 Valve plate
- 9 Gasket
- 10 Cylinder head
- 11 Segment valve (pressure side)
- 12 Segment valve (intake side)
- 13 Piston
- 14 Piston pin
- 15 Connecting rod
- 16 Gasket
- 17 Spacer washer
- 18 Bearing bushing
- 19 Crankshaft
- 20 Crankcase
- 21 Rubber sealing ring
- 22 Bracket for air compressor

**Note:** In order to guarantee complete closing of the non-return valve in the air reservoir when the engine is not running, the air must be able to flow out of the pressure line between air compressor and air reservoir. On the 1st version air compressor this is achieved by the connecting bore "a" of 0.3 mm diameter between pressure and intake chamber in the cylinder head, on the 2nd version by the notch "b" in the seat for the segment valve (11) on the pressure side (Fig. 32-15/4). The air then escapes into the atmosphere via the piston rings.

If the bore "a" is clogged, the pressure in the pressure line will prevent the valve cone of the non-return valve in the air reservoir from being pressed firmly against

its seat so that air can escape slowly from the air reservoir through the segment valve (11) on the pressure side.

A clogged bore should be cleaned with a 0.3 mm drill.

Proper functioning of the non-return valve and the connecting bore is checked by detaching the intake line of the air compressor at the vaporizer jar and holding it in a water vessel. If air escapes steadily, the non-return valve does not close completely. The cause may be either a clogged bore or a non-return valve that does not close properly. Before removing the cylinder head always check the non-return valve itself for leaks (see Job No. 32-16).

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# Air Reservoir

Job No.

32-16

## Removal and Installation of Air Reservoir, Leak Test

### Removal:

1. Pull push-pull button on instrument panel into 'Wheel Change' position.
2. Jack the car up at the front and remove the left front wheel.
3. Completely evacuate the air reservoir.
4. Disconnect both hose lines. Unscrew hexagon screws at the top (13a) and hexagon nut at the bottom (13b) (Fig. 32-16/1).
5. Remove air reservoir.

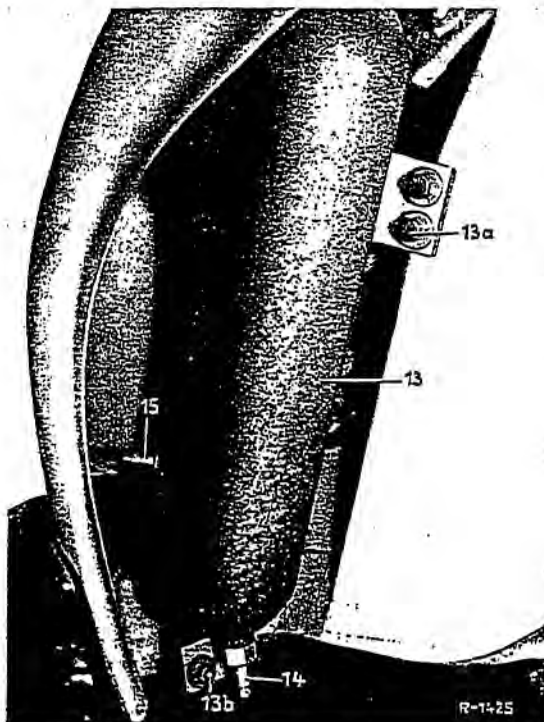


Fig. 32-16/1

- 13 Air reservoir
- 13a Upper attachment
- 13b Lower attachment
- 14 Drain valve
- 15 Filler valve

### Leak Test:

6. Check whether the non-return valve, the filler valve, the drain valve and the screw plug (5) are firmly seated (Fig. 32-16/2). For non-return valve tightening torque see Job No. 32-0.
7. Fill the air reservoir at the filler valve to the prescribed test pressure (see Job No. 32-0) and check for leaks under water (Fig. 32-16/2).

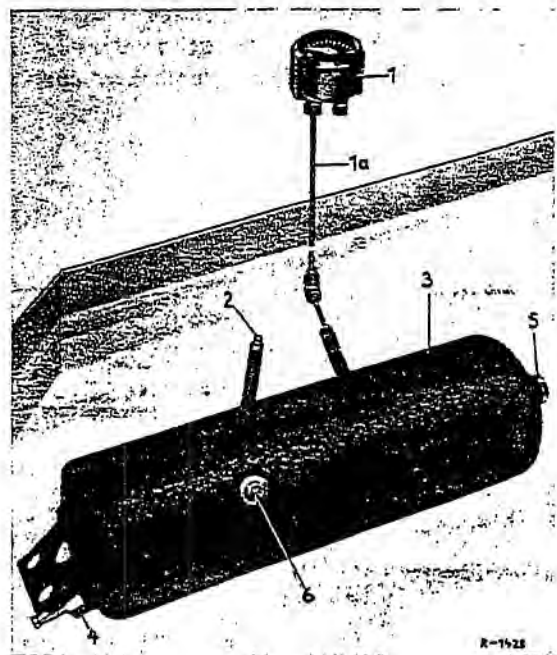


Fig. 32-16/2

- 1 Pressure gage
- 1a Connecting line
- 2 Non-return valve
- 3 Air reservoir
- 4 Drain valve
- 5 Screw plug
- 6 Filler valve

**Note:** a) If the non-return valve has a leak at the valve cone, replace the valve as an assembly.

32-16/1

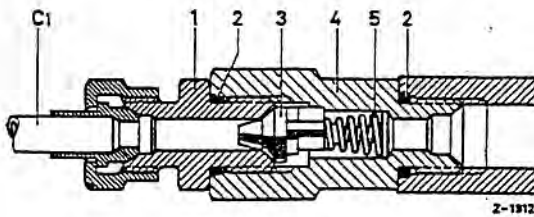


Fig. 32-16/3

Non-return valve

- |   |                       |
|---|-----------------------|
| C1 Pressure line from air compressor to air reservoir | 2 Rubber sealing ring |
| 1 Valve cap   | 3 Valve cone          |
|   | 4 Valve body          |
|   | 5 Valve spring        |

In order to check the non-return valve when the air reservoir is installed in the vehicle, disconnect the pressure line (C 1) from the air compressor and immerse the hose line in a water jar.

- b) In principle the filler valve of the air suspension system is the same as a tube filler valve, with the difference that the screwed-in insert takes the form of a high-pressure insert. As a replacement only the complete filler valve assembly can be supplied.

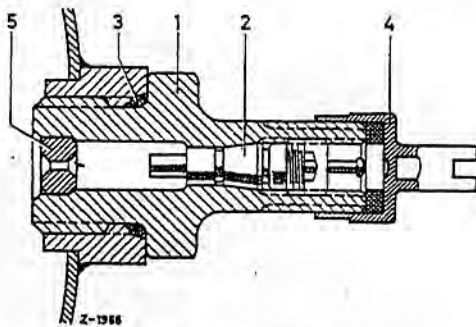


Fig. 32-16/4

Filler valve

- |                                     |
|-------------------------------------|
| 1 Valve body                        |
| 2 High-pressure insert              |
| 3 Rubber sealing ring               |
| 4 Dust cap with rubber sealing ring |
| 5 Throttle jet                      |

- c) After removing the snap ring on the valve body (1) the drain valve can be disassembled. If the rubber sealing ring in the valve plate (3) is damaged, the drain valve should be replaced as an assembly (Fig. 32-16/5).

Installation:

8. Attach the air reservoir to cowl making sure that the attachment parts are in their proper position (Fig. 32-16/6).

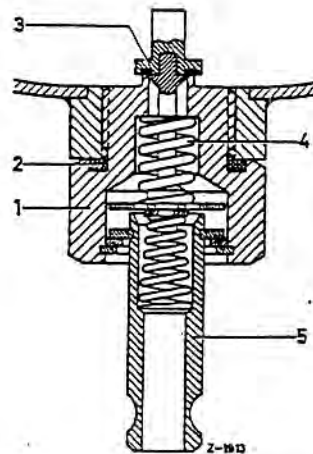
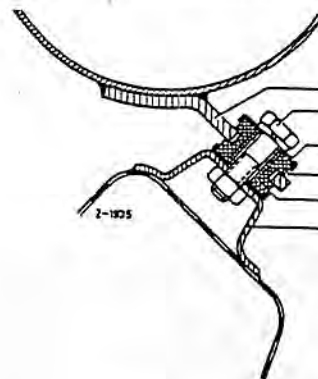


Fig. 32-16/5

Drain valve

- |                       |
|-----------------------|
| 1 Valve body          |
| 2 Rubber sealing ring |
| 3 Valve plate         |
| 4 Valve spring        |
| 5 Discharge tube      |

Upper attachment



Lower attachment

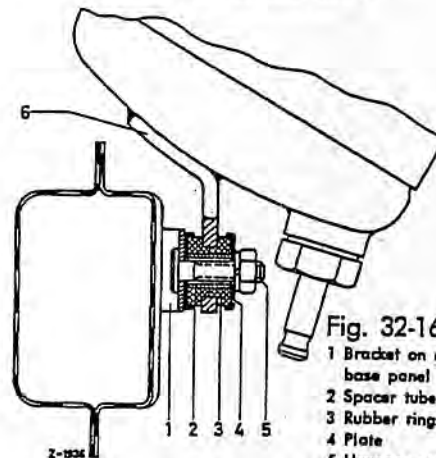


Fig. 32-16/6

- |                                 |
|---------------------------------|
| 1 Bracket on chassis base panel |
| 2 Spacer tube                   |
| 3 Rubber rings                  |
| 4 Plate                         |
| 5 Hexagon screw                 |
| 6 Bracket on air reservoir      |

9. Connect the two hose lines to the non-return valve and the outlet connection.
10. Fill the system with compressed air (see Job No. 32-12).
11. Install the left front wheel and jack the car down.

# Vaporizer Jar

Job No.

32-17

## Removal and Installation, Disassembly and Reassembly of Vaporizer Jar

### Removal:

1. Disconnect all three hose lines.
2. Unscrew hexagon screws and remove vaporizer jar from the cowl (Fig. 32-17/1).

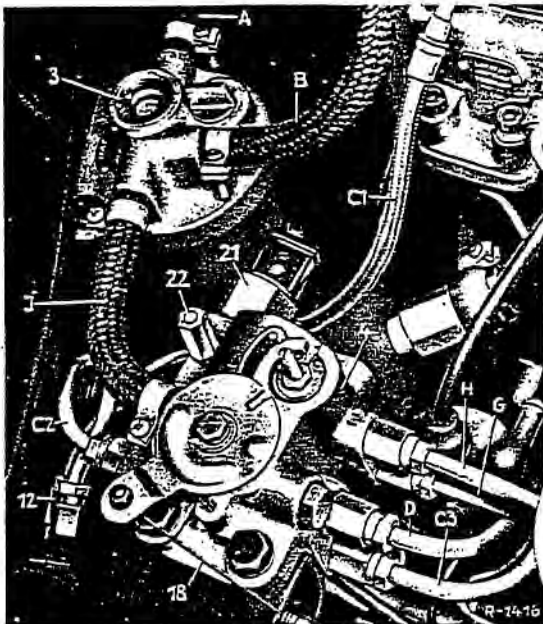


Fig. 32-17/1

- A Intake and exhaust line from air intake silencer to vaporizer jar
- B Intake line from vaporizer jar to air compressor
- C1 Pressure line from air compressor to air reservoir
- C2 Pressure line from air reservoir to valve unit
- C3 Pressure line (full working pressure) from valve unit to rear leveling valve
- D Pressure line (reduced working pressure) from valve unit to front leveling valves
- G Exhaust line from front leveling valves to valve unit
- H Exhaust line from rear leveling valve to valve unit
- J Exhaust line from valve unit to vaporizer jar
- 3 Vaporizer jar
- 4 Valve unit
- 12 Non-return valve
- 18 Cable for valve unit
- 21 Electric pressure indicator for warning lamp
- 22 Safety valve



Fig. 32-17/2

- 1 Valve body
- 2 Jar
- 3 Snap ring

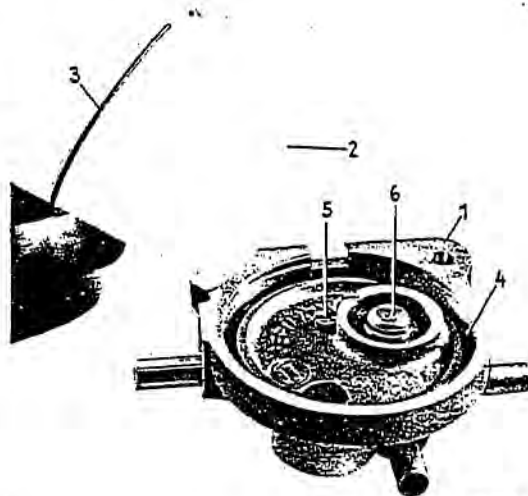


Fig. 32-17/3

- 1 Valve body
- 2 Jar
- 3 Snap ring
- 4 Rubber sealing ring
- 5 Jet in intake valve
- 6 Blow-off valve

### Disassembly:

3. If necessary, press out the snap ring (3) and remove the jar (2) (Figs. 32-17/2 and 3).

32-17/1

**Reassembly:**

4. Check whether the jet (5) in the valve body is fully serviceable (Fig. 32-17/3).
5. Install the jar, making sure that the rubber sealing ring (4) and the snap ring (3) are properly seated.

**Installation:**

6. Attach the vaporizer jar to the cowl and connect the hose lines.
7. During the winter season fill the jar with 96 per cent. ethyl alcohol (ethanol) (see Job No. 32-12, Section B).



# Valve Unit

Job No.

32-18

## Removal and Installation of Valve Unit, Valve Adjustment Check

### Removal:

1. Completely evacuate the air reservoir.
2. Pull out the plug on the electric indicator (21) for the warning lamp (Fig. 32-18/1).

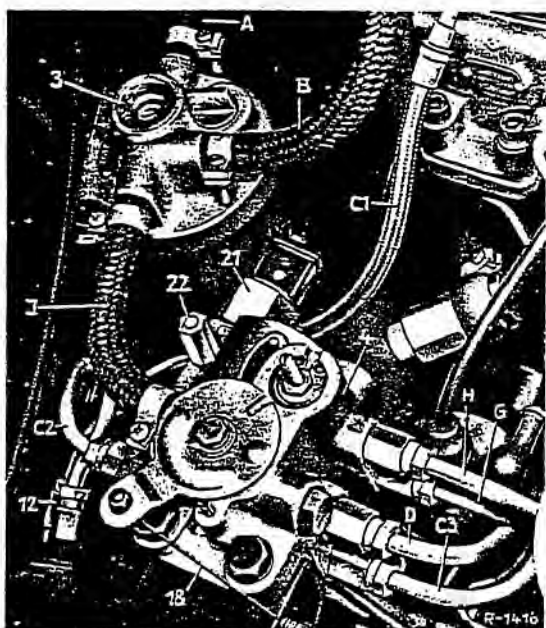


Fig. 32-18/1

- A Intake and exhaust line from air intake silencer to vaporizer jar
  - B Intake line from vaporizer jar to air compressor
  - C1 Pressure line from air compressor to air reservoir
  - C2 Pressure line from air reservoir to valve unit
  - C3 Pressure line (full working pressure) from valve unit to rear leveling valve
  - D Pressure line (reduced working pressure) from valve unit to front leveling valves
  - G Exhaust line from front leveling valves to valve unit
  - H Exhaust line from rear leveling valve to valve unit
  - J Exhaust line from valve unit to vaporizer jar
- 3 Vaporizer jar
  - 4 Valve unit
  - 12 Non-return valve
  - 18 Cable for valve unit
  - 21 Electric pressure indicator for warning lamp
  - 22 Safety valve

3. Disconnect the lines and hose lines as well as the Bowden cable (18) (Fig. 32-18/1).

4. Detach the valve unit from the cowl and remove.

### Installation:

5. Attach the valve unit to the cowl and connect the lines.

**Note:** It is advisable to install the cap nuts of the lines before the hexagon screws are tightened.

The various connections are marked on the valve unit body (Fig. 32-18/2).

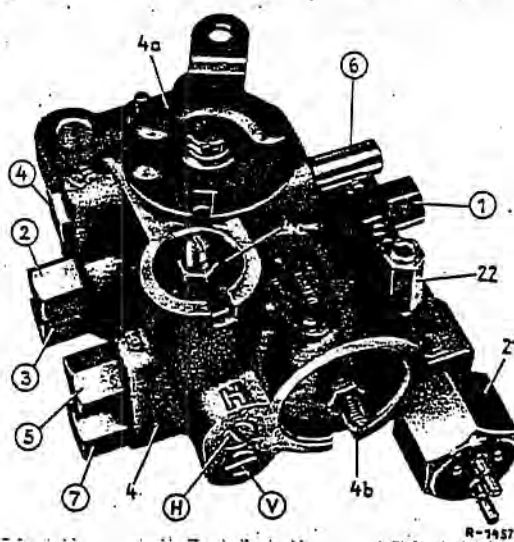


Fig. 32-18/2

- (1) Compressed air from air reservoir
  - (2) Compressed air to front leveling valves
  - (3) Compressed air to rear leveling valve
  - (4) Closed
  - (5) Exhaust air from leveling valve
  - (6) Exhaust air to vaporizer jar
  - (7) Exhaust air from front leveling valves
  - (D) Connection for electric pressure indicator for warning lamp
  - (V) Screw plug for exhaust air from front axle
  - (H) Screw plug for exhaust air from rear axle
- 4 Valve unit
  - 4a Lever
  - 4b Pressure reducing valve
  - 4c Pressure retaining valve
  - 21 Electric pressure indicator for warning lamp
  - 22 Safety valve

7. Connect the cable for the valve unit to the lever (1a). To do this, push the push-pull button on the instrument panel in completely and secure the lever on the valve unit by means of a 5 mm  $\phi$  pin in "Drive Position" (Fig. 32-18/3).

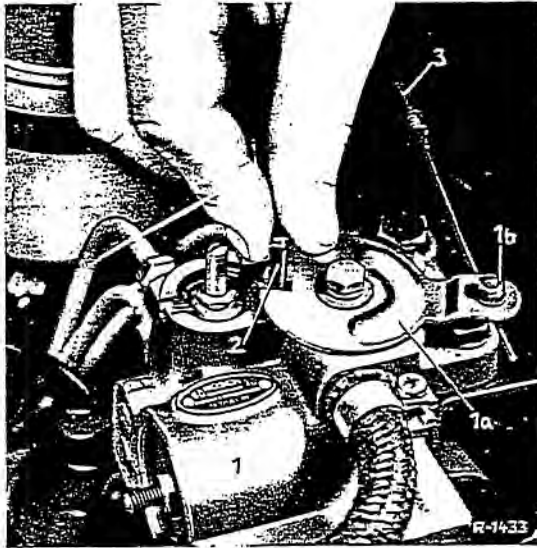


Fig. 32-18/3

- 1 Valve unit
- 1a Lever
- 1b Clamping screw
- 2 Fixing pin
- 3 Cable for valve unit

8. Fill the system with compressed air (see Job No. 32-12).

#### Valve Adjustment Check:

9. On the valve unit connect a pressure gage with twin indicators to the connections (2) (pressure line to front axle) and (7) (exhaust line from front axle) (Fig. 32-18/4).
10. In order to check the correct adjustment of the pressure reducing valve (4b) (Fig. 32-18/2) depress the car at the front in order to put the leveling valves on the front axle in the position "Air Intake". In this position the pressure in the pressure line to the front leveling valves must correspond to the values given in Job No. 32-0.
11. In order to check the correct adjustment of the pressure retaining valve (4c) (Fig.

- 32-18/2), lift the car at the front in order to get the leveling valves on the front axle in the position "Air Exhaust". In this position the pressure in the exhaust line from the leveling valves to the valve unit must correspond to the values given in Job No. 32-0.

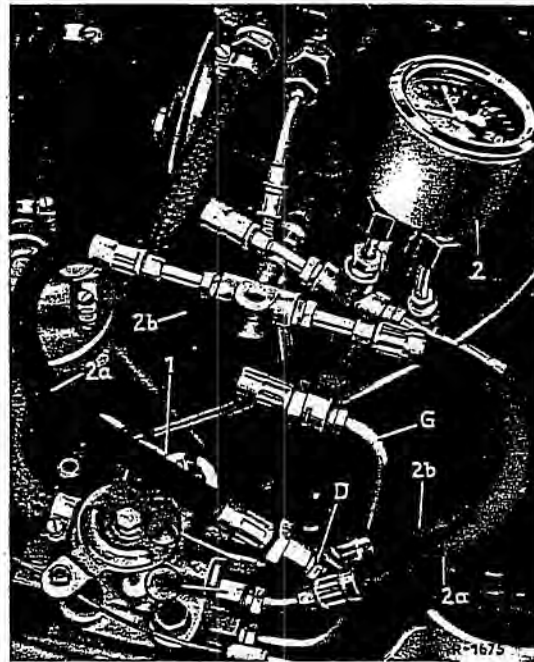


Fig. 32-18/4

- (2) Connection for compressed air to front leveling valves
- (7) Connection for exhaust air from front leveling valves
- D Pressure line (reduced working pressure) from valve unit to front leveling valves
- G Exhaust line from front leveling valves to valve unit
- 1 Valve unit
- 2 Pressure gage with twin indicators
- 2a Connection line to pressure gage for compressed air
- 2b Connection line to pressure gage for exhaust air

12. If necessary, adjust the filling pressure on the pressure reducing valve (4b) and the blow-off pressure on the pressure retaining valve (4c) (Fig. 32-18/2). The pressure is increased by turning the adjusting screw in, and it is decreased by turning the adjusting screw out.

**Note:** During these checking operations the minimum pressure in the air reservoir should be 12 atm.

# Leveling Valves

Job No.

32-19

## Removal and Installation of Leveling Valves, Leak Test

### Removal:

1. Jack the car up.  
Leave the push-pull button on the instrument panel in "Drive Position".
2. Completely evacuate the air reservoir.

**Note:** The connections at the leveling valve are marked as follows:

- (E) = Filling line  
(B) = Connecting line to bellows  
(A) = Exhaust line

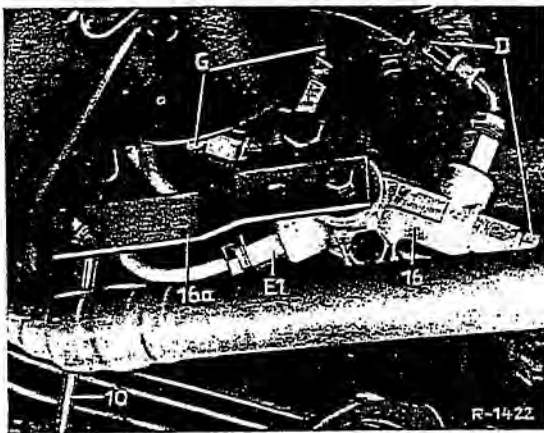


Fig. 32-19/1

Leveling valve on front axle, left

- D Pressure line (reduced working pressure) from valve unit to front leveling valves  
E1 Connecting line from front leveling valve to air chamber  
G Exhaust line from front leveling valve to valve unit  
10 Connecting rod  
16 Front leveling valve, left  
16a Lever

3. Detach the connecting rod (10) of the leveling valve. To do this, unscrew the ball pin from the lever (Fig. 32-19/1 and 2).
4. Disconnect the lines at the leveling valve. Unscrew the leveling valve from the bracket and remove (Figs. 32-19/1 and 2).

### Installation:

5. Screw on the leveling valve and connect the lines.

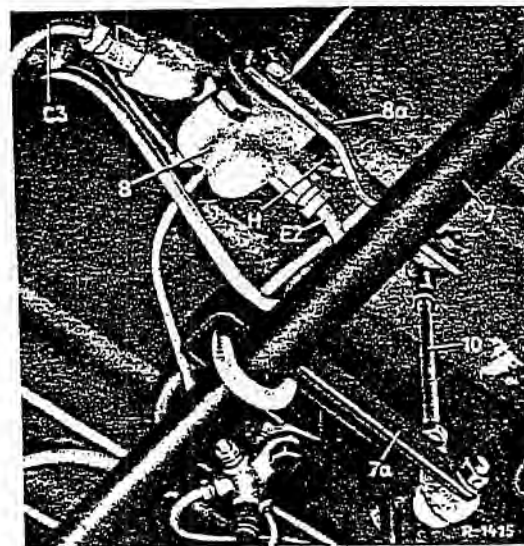


Fig. 32-19/2

Leveling valve on rear axle

- C3 Pressure line (full working pressure) from valve unit to rear leveling valve  
E2 Connecting line from rear leveling valve to air chamber  
H Exhaust line from rear leveling valve to valve unit

- 7 Torsion bar on rear axle  
7a Lever on torsion bar  
8 Rear leveling valve  
8a Lever

6. Jack the car down.

**Caution!** Car has only very little ground clearance.

7. Fill the system with compressed air (see Job No. 32-12).
8. Check the car level (see Job No. 40-5).

32-19/1

**Leak Test:**

Minimum pressure in air reservoir 12 atm.

9. Disconnect the exhaust line (3) from the valve unit to the vaporizer jar at connection (1a) (Fig. 32-19/3).
10. Connect the hose (4) of the water jar (5) to the valve unit. With the car in a station-

ary position no air should escape via the exhaust line. If air escapes nevertheless, this is a sign that there is a leak in one of the leveling valves (Fig. 32-19/3).

11. In order to determine which one of the leveling valves has a leak, disconnect the exhaust line (2) (Connection A) at the valves and instead connect the hose (3) of the water jar (4) (Fig. 32-19/4).

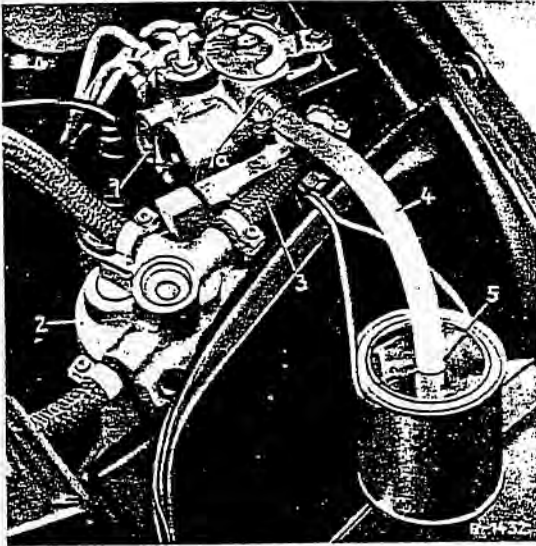


Fig. 32-19/3

- 1 Valve unit
- 1a Connection for exhaust line
- 2 Vaporizer jar
- 3 Exhaust line
- 4 Hose
- 5 Water jar

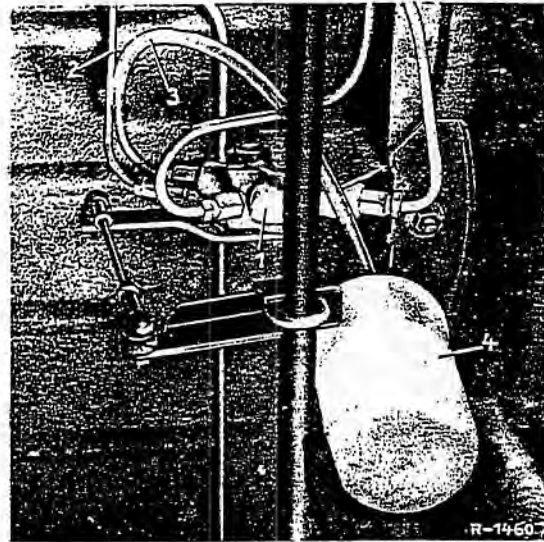


Fig. 32-19/4

- 1 Leveling valve
- 2 Exhaust line from leveling valve to valve unit (Connection A)
- 3 Hose to water jar
- 4 Water jar

# Front Axle - Group 33

	Job No.
Front Axle (General Data, Dimensions and Tolerances)	33-0
Removal and Installation of Front Axle Support with Front Axle Halves	33-1
A. 1st Version Front Axle	
B. 2nd Version Axle	
Removal and Installation of Front Axle Halves	33-2
Removal and Installation of Rubber Mountings for Front Axle Longitudinal Support	33-3
A. 1st Version Front Axle	
B. 2nd Version Front Axle	
Checking of Front Axle Support	33-4
Front Wheel Bearings	33-5
Removal, Disassembly, Checking, Repair, Reassembly, and Installation of Front Wheel Hub, Adjustment of Front Wheel Bearings	

## Front Axle Suspension

Model	Version	Rubber Mounting		Shown in Fig.	Associated front axle support Part No.
		Part No.	Height under load mm   kg		
220 b 220 Sb 220 SEb Sedan	1st	111 330 10 75 <sup>1)</sup> 111 330 1175 <sup>1)</sup>	108±1	33-0/4	111 330 23 42
220 SEb Coupé	1st	112 330 00 75			111 330 27 42
220 b 220 Sb 220 SEb 230 S 250 S 250 SE 300 SE 300 SEb 300 SEL 230 SL <sup>3)</sup> 250 SL <sup>3)</sup>	On models 220 b 220 Sb 220 SEb 220 SEb Sedan 220 SEb Coupé 2nd version	111 330 14 75 <sup>2)</sup>	87±1	220 33-0/5	111 330 30 42 111 330 34 42

<sup>1)</sup> Optional

<sup>2)</sup> Previous version had the Part No. 111 330 12 75

<sup>3)</sup> The upward spring travel of the rubber mounting is limited by a rubber stop (see Fig. 33-1/16 b).

## Models 190 c, 190 Dc, 200, 200 D, 230

Rubber Mounting						Shown in Fig.	Associated front axle support Part No.
top			bottom				
Part No.	Height mm	Rubber hardness °Shore	Part No.	Height mm	Rubber hardness °Shore		
110 331 13 44	30±1	55±5	110 331 12 44	67±1	55±5	33-0/6	110 330 02 42 111 330 30 42

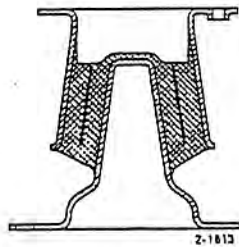


Fig. 33-0/4

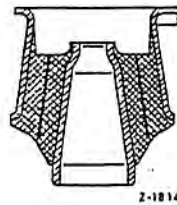


Fig. 33-0/5

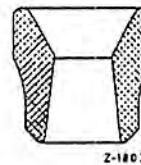
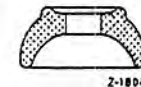


Fig. 33-0/6

Rubber Mountings

## Longitudinal Support of Front Axle\*

### Front Axle 1<sup>st</sup> Version

Models 220 b, 220 Sb, 220 SEb Sedan

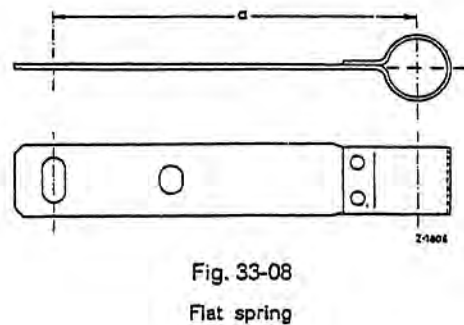
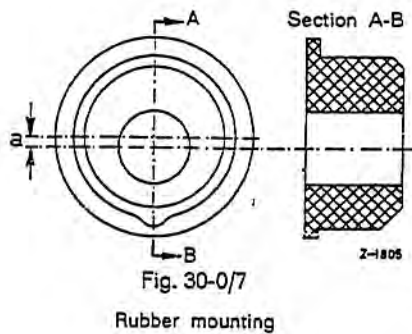
Flat spring			
Part No.	Length mm	Rubber mounting Part No.	Metal thickness mm
111 331 07 12	298±0.5 <sup>1)</sup>	110 322 06 85	2.5

<sup>1)</sup> Together with replacement front axle support Part No. 111 330 34 42 install flat springs 286 mm long, Part No. 111 331 12 12.

### Front Axle, 2<sup>nd</sup> Version

Model	Flat spring		Rubber mounting	
	Part No.	Length	Part No.	Eccentricity "a" of bore
<b>Cars with Mechanical Steering</b>				
190 c, 190 Dc, 200 200 D, 220 b, 220 Sb 220 SEb Sedan, 230, 230 SL, 250 SL	111 331 11 12	248	110 322 15 85	1.5
220 SEb/C, 230 S, 250 S, 250 SE	112 331 00 12	243		
<b>Cars with Power Steering</b>				
190 c, 190 Dc, 200 200 D, 230	111 331 11 12	248	112 322 03 85	4.5
220 b, 220 Sb, 220 SEb, 230 S, 250 S, 250 SE, 300 SEb, 300 SE, 300 SEL	112 331 00 12	243	110 322 15 85	1.5
230 SL, 250 SL				

<sup>1)</sup> In special cases, if the prescribed caster adjusting values cannot be obtained with the original parts it is permissible to use flat springs of 243 mm length or rubber mountings offset by 4.5 mm. It goes without saying that the left and right flat springs must be of equal length and that the rubber mountings must have the same offset when repairs are being carried out on the chassis base panel assembly.



### Grease Reserve of Front Wheel Hub

Models 190 c to 300 SEL

Anti-friction bearing grease		
Total capacity <sup>1)</sup> p	Hub with bearings <sup>2)</sup> p	Hub cap <sup>3)</sup> p
65—80	45—55	20—25

**Note: Use the Specified Amounts, Neither More nor Less!**

<sup>1)</sup> It is advisable to weigh the total amount before reassembling the front wheel hub.

<sup>2)</sup> The races of the taper roller bearings should be well filled with anti-friction bearing grease. Apply grease also to the front faces of the rollers.

<sup>3)</sup> Fill up approximately to the flared rim.

### Wheel Bearing Play

Models 190 c to 300 SEL

End play of front wheel hub (adjustable by clamping nut on steering knuckle)	0.01—0.02 mm (measured with Tester 136 589 04 21 and dial gage <sup>1)</sup> )
---	---

<sup>1)</sup> When the wheel bearing play is properly adjusted, the ground washer located between the outer taper roller bearing and the clamping nut can just be turned by hand. However, this method should only be used as an additional check because the wheel bearing play should always be adjusted with a dial gage.

### Tightening Torques\*

Models 190 to 300 SEL

Front Axle	Thread	Tightening Torque	
Hexagon screw for rubber mounting of front axle suspension on chassis base panel	M 12 × 1.5	10	
Hexagon screws for fastening the control arms to the front axle support <sup>1)</sup>	top	10	
	bottom	13	
Longitudinal support of front axle	Hexagon nut for fastening the flat spring to the chassis base panel	M 14 × 1.5	12
	Hexagon screw for the rubber mounting	M 16 × 1.5	
	Hexagon screws (clamping screws) for the rubber mounting	M 8	2.5
Threaded bushes in control arm	M 30 × 2 M 31 × 2	18	
Hexagon nut for fastening the steering knuckle support to the king pin	M 14 × 1.5	9	

<sup>1)</sup> Only quality 10 K screws and quality 8 G nuts should be used.



# Removal and Installation of Front Axle Support together with Front Axle Halves

Job No.

33-1

Modification: 2nd Version Front Axle (Addition)

## A. 1st Version Front Axle

### Removal:

1. Jack up the car at the front, remove the front wheels and the brake drums.

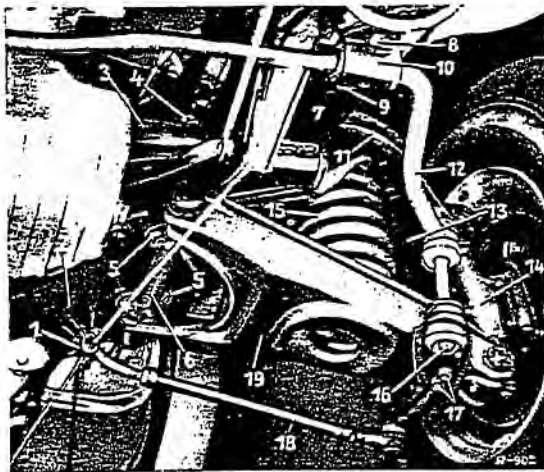


Fig. 33-1/1

- 1 Cable guide at front axle support
- 2 Front axle support
- 3 Engine support
- 4 Hexagon screw and spring washer
- 5 Hexagon screws with nuts and lock washers for fastening the pivot pin to the front axle support
- 6 Pivot pin for lower control arm
- 7 Flat spring supporting the front axle support
- 8 Hexagon screw (M 12X1.5X25) with lock washer
- 9 Hexagon screw (M 14X1.5X25) with lock washer
- 10 Rubber mounting for torsion bar
- 11 Upper control arm
- 12 Torsion bar
- 13 Front shock-absorber
- 14 Steering knuckle
- 15 Front spring
- 16 Hexagon screw for fastening the torsion bar to the lower control arm
- 17 Hexagon nuts with lock washers for fastening the lower shock-absorber suspension
- 18 Tie-rod
- 19 Lower control arm

2. Remove the front shock-absorbers (see Job-No. 32-2).
3. Remove the torsion bar (see Job-No. 32-6).
4. Remove the front springs (see Job No. 32-4). Thereafter reattach the lower control arms provisionally to the front axle support.

5. Screw off the wing nut (1) for adjusting the hand-brake at the hand-brake lever (3). Remove the cotter pin (5) which secures the center brake cable (7) at the lower part of the lever and pull the brake cable through the guide on the front axle support (Fig. 33-1/2).

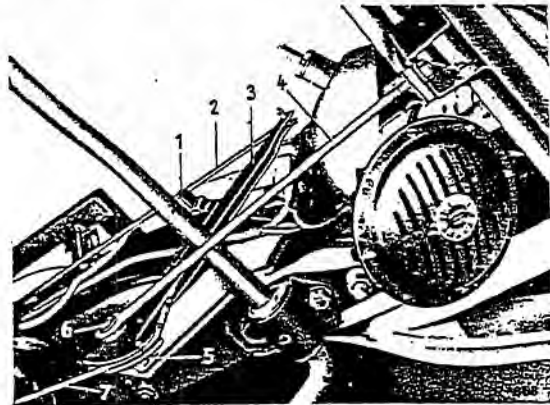


Fig. 33-1/2

- |                     |                      |
|---------------------|----------------------|
| 1 Wing nut          | 5 Cotter pin         |
| 2 Front brake cable | 6 Pivot pin          |
| 3 Hand-brake lever  | 7 Center brake cable |
| 4 Supporting rod    |                      |

6. Unscrew the hexagon nut (7) on the two flat springs (8) for the longitudinal support of the front axle right and left and knock out the bolt (2) (Fig. 33-1/3).

**Note:** When removing the front axle support it is not necessary to loosen the hexagon nut (15) at the eccentric bolt (14). However, if it proves difficult to knock out the bolt (2) mark the position of the flat spring on the chassis base panel and unscrew the hexagon nut at the eccentric bolt. In such cases the flat spring remains attached to the front axle support when the latter is removed (Fig. 33-1/3).

7. Disconnect the brake hose from the brake line left and right at the chassis base panel (Fig. 33-1/9).

33-1/1

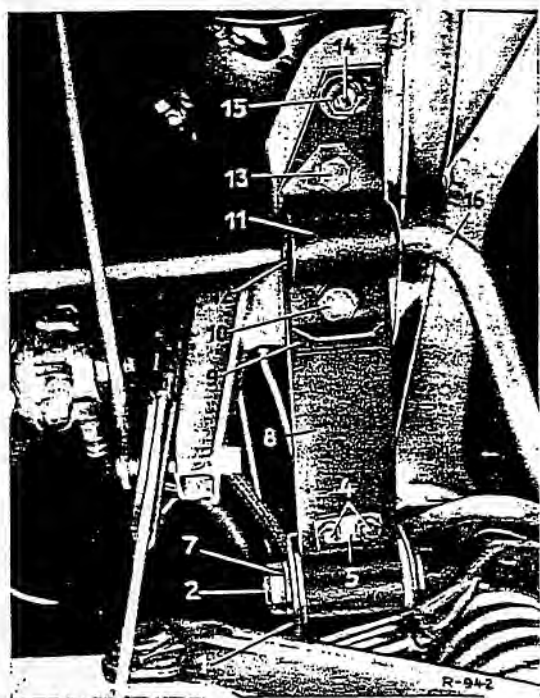


Fig. 33-1/3

- 1 Bearing bracket at front axle support
- 2 Bolt
- 4 Hexagon screws (clamping screws)
- 5 Locking plate
- 7 Hexagon nut
- 8 Flat spring
- 9 Locking plate for rubber mounting
- 10 Hexagon screw (M 14X1.5X25) with lock washer
- 11 Bracket for rubber mounting
- 12 Rubber mounting for torsion bar
- 13 Hexagon screw (M 12X1.5X25) with lock washer
- 14 Eccentric bolt
- 15 Hexagon nut with lock washer and washer
- 16 Torsion bar

8. Detach the tie-rods right and left from the steering knuckle arm (see Job No. 46-9/).

9. Remove the battery and on cars with carburetor engines remove the air intake silencer.

10. Place Supporting Bracket 111 589 03 31 (1) for the engine on the right and left of the wheel arch panel. Then suspend the engine by the water pump and raise it slightly (Fig. 33-1/4).

11. Unscrew the two hexagon screws (4) by which the engine support (3) is fastened to the rubber mountings of the front engine suspension (Fig. 33-1/1).

12. Place the jack with Fixture 111 589 02 63 under the front axle support (Fig. 33-1/7).

13. Unscrew right and left the hexagon screws (2) for fastening the rubber mountings for the suspension of the front axle support to the chassis base panel (Fig. 33-1/5).

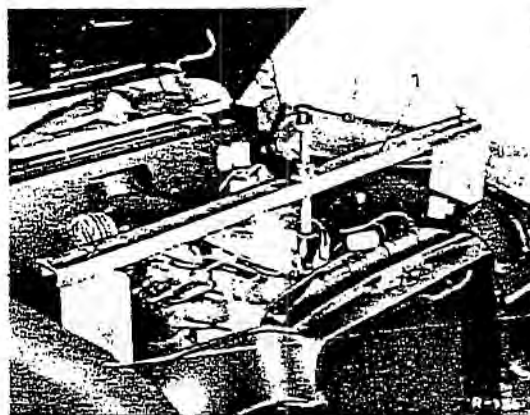


Fig. 33-1/4

- 1 Supporting Bracket 111 589 03 31 for the engine

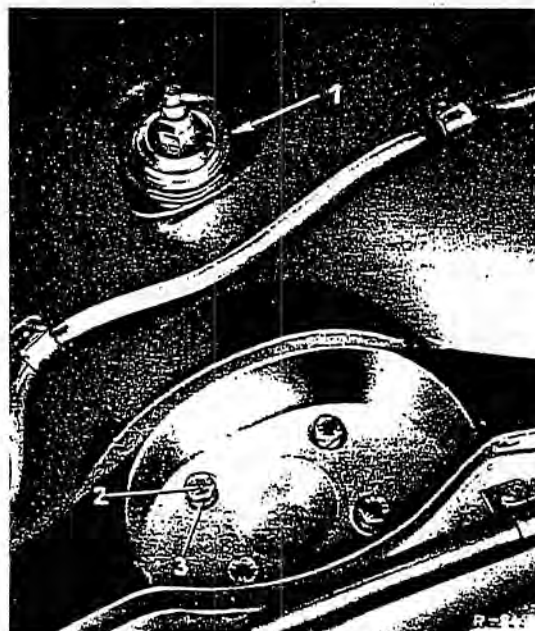


Fig. 33-1/5

- 1 Upper shock-absorber suspension
- 2 Hexagon screws with lock washers
- 3 Washers

14. Jack down the car and remove the front axle support with the front axle halves.

15. Check the rubber mountings (3) of the flat springs (8) supporting the front axle support and replace them if necessary (see Job No. 33-3). Do not yet tighten the hexagon screws (clamping screws) (Fig. 33-1/8).
16. Check the two rubber mountings (4) for the front axle support. If necessary, replace the rubber mountings. For this purpose

remove the four hexagon screws (5) left and right from the threaded ring (6) (Fig. 33-1/6).

**Note:** The upper part of the rubber mounting has an eccentric position on the lower fixing cup. When installing the rubber mounting make sure that the wider part of the cup points outward (Fig. 33-1/6).

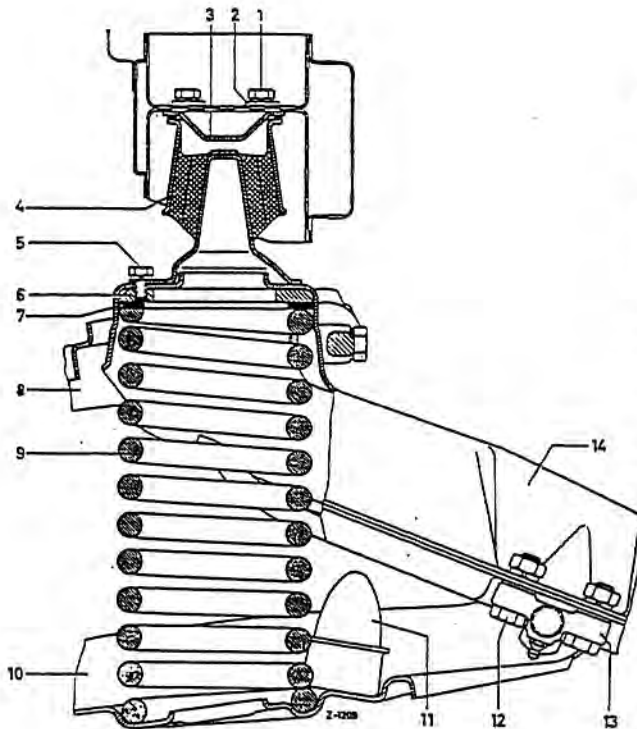


Fig. 33-1/6

- 1 Hexagon screws with lock washers for fastening the rubber mounting to the chassis base panel
- 2 Washer
- 3 Stop plate at chassis base panel
- 4 Rubber mounting for front axle support
- 5 Hexagon screws with lock washers for fastening the rubber mounting to the front axle support
- 6 Threaded ring
- 7 Rubber washer
- 8 Upper control arm
- 9 Front spring
- 10 Lower control arm
- 11 Rubber buffer
- 12 Hexagon screws (M 12×1.5) with nuts and lock washers
- 13 Pivot pin for lower control arm
- 14 Front axle support

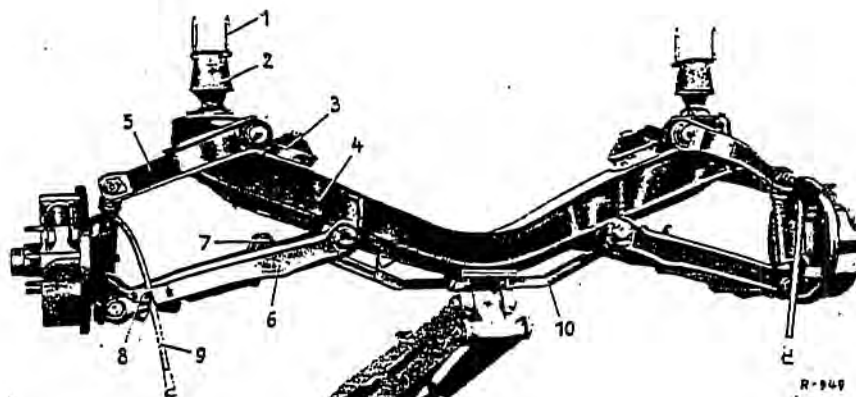


Fig. 33-1/7

- 1 Guide pin
- 2 Rubber mounting for front axle support
- 3 Rubber mounting of the front engine suspension
- 4 Front axle support
- 5 Upper control arm
- 6 Lower control arm
- 7 Rubber buffer
- 8 Steering knuckle
- 9 Brake hose
- 10 Fixture 111 589 02 63

17. Place the front axle support with the front axle halves in Fixture 111 589 02 63 on the jack and screw two guide pins (1) each crosswise into the rubber mountings (2) for the front axle support, at both right and left (Fig. 33-1/7).
18. Lift the front axle support inserting the flat springs (8) on the left and right into the bearing bracket (1) on the front axle support (Fig. 33-1/8).
19. Screw out the guide pins from the rubber mountings for the front axle support. Then screw in and tighten the four hexagon screws for fixing the rubber mountings right and left to the chassis base panel (Fig. 33-1/5).
20. Fit the bolts (2) for the flat springs for the longitudinal support of the front axle support at the left and at the right and tighten the hexagon nut (7) with the prescribed torque (Fig. 33-1/8).

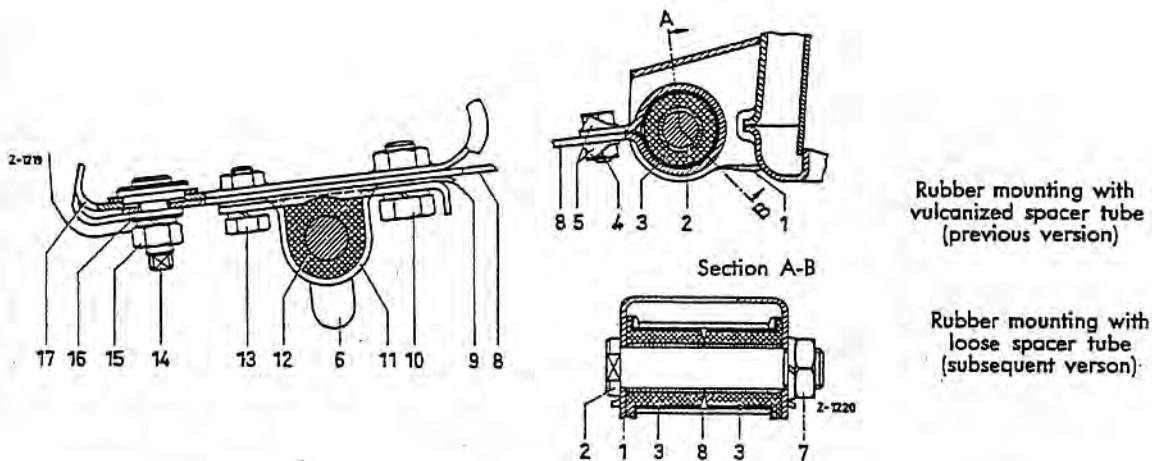


Fig. 33-1/8

- |   |   |  |
|---|---|--|
| 1 Bearing bracket of front axle support | 8 Flat spring                                   | 15 Hexagon nut with lock washer with lock washer |
| 2 Bolt                                  | 9 Locking plate                                 | 16 Washer  |
| 3 Rubber mounting for flat spring       | 10 Hexagon screw (M 14X1.5X25) with lock washer | 17 Chassis base panel                            |
| 4 Hexagon screw with nut                | 11 Retainer for rubber mounting                 | 18 Spacer ring                                   |
| 5 Locking plate                         | 12 Rubber mounting for torsion bar              | 19 Spacer tube                                   |
| 6 Torsion bar                           | 13 Hexagon screw (M 12X1.5X25)                  |  |
| 7 Hexagon nut with lock washer          | 14 Eccentric bolt                               |  |

**Note:** If the front axle support was removed together with the flat springs (8), fasten the flat springs left and right to the chassis base panel with the hexagon nut (15) for the eccentric bolt (14), noting the position marked during removal.

b) If the rubber mountings of the flat springs have been replaced, the hexagon screws (clamping screws) should be tightened with the prescribed torque. On recent cars the locking plates have been replaced by lock washers (Fig. 33-1/8).

21. Screw in and tighten the two hexagon screws (4) for fastening the engine support (3) to the rubber mountings of the front engine suspension. Then remove the supporting bracket for the engine.

22. Install the front springs (see Job No. 32-4).
23. Install the torsion bar (see Job No. 32-6).
24. Install the front shock-absorbers (see Job No. 32-2).
25. Install the battery and on cars with carburetor engines install the air intake silencer.
26. Fit the tie-rods to the right and left of the steering knuckle arm (see Job No. 46-9).
27. Check the brake hoses (7) right and left and make sure that they fit tightly into the brake line on the brake anchor plate. Loosen the hexagon screw (5) on the retainer (1) and insert the brake hose in the protection plate (6) at the retainer (1). Take

care that the hose is not twisted. Now tighten the hexagon nut (5) on the retainer. Fit the brake hose retainer (2), screw the sleeve nut (4) of the brake line (3) into the brake hose and tighten, holding the brake hose steady (Fig. 33-1/9).

**Note:** In early models there is no protection plate for the brake hose retainer. When connecting up make quite sure that the brake hose is not twisted; otherwise there is a danger that the hose will rub against the upper control arm.

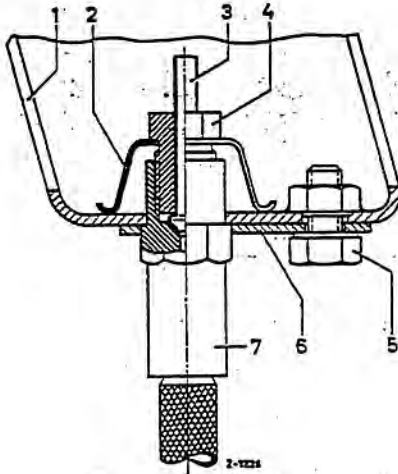


Fig. 33-1/9

- |                                  |                                    |
|----------------------------------|------------------------------------|
| 1 Retainer at chassis base panel | 5 Hexagon screw with spring washer |
| 2 Brake hose retainer            | 6 Protection plate                 |
| 3 Brake line                     | 7 Brake hose                       |
| 4 Sleeve nut                     |                                    |

28. Bleed the brake system.

29. Pull the center brake cable (7) through the guide on the front axle support and fit it to the hand-brake lever (3). Fit the cotter pin (5) for securing the brake cable at the lower end of the lever (Fig. 33-1/2). Adjust the hand-brake (see Job No. 42-20).

30. Fit the front wheels and the brake drums, jack down the car, and tighten up the wheel nuts.

31. Check the axle positioning distance, the camber, caster and toe-in of the front wheels, and if necessary adjust (see Job No. 40-3).

## B. 2nd Version Front Axle

On cars with air suspension see "General Assembly Instructions" (Job No. 32-11).

### Removal:

1. Jack up the car at the front, remove the front wheels and on cars with drum brakes remove the brake drums.
2. Remove the front shock absorber (see Job No. 32-2).
3. Remove the torsion bar (see Job No. 32-6).

**Note:** The flat springs for the longitudinal support of the front axle are attached to the

chassis base panel together with the torsion bar mounting (Fig. 33-1/12). Before the hexagon nuts are slackened, the position of the flat springs should be marked on both sides by means of a scribe.

4. Remove the front springs (see Job No. 32-4). Then reattach the lower control arms provisionally to the front axle support.
5. Unscrew the wing nut (8) for the hand-brake adjustment underneath the tunnel (Fig. 33-1/11).

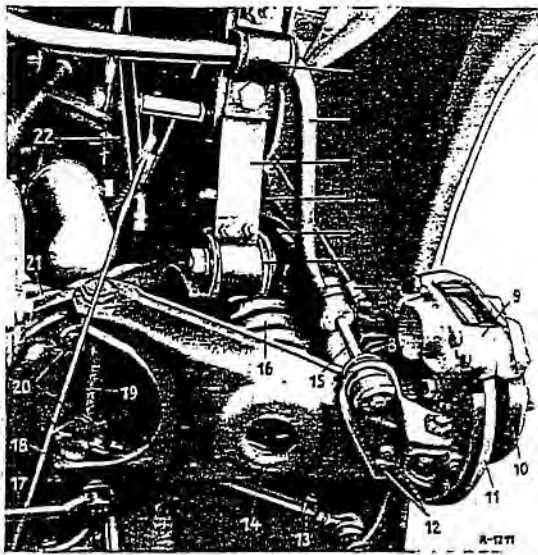


Fig. 33-1/10

- |  |  |
|--|--|
| 1 Torsion bar and flat spring mounting on chassis base panel | 12 Lower shock absorber suspension                                     |
| 2 Torsion bar  | 13 Tie-rod   |
| 3 Flat spring  | 14 Lower control arm   |
| 4 Shock absorber   | 15 Torsion bar mounting on lower control arm                           |
| 5 Upper control arm  | 16 Front spring  |
| 6 Flat spring mounting on front axle support                 | 17 Center tie-rod  |
| 7 Brake hose   | 18 Center brake cable  |
| 8 Steering knuckle   | 19 Pivot pin   |
| 9 Brake caliper  | 20 Hexagon screw for fastening the pivot pin for the lower control arm |
| 10 Front wheel hub   | 21 Engine support  |
| 11 Brake disk  | 22 Hand-brake lever  |

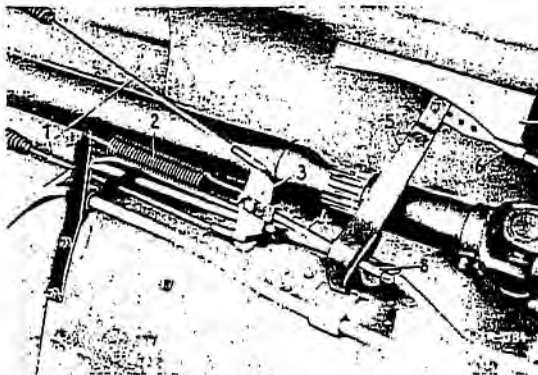


Fig. 33-1/11

- |                     |   |
|---------------------|---|
| 1 Rear brake cables | 6 Center brake cable                    |
| 2 Return spring     | 7 Guide for equalizer                   |
| 3 Equalizer         | 8 Wing nut for adjusting the hand brake |
| 4 Tensioning screw  |   |
| 5 Relay lever       |   |

6. Remove the cotter pin (6) securing the center brake cable (5) to the lower part of the hand-brake lever and detach the brake cable (Fig. 33-1/12).

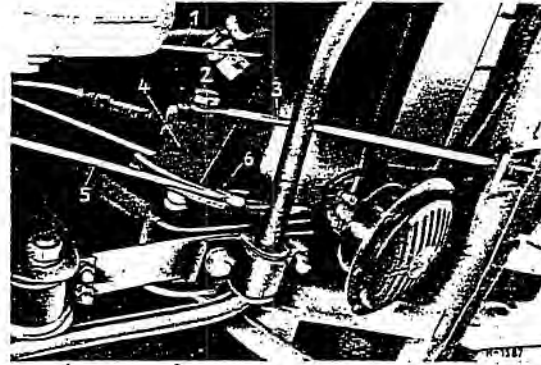


Fig. 33-1/12

- |   |
|---|
| 1 Front brake cable                                     |
| 2 Hexagon screw with locking plate                      |
| 3 Pull rod for supporting the hand-brake lever mounting |
| 4 Hand-brake lever                                      |
| 5 Center brake cable                                    |
| 6 Cotter pin  |

7. Detach the brake hose from the brake line on the chassis base panel left and right (Fig. 33-1/20).

8. Loosen and tap out the hexagon screw (6) on the bearing bracket (5) for the two flat springs (2) for the front axle longitudinal support at the left and at the right (Fig. 33-1/13). Remove the flat spring from the bearing bracket.

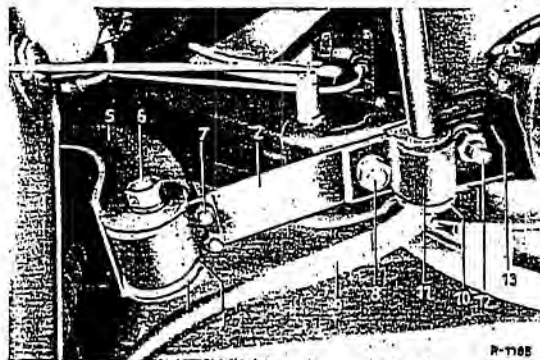


Fig. 33-1/13

- |   |  |
|---|--|
| 1 Spacer ring   | 8 Square screw with nut and lock washer  |
| 2 Flat spring   | 9 Torsion bar                            |
| 4 Rubber mounting   | 10 Rubber mounting for torsion bar       |
| 5 Bearing bracket at front axle support                   | 11 Bracket for rubber mounting           |
| 6 Hexagon screw with nut and lock washer                  | 12 Eccentric                             |
| 7 Hexagon screw (clamping screw) with nut and lock washer | 13 Bearing bracket on chassis base panel |

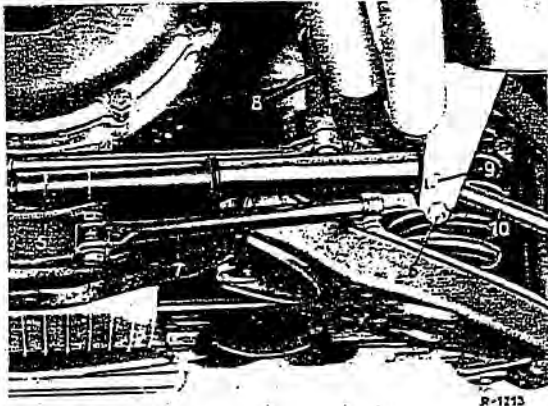


Fig. 33-1/14

- |  |  |
|--|--|
| 5 Steering shock absorber                | 8 Steering relay arm                     |
| 6 Hexagon screw with nut and lock washer | 9 Hexagon screw with nut and lock washer |
| 7 Strut for front axle lateral support   | 10 Right tie-rod                         |

9. Unscrew the strut (7), which serves as a lateral support of the front axle, from the front axle support (Fig. 33-1/14).

Note: Models 190 c and 190 Dc have no front axle lateral support.

10. Detach the tie-rods left and right from the steering knuckle (see Job No. 46-9).
11. Remove the battery and on cars with carburetor engines remove the air intake silencer.
12. Place Supporting Bracket 111 589 03 31 for the engine right and left on the cowl. Suspend the engine by the water pump and raise it slightly (Fig. 33-1/15).

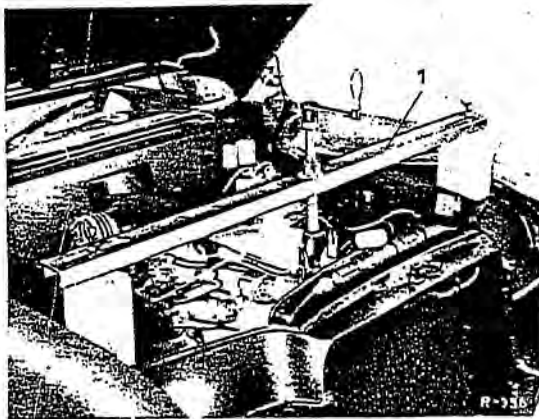


Fig. 33-1/15

- 1 Supporting Bracket 111 589 03 31 for the engine

13. Unscrew the two hexagon screws fixing the engine support (21) to the rubber mountings of the front engine suspension (see Fig 33-1/10).

14. Place a jack under the front axle support, using Fixture 111 589 02 63 (Fig. 33-1/18).
15. Unscrew the hexagon screw (6) of the rubber mountings (4) for the front axle suspension from the chassis base panel at the left and at the right and remove the stop plate (5) (Fig. 33-1/16).
16. Jack down the car and remove the front axle support with the front axle halves

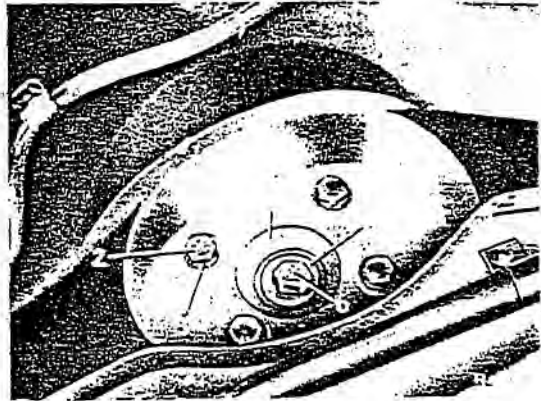


Fig. 33-1/16

- |                                    |
|------------------------------------|
| 2 Hexagon screws with lock washers |
| 3 Washers                          |
| 4 Rubber mounting                  |
| 5 Stop plate                       |
| 6 Hexagon screw with lock washer   |

Note: On Model 230 SL a stop (1) has been provided at the upper part of the front axle suspension in order to limit the upward spring travel of the rubber mounting (Figs. 33-1/16a and 16b).

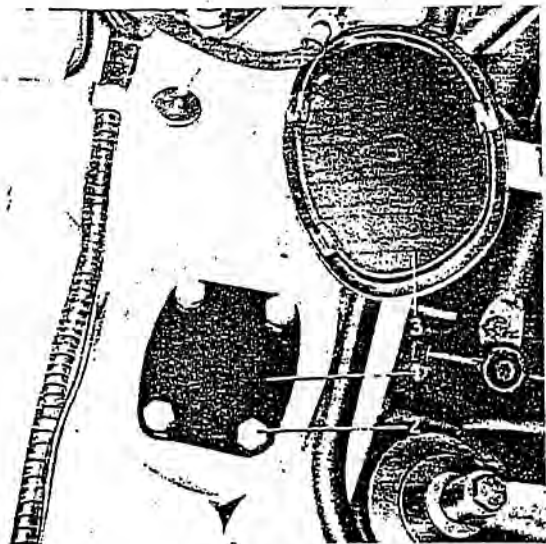


Fig. 33-1/16a

- |                                    |
|------------------------------------|
| 1 Stop                             |
| 2 Hexagon screws with lock washers |
| 3 Cover plate                      |

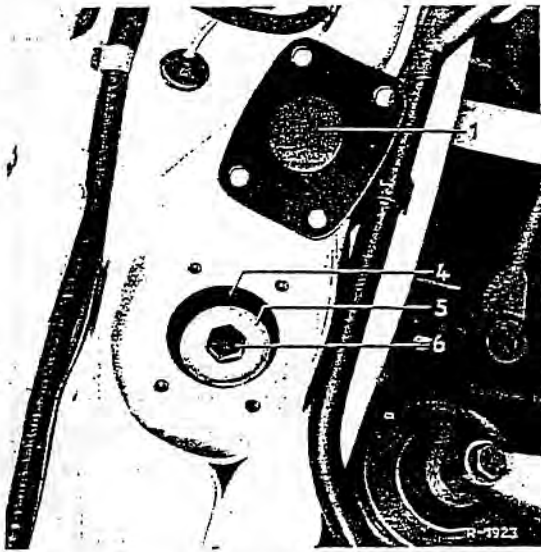


Fig. 33-1/16b

- 1 Stop
- 4 Rubber mounting
- 5 Stop plate
- 6 Hexagon screw with lock washer

**Installation:**

17. Check the two rubber mountings (4) for the front axle support and if necessary replace them. To do this slacken the four hexagon screws left and right on the chassis base panel (Fig. 33-1/17).
18. Check the rubber mountings (4) of the flat springs (2) for the longitudinal support of the front axle support (Fig. 33-1/19) and if necessary replace them (see Job No. 33-3).
19. Check the rubber mountings (1) of the strut for the lateral support of the front axle support and if necessary replace them (Fig. 33-1/21).
20. Place the front axle support with the front axle halves on the car jack in Fixture 111 589 02 63 (Fig. 33-1/18).

Models 220 b, 220 Sb, 220 SEb, 300 SE Models 190 c, 190 Dc

Model 230 SL

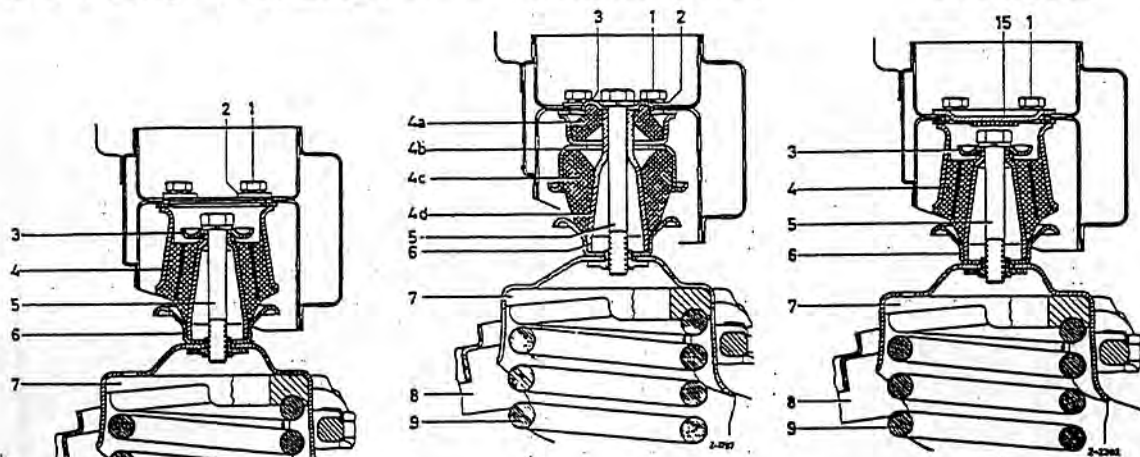


Fig. 33-1/17

- 1 Hexagon screws with lock washers for fastening the rubber mounting
- 2 Washers
- 3 Stop pipe
- 4 Rubber mounting for front axle support
  - 4a Rubber mounting top
  - 4b Stop bearing
  - 4c Rubber mounting bottom
  - 4d Supporting tube
- 5 Hexagon screws with lock washer for fastening the front axle support to the rubber mounting
- 6 Cup for rubber mounting
- 7 Rubber mounting
- 8 Upper control arm
- 9 Front spring
- 10 Lower control arm
- 11 Rubber buffer
- 12 Hexagon screws (M 12X1.5X38) with nuts and lock washers
- 13 Pivot pin for lower control arm
- 14 Front axle support
- 15 Stop

When repairs are being carried out, fit the hexagon screws (1) with the head upward.

Use only specified screws and nuts. For tightening torques see Job. No. 33-0.



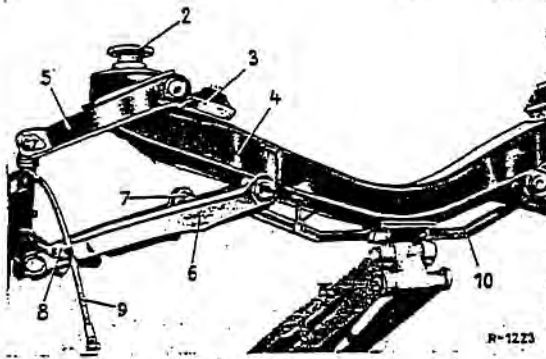


Fig. 33-1/18

- |   |                          |
|---|--------------------------|
| 2 Cup for rubber mounting of front axle support | 8 Steering knuckle       |
| 3 Rubber mounting of front engine suspension    | 9 Brake hose             |
| 4 Front axle support                            | 10 Fixture 111 589 02 63 |
| 5 Upper control arm                             |                          |
| 6 Lower control arm                             |                          |
| 7 Rubber buffer                                 |                          |

21. Lift the front axle support, at the same time inserting the flat spring (2) at the left and at the right into the bearing bracket (5) on the front axle support (Fig. 33-1/19).

22. Screw the hexagon screw (5) for the front axle suspension on the chassis base panel at the left and at the right into the front axle support and tighten with the prescribed torque (see Job No. 33-0).

23. Fit the flat springs for the front axle longitudinal support into the front axle support but do not tighten the hexagon nuts yet (Fig. 33-1/19).

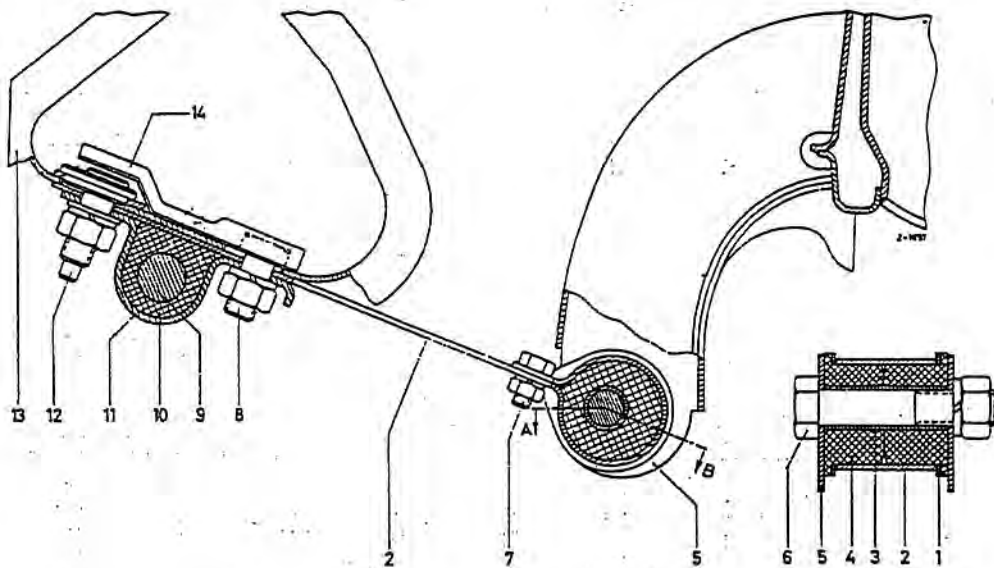


Fig. 33-1/19

- |   |  |
|---|--|
| 1 Spacer ring   | 8 Square screw with nut and lock washer  |
| 2 Flat spring   | 9 Torsion bar                            |
| 3 Spacer tube   | 10 Rubber mounting for torsion bar       |
| 4 Rubber mounting   | 11 Bracket for rubber mounting           |
| 5 Bearing bracket of front axle support                   | 12 Eccentric                             |
| 6 Hexagon screw with nut and lock washer                  | 13 Bearing bracket on chassis base panel |
| 7 Hexagon screw (clamping screw) with nut and lock washer | 14 Cage for square screw and eccentric   |

**Note:** If the front axle support was removed together with the flat springs for the front axle longitudinal support, pay attention to the positions marked on the chassis base panel before removal. Tighten the hexagon nut on the eccentric (12) and the hexagon screw with the prescribed torque (see Job No. 33-0).

24. Screw on and tighten the two hexagon screws (4) for fastening the engine support (3) to the rubber mountings of the front engine suspension. Remove the supporting bracket for the engine (Fig. 33-1/1).

25. Install the front springs (see Job. No. 32-4).

26. Install the torsion bar (see Job. No. 32-6).

27. Install the front shock-absorbers (see Job No. 32-2).
28. Install the battery and on cars with carburetor engine install the air intake silencer.
29. Fit the right and left tie-rods on the steering knuckle (see Job No. 46-9).
30. Check the brake hoses (7) right and left and make sure that they fit tightly into the brake line. Loosen the hexagon screw (5) on the retainer (1) and insert the brake hose in the protection plate (6) at the retainer (1). Take care that the hose is not twisted. Tighten the hexagon nut (5) on the retainer. Fit the brake hose retainer (2), screw the sleeve nut (4) of the brake line (3) into the brake hose and tighten, holding the brake hose steady (Fig. 33-1/2).
31. Bleed the brake system.
32. Pull the center brake cable (5) through the guide on the front axle support and fit it to the hand-brake lever (4) Fig. 33-1/2).

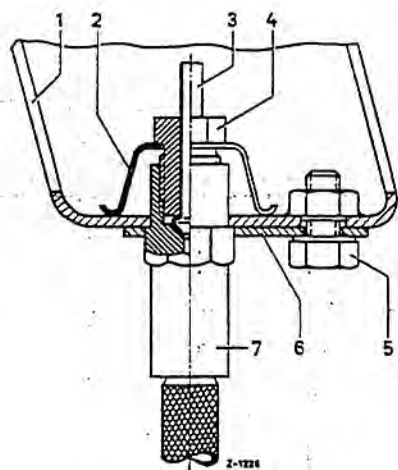


Fig. 33-1/20

- |                                  |                                    |
|----------------------------------|------------------------------------|
| 1 Retainer at chassis base panel | 5 Hexagon screw with spring washer |
| 2 Brake hose retainer            | 6 Protection plate                 |
| 3 Brake line                     | 7 Brake hose                       |
| 4 Sleeve nut                     |                                    |

33. Fit the cotter pin (6) for securing the brake cable at the lower end of the lever (Fig. 33-1/12). Adjust the hand brake (see Job No. 42-20).
34. Fit the front wheels and the brake drums, jack down the car, and tighten up the wheel nuts.
35. Check the front axle positioning distance as well as the camber, caster and toe-in of the front wheels and, if necessary, adjust (see Job No. 40-3).
36. Mount the strut for the lateral support of the front axle (Fig. 33-1/21). Make sure that the rubber mountings for the front axle support are not under stress. Tighten the hexagon screw (5) of the clamp (6).

**Note:** The clamp of the strut should only be tightened with the front axle under load (i. e. the road wheels must be on the ground).

The strut must always be fitted in such a way that the clamp side points to the bearing bracket on the chassis base panel and the screw side of the clamp points toward the front (Figs. 33-1/14 and 33-1/21).

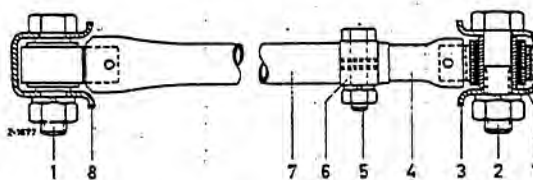


Fig. 33-1/21

- |  |   |
|--|---|
| 1 Rubber mounting                        | 5 Hexagon screw (clamping screw) with nut and lock washer |
| 2 Hexagon screw with nut and lock washer | 6 Clamp   |
| 3 Mounting hole on chassis base panel    | 7 Outside tube  |
| 4 Adjustable inside tube                 | 8 Bearing bracket on front axle support                   |
|  | 9 Hexagon screw   |

# Removal and Installation of Front Axle Halves

Modification: 2nd Version Front Axle (Addition)

Job No.
33-2

## Removal:

1. Remove the front axle support together with the two front axle halves (see Job No. 33-1).
2. Loosen the two hexagon screws (5) fastening the pivot pin (6) for the upper control arm to the front axle support, after tapping up the locking plates (4), and remove together with the shims (3) (Fig. 33-2/1).

**Note:** When removing the shims watch the order of their arrangement (see note to No. 4).

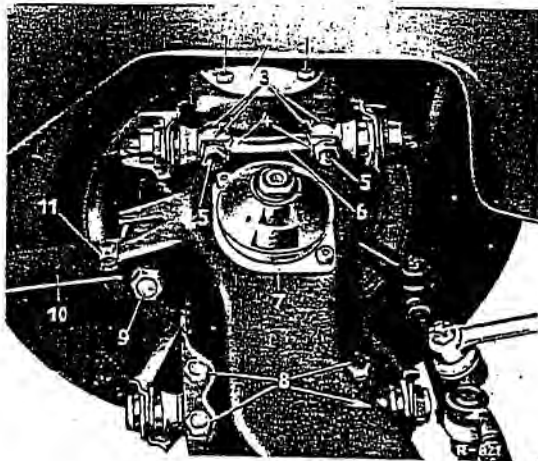


Fig. 33-2/1

- 1 Hexagon screws for fastening the rubber mounting to the front axle support
- 2 Rubber mounting
- 3 Shims
- 4 Locking plate
- 5 Hexagon screw (M 12X1.5X40)
- 6 Pivot pin for upper control arm
- 7 Rubber mounting of front engine suspension
- 8 Hexagon screws (M 12X1.5X38)
- 9 Pin for fastening the flat spring to the front axle support
- 10 Flat spring supporting the front axle support
- 11 Hexagon screws (clamping screws) for the rubber mounting of the flat spring

3. Loosen the hexagon screws (8) provisionally fixing the lower control arm, and take off the front axle half (Fig. 33-2/1).

## Installation:

4. Install the front axle half and fasten the upper control arm to the front axle support with the two hexagon screws (5). Take care to observe the correct order of the shims (3) between the pivot pin and the front axle support. If necessary replace the locking plates (4) for the screws (Fig. 33-2/2).

When carrying out repairs, mount the locking plates in such a way that the lug at the screw head can be tapped over at the top and not below as is shown in the drawing. Tighten the hexagon screws with the prescribed torque (see Job. Nr. 33-0).

### Upper control arm mounting on front axle

1st version

2nd version

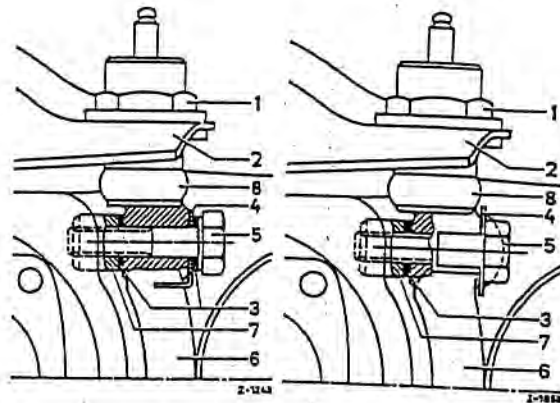


Fig. 33-2/2

- 1 Threaded bushing for upper control arm
- 2 Upper control arm
- 3 Shim
- 4 Locking plate
- 5 Hexagon screw (M 12X1.5X40)
- 6 Pivot pin for lower control arm
- 7 Front axle support
- 8 Rubber sealing ring

**Note:** The shims (3) are used for additional adjustment of the front wheel camber if the eccentric adjustment at the steering knuckle should not be sufficient.

In the case of the 1<sup>st</sup> version front axle a shim 2 mm thick has normally been inserted between the front axle support and the pivot pin and between the locking plate and the hexagon screw (Fig. 33-2/2).

In the case of the 2<sup>nd</sup> version front axle a shim 2 mm thick has normally been inserted between the front axle support and the pivot pin (Fig. 33-2/2a).

If a shim between the front axle support and the pivot pin is removed, it must be

inserted between the locking plate and the hexagon screw.

In any case shims with a total thickness of 2 mm must be installed. Under no circumstances must the shims be omitted; otherwise there is a danger that the screw will knock against the front spring.

5. Fasten the lower control arm provisionally to the front axle support.
6. Install the front axle support with the front axle halves (see Job No. 33-1).

# Removal and Installation of Rubber Mounting for Front Axle Longitudinal Support

Job No.

33-3

## Removal:

1. Loosen the two hexagon screws (clamping screws) (4) on the flat spring (8) for the front axle longitudinal support (Fig. 33-3/1).

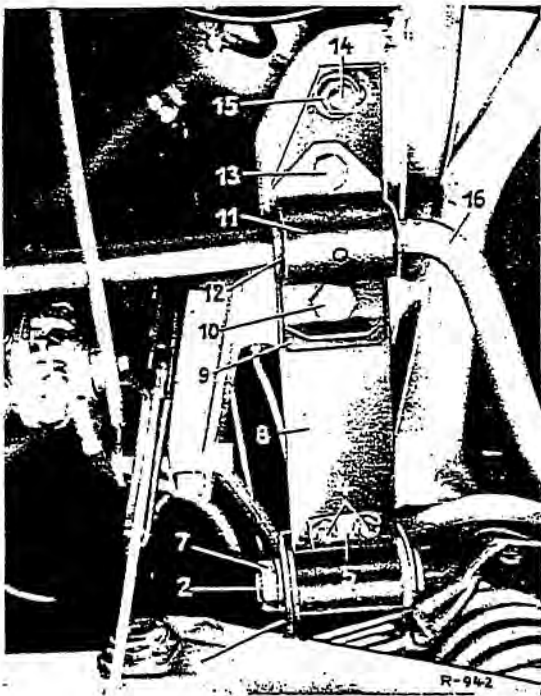


Fig. 33-3/1

- 1 Bearing bracket on front axle support
- 2 Bolt
- 4 Hexagon screws (clamping screws)
- 5 Locking plate
- 7 Hexagon nut with spring washer
- 8 Flat spring
- 9 Locking plate for rubber mounting
- 10 Hexagon screw (M 14X1.5X25 with spring washer)
- 11 Bracket for rubber mounting
- 12 Rubber mounting for torsion bar
- 13 Hexagon screw (M 12X1.5X25) with spring washer
- 14 Eccentric
- 15 Hexagon nut with spring washer and washer
- 16 Torsion bar

2. Detach the flat spring mounting on the front axle support (Fig. 33-3/1).
3. Unscrew the hexagon screws (10) and (13) and press the flat spring off the bearing bracket (Fig. 33-3/1).

**Note:** The flat spring need not be removed when the rubber mountings are being replaced; therefore do not loosen the hexagon nut (15) on the eccentric (14). If for some reason the flat spring is removed, its position on the chassis base panel should be marked beforehand with a scriber.

4. Remove rubber mountings (3), spacer rings (18) and spacer tube (19) from the flat spring (Fig. 33-3/2).

**Note:** On some 1<sup>st</sup> version cars rubber mountings (3) were used with a vulcanized spacer tube (33-3/2).

## Installation:

5. Check the rubber mountings (see Table in Job No. 33-0) and rub them with talc.
6. Insert the rubber mountings in the flat spring with the spacer rings installed and press in the spacer tube.

**Note:** The projection on the rubber mounting must engage the clamping gap in the flat spring. Do not yet tighten the hexagon screws (clamping screws) (4) (Fig. 33-3/2).

7. Fasten the flat spring to the front axle support; but do not yet tighten the hexagon nut (7) (Fig. 33-3/2).
8. Fasten the flat spring together with the torsion bar to the chassis base panel making sure that the locking plate (9) and the rubber mounting in the bracket (11) are correctly positioned (Fig. 33-3/2). For the prescribed torque see Job No. 33-0.
9. Tighten the two hexagon screws (clamping screws) (4) with the prescribed torque (see Job No. 33-0) (Fig. 33-3/2).

33-3/1

**Note:** a) The clamping screws for the rubber mountings should not be tightened before the flat spring has been fixed in position in relation to the front axle support and the chassis base panel. This is necessary to prevent stress conditions and to obtain a smooth running of the front wheels.

b) On recent cars the clamping screws are no longer secured by means of locking plates, but by lock washers (Fig. 33-3/2).

10. Tighten the hexagon nut (7) for the bolt (2) on the front axle support (for prescribed torque see Job No. 33-0).

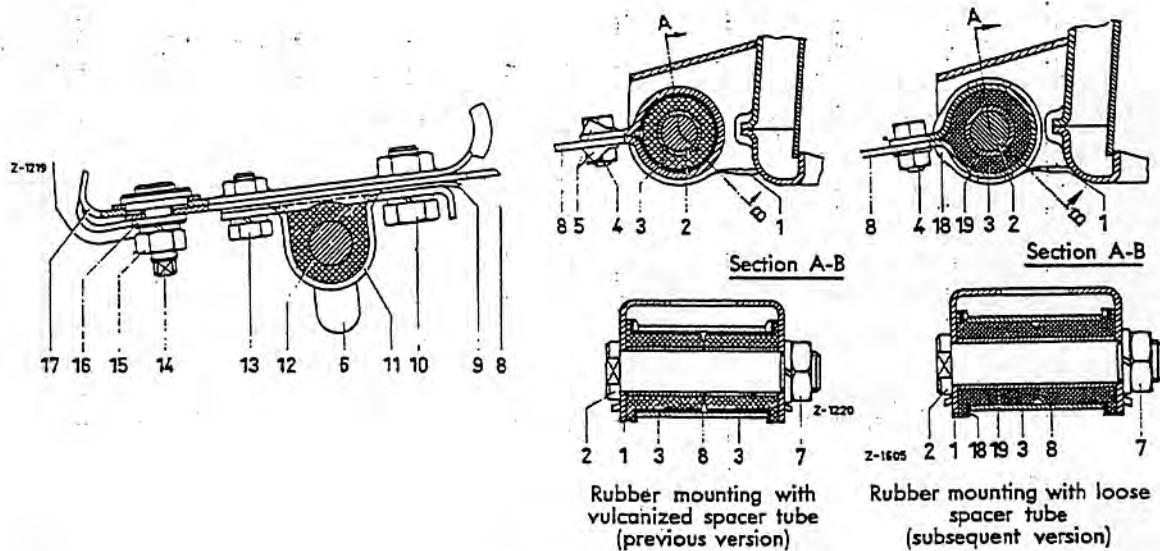


Fig. 33-3/2

- |                                   |   |                                   |
|-----------------------------------|---|-----------------------------------|
| 1 Bearing bracket                 | 8 Flat spring                                     | 14 Eccentric                      |
| 2 Bolt                            | 9 Locking plate                                   | 15 Hexagon nut with spring washer |
| 3 Rubber mounting for flat spring | 10 Hexagon screw (M 14x1.5x25) with spring washer | 16 Washer                         |
| 4 Hexagon screw with nut          | 11 Bracket for rubber mounting                    | 17 Chassis base panel             |
| 5 Locking plate                   | 12 Rubber mounting for torsion bar                | 18 Spacer ring                    |
| 6 Torsion bar                     | 13 Hexagon screw (M 12x1.5x25)                    | 19 Spacer tube                    |
| 7 Hexagon nut with spring washer  |   |                                   |

## B. 2nd Version Front Axle

Modification: Fig. 33-3/3 corrected

### Removal:

1. Loosen the two hexagon screws (clamping screws) (7) on the flat spring (2) for the front axle longitudinal support (Fig. 33-3/3).

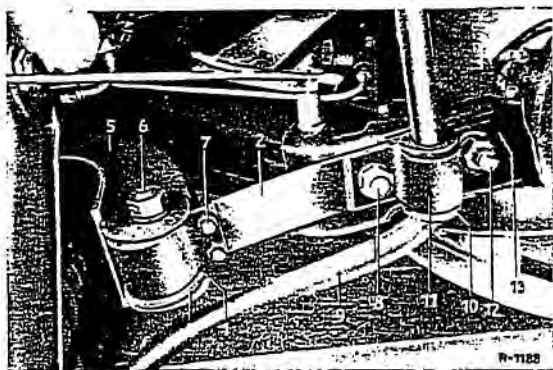


Fig. 33-3/3

- |   |  |
|---|--|
| 1 Spacer ring   | 8 Square screw with nut and lock washer  |
| 2 Flat spring   | 9 Torsion bar                            |
| 4 Rubber mounting   | 10 Rubber mounting for torsion bar       |
| 5 Bearing bracket on front axle support                   | 11 Bracket for rubber mounting           |
| 6 Hexagon screw with nut and lock washer                  | 12 Eccentric                             |
| 7 Hexagon screw (clamping screw) with nut and lock washer | 13 Bearing bracket on chassis base panel |

2. Detach the flat spring mounting on the front axle support (Fig. 33-3/3).
3. Carefully mark the position of the flat spring on the chassis base panel by means of a scribe.
4. Detach the flat spring at the chassis base panel and remove together with the bracket (11) for the rubber mounting (10) of the torsion bar (Fig. 33-3/3).
5. Remove rubber mountings (4), spacer rings (1) and spacer tube (3) from the flat spring (Fig. 33-3/4).

### Installation:

6. Check the rubber mountings (see Table in Job No. 33-0) and rub them with talc.
7. Insert the rubber mountings in the flat spring with the spacer rings installed and press in the spacer tube.

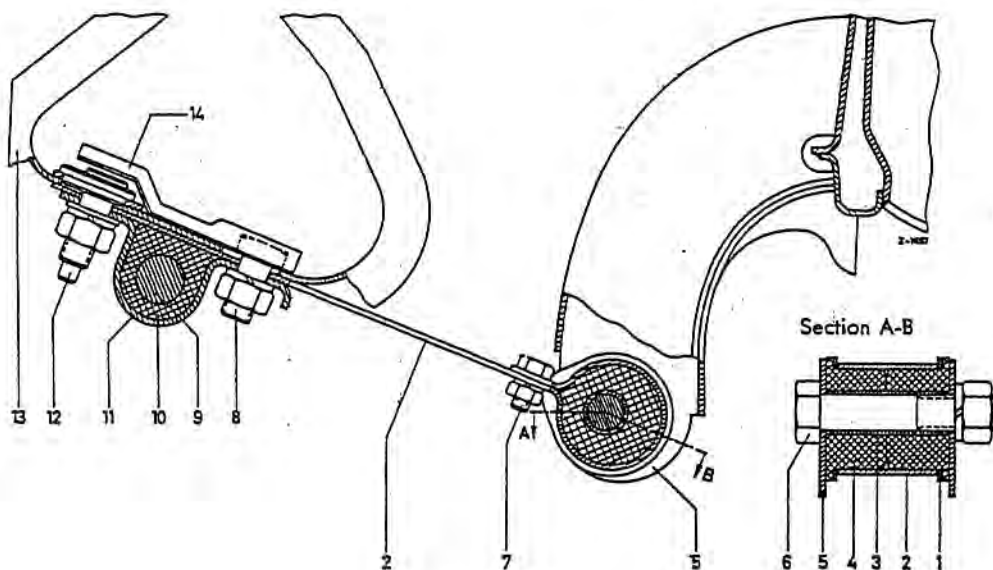


Fig. 33-3/4

- |   |   |
|---|---|
| 1 Spacer ring   | 8 Square screw with nut and lock washer       |
| 2 Flat spring   | 9 Torsion bar                                 |
| 3 Spacer tube   | 10 Rubber mounting for torsion bar            |
| 4 Rubber mounting   | 11 Bracket for rubber mounting                |
| 5 Bearing bracket on front axle support                   | 12 Eccentric with hexagon nut and lock washer |
| 6 Hexagon screw with nut and lock washer                  | 13 Bearing bracket on chassis base panel      |
| 7 Hexagon screw (clamping screw) with nut and lock washer |   |

**Note:** The projection on the rubber mounting must engage the clamping gap in the flat spring. Do not yet tighten the hexagon nuts (clamping screws) (7) (Fig. 33-3/2).

8. Fasten the flat spring to the front axle support, but do not yet tighten the hexagon nut (Fig. 33-3/4).
9. Fasten the flat spring together with the torsion bar to the chassis base panel, paying attention to the markings made during removal showing the position of the flat spring. Also make sure that the rubber mounting of the torsion bar is correctly seated in the bracket. For tightening torque of the hexagon nut see Job No. 33-0.

10. Tighten the two hexagon screws (clamping screws) (7) with the prescribed torque (see Job No. 33-0) (Fig. 33-3/4).

**Note:** a) The clamping screws (7) for the rubber mountings should not be tightened before the flat spring has been fixed in position in relation to the front axle support and the chassis base panel. This is necessary to prevent stress conditions and to obtain a smooth running of the front wheels.

11. Tighten the hexagon screw (6) on the front axle support (for the prescribed torque see Job No. 33-0).



## Checking of the Front Axle Support

Job No.

33-4

When overhauling the front axle, it is advisable to check the front axle support, and when repairs are carried out after an accident it is imperative that this should be done. The most important measuring points are the mounting points for the lower and upper control arms (see check diagrams in Job No. 33-0).

To check the front axle support for twisting and distortion a simple check gage has been designed which is placed in the front axle support and connected to the eyes for fastening the upper control arms (Fig. 33-4/1).

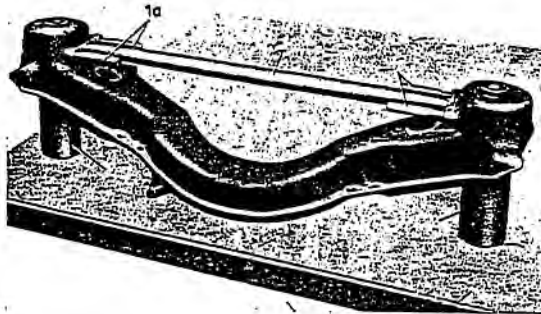


Fig. 33-4/1

- 1 Check gage 111 589 11 23
- 1a Locating bolts
- 2 Support bolts

The check gage has a length of 805.6 mm which is the minimum distance between the fastening eyes for the upper control arms on the front axle supports Part. No. 1113302342 and 1113302742. To measure the actual distance insert a feeler gage between the eye and the check gage. If the distance marked in the check diagrams for the various versions of the front axle support is not obtained or if the front axle support is twisted or distorted the support should be replaced.

If Check Gage 111 589 11 23 is not available the front axle support should be checked on a surface plate. To do this place the contact surfaces for the flat springs on two support bolts (2) which are of exactly the same height. The dimensions are given in the check diagrams.

1970

# Report of the Board of Directors

The Board of Directors has the honor to present to you the report of the management of the Corporation for the year ended December 31, 1970.

The Corporation has achieved significant progress in the past year, particularly in the areas of research and development, and in the expansion of its operations.



The Corporation's financial performance for the year ended December 31, 1970, is summarized in the following table:

Item	1970	1969
Net Income	\$1,200,000	\$900,000
Operating Expenses	\$800,000	\$750,000
Research and Development	\$300,000	\$250,000
Capital Expenditures	\$150,000	\$120,000
Dividends Paid	\$200,000	\$180,000

# Front Wheel Bearings

Job No.

33-5

## Removal, Disassembly, Checking, Repair, Reassembly, and Installation of Front Wheel Hub, Adjustment of Front Wheel Bearings

Front Axle Half Installed

Modification: Note to para 28

In the case of cars with air suspension pay attention to "General Instructions for Assembly Work" (see Job No. 32-11).

### Removal:

1. Remove the brake drum, and in the case of the disk brakes remove the brake caliper (1) (see Fig. 33-5/4 and Job No. 42-7).
2. Pull the hub cap (1) off the front wheel hub by means of Puller 180 589 00 33 (Fig. 33-5/1).

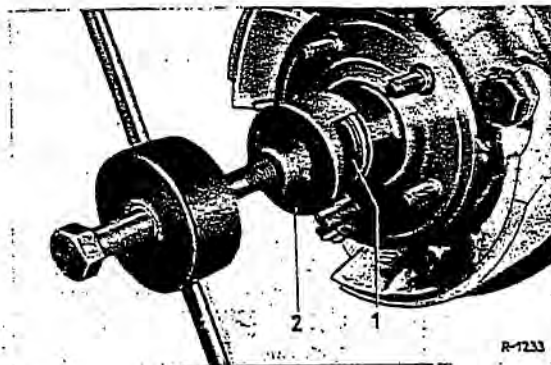


Fig. 33-5/1

- 1 Hub cap
- 2 Puller 180 589 00 33

3. Slacken the hexagon socket screw of the clamping nut (1) on the wheel spindle, remove the clamping nut and the washer (Fig. 33-5/2).

4. Pull off the front wheel hub using Puller 136 589 15 33, if necessary.

### Disassembly:

5. Take the inner race with roller cage (6) of the outer annular taper roller bearing out of the hub (Fig. 33-5/3).

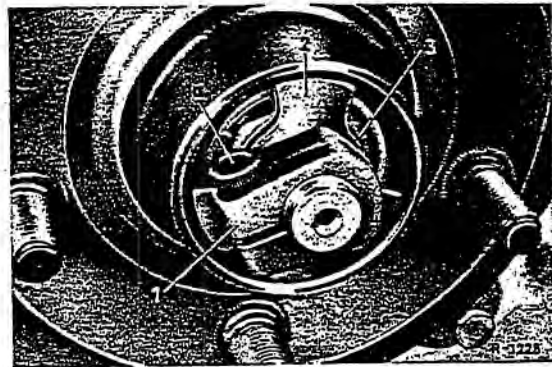


Fig. 33-5/2

- 1 Clamping nut
- 1a Hexagon socket screw with lock washer
- 2 Washer
- 3 Outer annular taper roller bearing

6. Use a suitable brass or aluminium drift to evenly tap the outer race (4) of the inner annular taper roller bearing and take the inner race with roller cage (3), the puller ring (2) and the seal (1) out of the front wheel hub (Fig. 33-5/3).

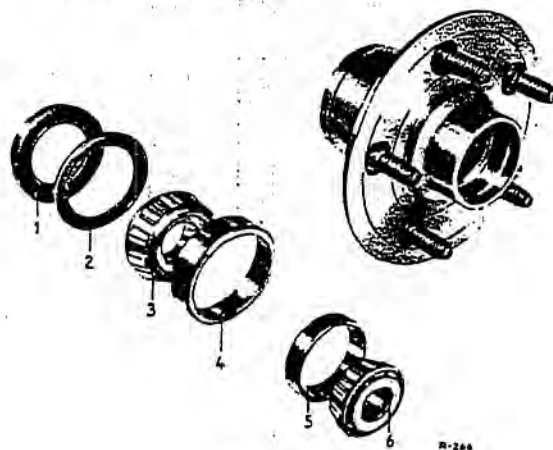


Fig. 33-5/3

- 1 Seal
- 2 Puller ring
- 3 Inner race with roller cage of inner annular taper roller bearing
- 4 Outer race
- 5 Outer race
- 6 Inner race with roller cage of outer annular taper roller bearing

33-5/1

7. Use a brass or aluminum drift in the same way to tap the outer race (5) of the outer annular taper roller bearing carefully out of the hub (Fig. 33-5/3).
8. In the case of front wheel hubs for disk brakes remove the brake disk (see Job No. 42-11).

**Checking and Repair:**

9. Check the flange of the front wheel hub for run-out (for dimensions see Job No. 33-0).
10. Check the wheel fixing bolts to make sure that they are tightly fixed in the hub.
11. Check the annular taper roller bearing and the bearing mountings in the front wheel hub and check the wheel spindle (for dimensions see Job No. 33-0).
12. Check the contact surface for the seal on the wheel spindle.

**Note:** In the case of the 1<sup>st</sup> version front wheel bearings (annular taper roller bearing with millimeter measurements) a spacer ring (6) is pressed on the wheel spindle and its contact surface for the seal (5) is provided with a reverse thread pattern (Fig. 33-5/4).

In the case of the 2<sup>nd</sup> version front wheel bearings (annular taper roller bearing with inch measurements) the seal (4) turns on

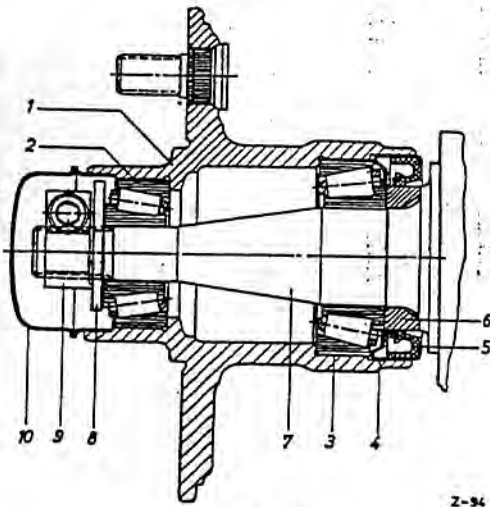


Fig. 33-5/4

**1st version front wheel bearings**

- |                                      |                 |
|--------------------------------------|-----------------|
| 1 Front wheel hub                    | 5 Seal          |
| 2 Outer annular taper roller bearing | 6 Spacer ring   |
| 3 Inner annular taper roller bearing | 7 Wheel spindle |
| 4 Puller ring                        | 8 Washer        |
|                                      | 9 Clamping nut  |
|                                      | 10 Hub cap      |

the wheel-spindle, which is provided with a reverse thread pattern (Fig. 33-5/4a).

13. If on the 1<sup>st</sup> version of the front wheel bearings the contact surface for the seal on the spacer ring (6) is worn, replace the spacer ring (6). To do this heat the ring by means of a welding torch to about 80° C and remove it from its seat on the wheel spindle. Shrink on a new heated spacer ring paying attention to the assembly instructions in Job No. 33-0. The contact surface of the spacer ring should only be reconditioned in an emergency. In the case of the 2<sup>nd</sup> version front wheel bearings remachine the contact surface for the seal on the wheel spindle, if necessary (for dimensions see Job No. 33-0). This can only be done after the steering knuckle has been removed.

In this case the reserve thread pattern need not be applied.

14. Check the washer which is ground on both sides (2) and, if necessary, regrind or replace it (Fig. 33-5/2).

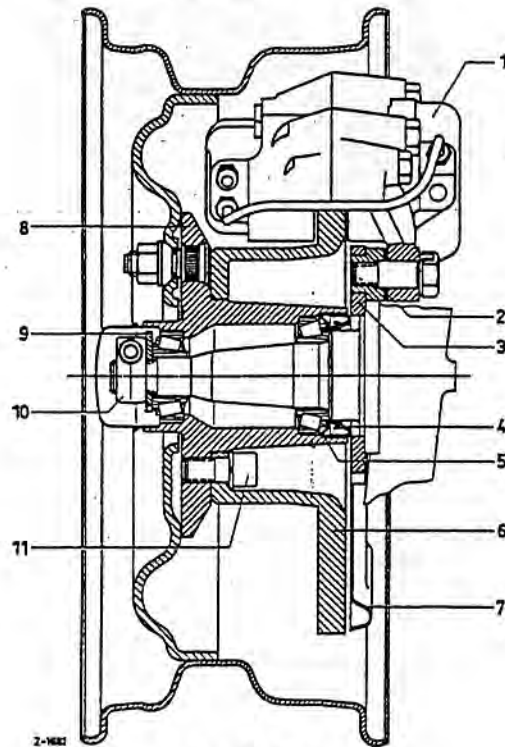


Fig. 33-5/4a

**2nd version front wheel bearings**

- |                             |  |
|-----------------------------|--|
| 1 Brake caliper             | 7 Cover plate                            |
| 2 Shim                      | 8 Front wheel hub                        |
| 3 Bracket for brake caliper | 9 Washer                                 |
| 4 Seal                      | 10 Clamping nut                          |
| 5 Puller ring               | 11 Hexagon socket screw with lock washer |
| 6 Brake disk                |  |

15. If necessary, check the wheel spindle for run-out.

**Reassembly:**

16. Press the outer races (2) and (3) of the annular taper roller bearings into the front wheel hub using Assembly Fixture 120 589 03 61 in the case of the 1<sup>st</sup> version front wheel bearings and Assembly Fixture 111 589 13 61 in the case of the 2<sup>nd</sup> version front wheel bearings (Figs. 33-5/5 and 33-5/6).

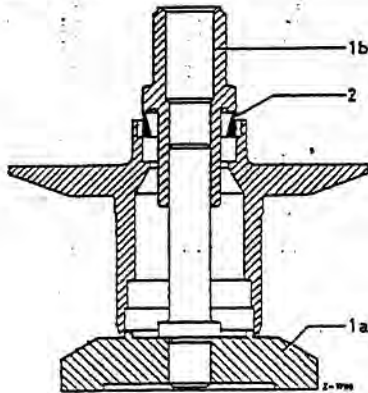


Fig. 33-5/5

**Pressing in of outer race**

of outer annular taper roller bearing

- 1 Assembly Fixture 120 589 03 61 or 111 589 13 61
- 1a Base plate with guide pin
- 1b Pressure sleeve for outer race of outer annular taper roller bearing
- 2 Outer race of outer annular taper roller bearing

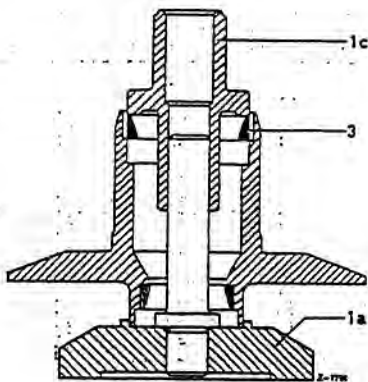


Fig. 33-5/6

**Pressing in of outer race**

of inner annular taper roller bearing

- 1 Assembly Fixture 120 589 03 61 or 111 589 13 61
- 1a Base plate with guide pin
- 1c Pressure sleeve for outer race of inner annular taper roller bearing
- 3 Outer race of inner annular taper roller bearing

17. Install the inner race and roller cage of the inner annular taper roller bearing together with the puller ring (Figs. 33-5/4 and 4a).

**Note:** Before assembly fill the roller cages with antifriction bearing grease (for prescribed amount see Job No. 33-0).

18. Coat the circumference of the seal (4) with sealing compound and press in by means of Assembly Fixture 120 589 03 61 or 111 589 13 61 (Fig. 33-5/7).

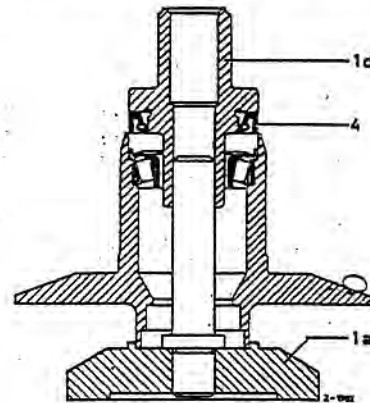


Fig. 33-5/7

**Pressing in of seal**

- 1 Assembly Fixture 120 589 03 61 or 111 589 13 61
- 1a Base plate with guide pin
- 1d Pressure sleeve for seal
- 4 Seal

**Note:** On a comparatively large number of cars with the 2<sup>nd</sup> version front wheel bearings seals were installed which are provided with a reverse thread pattern on the contact surface. If such seals are used for repair job, please note the assembly instructions L = left side and R = right side.

The seals now used have no reverse thread pattern and left and right are identical (see also Job No. 33-0).

19. Put anti-friction bearing grease in the front wheel hub (for prescribed amount see Job No. 33-0).

**Note:** Always put in the prescribed amount of grease. If the amount of grease is excessive the kneading action causes overheating of the grease and as a result it may lose its lubrication properties. On the other hand, the amount of grease must not be too small since this may prejudice proper lubrication of the annular taper roller bearings.

20. In the case of a front axle with disk brake install the brake disk on the front wheel hub (see Job No. 42-11).

**Installation:**

- 21. Coat the contact surface for the seal on the spacer ring or on the wheel spindle with Molykote paste (Figs. 33-5/4 and 4a).
- 22. Press the wheel hub onto the wheel spindle. Install the inner race and roller cage of the outer annular taper roller bearing. Put on the ground steel washer and screw on the clamping nut.

**Adjustment of Front Wheel Bearings:**

- 23. Tighten the clamping nut to such an extent that the hub can just be turned. Then slacken the clamping nut and neutralise the stresses by a blow on the wheel spindle.
- 24. Attach Tester 136 589 04 21 to the hub and adjust the dial gage to an initial tension of approx. 2 mm (Fig. 33-5/8). Check the end play of the hub by vigorously pulling and pushing the flange. Turn the hub several times before making any measurements.

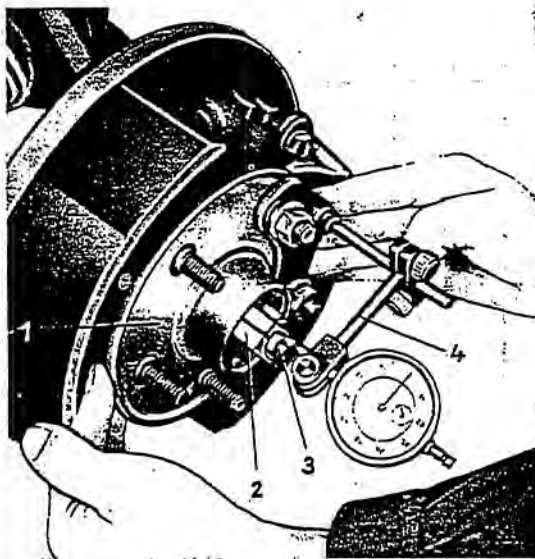


Fig. 33-5/8

- 1 Front wheel hub
- 2 Clamping nut
- 3 Wheel spindle
- 4 Tester 136 589 04 21 with dial gage

- 26. Tighten the hexagon socket screw of the clamping nut and recheck the end play.

- 27. Make an additional check by turning the ground washer between the inner race of the outer annular taper roller bearing and the clamping nut (Fig. 33-5/9, for checking instructions see Job No. 33-0).

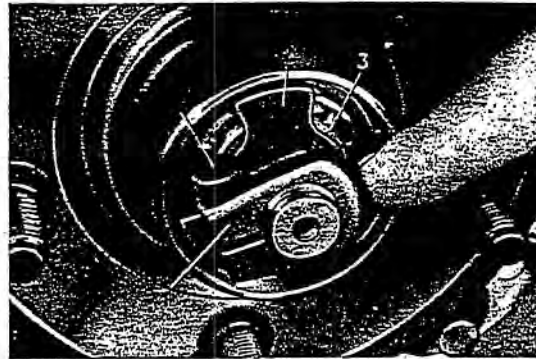


Fig. 33-5/9

- 1 Clamping nut
- 2 Washer
- 1a Hexagon socket screw
- 3 Outer annular taper roller bearing

- 28. Check the position of the notched socket pin (suppressor pin) in the wheel spindle and of the contact spring in the hub cap.
- 29. Put anti-friction bearing grease into the hub cap (for prescribed amount see Job No. 33-0) and press on the cap using Fixture 180 589 11 39 (Fig. 33-5/10).

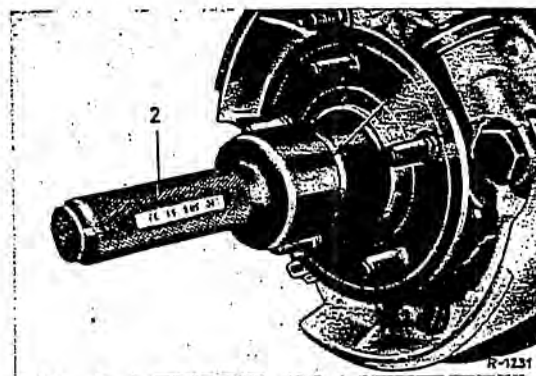


Fig. 33-5/10

- 1 Hub cap
- 2 Fixture 180 589 11 39

- 30. Install the brake drum or the brake caliper (see Job No. 42-7).

## Rear Axle

## Group 35

	Job No.
Rear Axle (General Data, Dimensions, and Tolerances)	35-0
Removal and Installation of Rear Axle	35-1
Cross Strut for Rear Axle Support	35-1a
Rear Axle Shaft (Models 190 c, Dc, 200, D, 220 b/Sb/SEb, 230, S, SL, 300 SE Sedan, 300 SE/C up to Aug. 65) Removal, Disassembly, Reassembly and Installation	35-3
Rear Axle Shaft (Models 250 S, SE, 300 SEB, 300 SE/C as from Aug. 65, 300 SEL) Removal, Disassembly, Reassembly and Installation	35-3a
Replacing Seal for Drive Pinion	35-8
Replacement of Rear Axle Cuff between Rear Axle Housing and Right Axle Tube	35-9

Job No.

35-0

## Rear Axle

### General Data, Dimensions, and Tolerances

*Modification: Models as from August 1965 added; other modifications marked \**

#### Rear Axle Suspension

Models 190 c to 300 SEL

Distance between surface of joint flange and axle of support of rear axle suspension	mm	172 ± 1
Check distance "a" between surface of joint flange and support of rear axle suspension (see Fig. 35-4/21)	mm	158 ± 1

#### Rear Axle Oil Capacity

Models 190 c to 300 SEL

Capacity	2.5 ltr.
----------	----------

**Caution!** For rear axles with lock compensation differential only use special Oil.

#### Tightening Torques

Models 190 c to 300 SEL

Hexagon screws for fastening ring gear		mkg	8 <sup>1)</sup>
Grooved nut for annular grooved bearing or barrel roller bearing of rear axle shaft		mkg	20
Hexagon nuts of fitted screws for fastening brake anchor plate or seal retainer to axle tube		mkg	2.5
Hexagon screw at connecting pin		mkg	12
Hexagon screw at top of rubber mounting for support of rear axle suspension		mkg	18
Hexagon screws (clamping screws) in cover of rear axle bearing and in support of rear axle suspension		mkg	4.5
Shouldered castle nuts or hexagon nuts for fastening torque arms to chassis base panel		mkg	10
Hexagon screws for fastening torque arm to axle tube			20
Hexagon screws for fastening cover to front of rear axle housing	M7	mkg	2.5 <sup>2)</sup>
	M8	mkg	3.5 <sup>2)</sup>
Hexagon screws for fastening left axle tube with bearing flange to rear axle housing	M8	mkg	2.5
	M10	mkg	5
Tensioning screw for fastening the sliding joint to the differential side gear	8 G	mkg	4.5
	10 K	mkg	6.5
Hexagon socket screws for wheel fixing disk and brake disk on rear axle shaft		mkg	13.5
Hexagon socket screws of bearing caps for mounting of brake support on axle tube		mkg	2.5

<sup>1)</sup> The hexagon screws are not secured by locking plates.

<sup>2)</sup> Use only grade 10 K screws.

35-0/1



## Anti-Friction Bearings

The following points must be taken into account when judging the serviceability of the bearings:

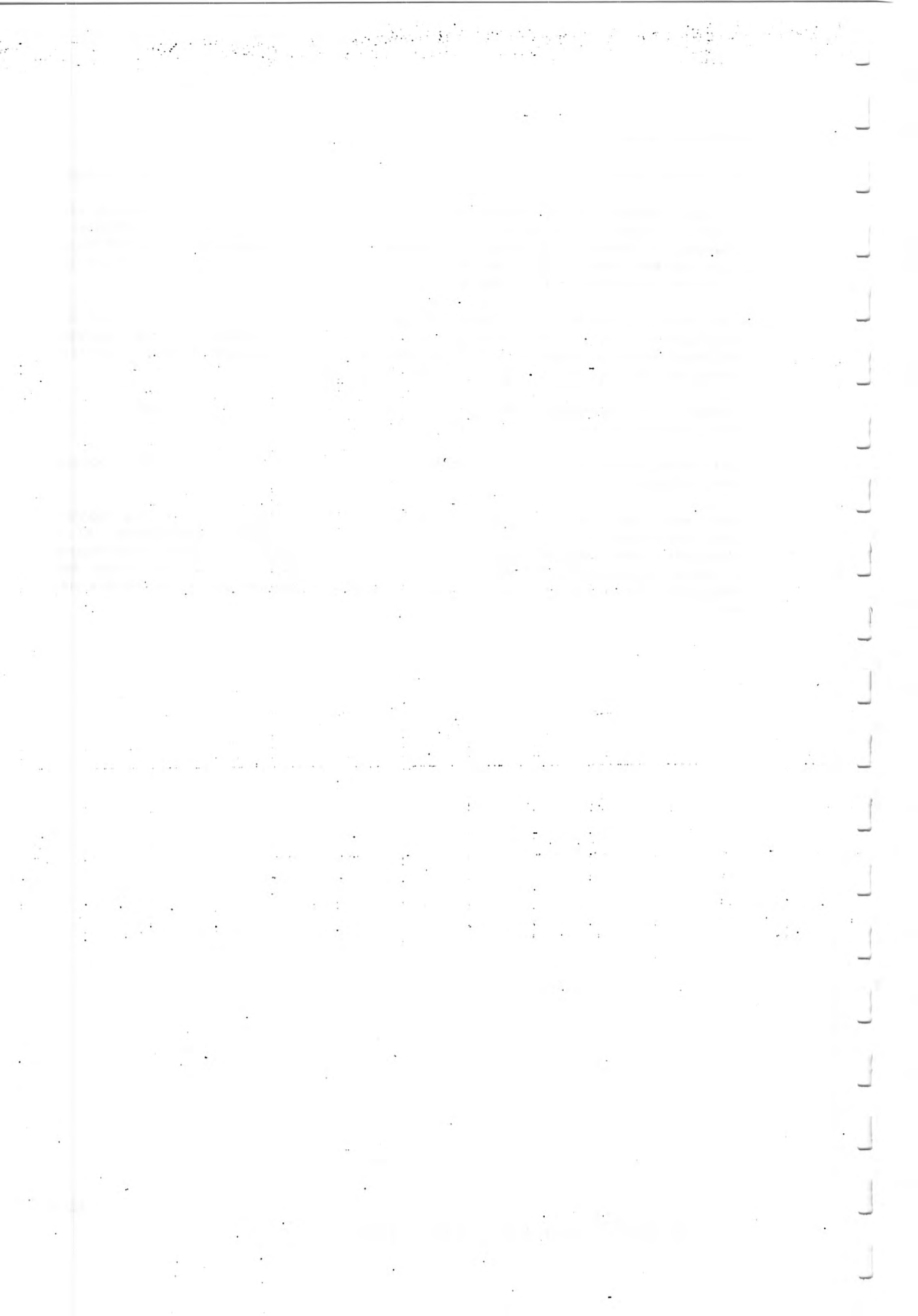
As a rule, a bearing can still be regarded as serviceable, if the raceways or contact surfaces and the balls or rollers show no visible signs of wear or damage. In order to form a really sound judgement, the bearing must previously be cleaned in gasoline or trichloroethylene until all traces of dirt have been rinsed out of the bearing. A bearing can be considered free from all traces of dirt if there are no binding spots when it is rotated by hand.

A few drops of extra-thin engine oil should be put on the cleaned bearing so that it can be tested for silent running. When this test is made, it should be remembered that even bearings which have only been in operation for a short period of time are appreciably noisier than new bearings, but this does not necessarily mean that they are unserviceable.

In order to avoid unnecessary rejection of bearings which are still serviceable, assessment of bearing serviceability should only be done by an expert who is experienced in this work.

Under normal running conditions, the radial play of a bearing should only show a slight increase during its lifetime.

When repairs are being carried out on a vehicle which has covered 100 000 km, the bearings should automatically be rejected even if examination shows that they are still serviceable. This is because their further period of serviceability is an unknown factor. But the decision must depend on whether replacement of the bearings is easy, i. e., on whether it can be done without any considerable disassembly and reassembly work or whether replacement involves considerable preparation.



# Removal and Installation of Rear Axle

Job No.
35-1

*Modification: Instructions for cars with air suspension added*

**Note:** In the case of cars with air suspension see "General Instructions for Assembly Work" (See Job No. 32-11).

## Removal:

1. Jack up the car at the rear. Remove the rear wheels and on cars with drum brakes remove the brake drums.
2. On cars with air suspension remove the torsion bar on the rear axle (see Job No. 32-9).
3. Unfasten the pipe clip on the rear exhaust pipe. Prize out the rubber rings (1) of the rear exhaust suspension with a screw driver, taking care not to damage them. Remove the rear exhaust pipe together with the intermediate muffler and the main muffler (Figs. 35-1/1 and 35-1/2).

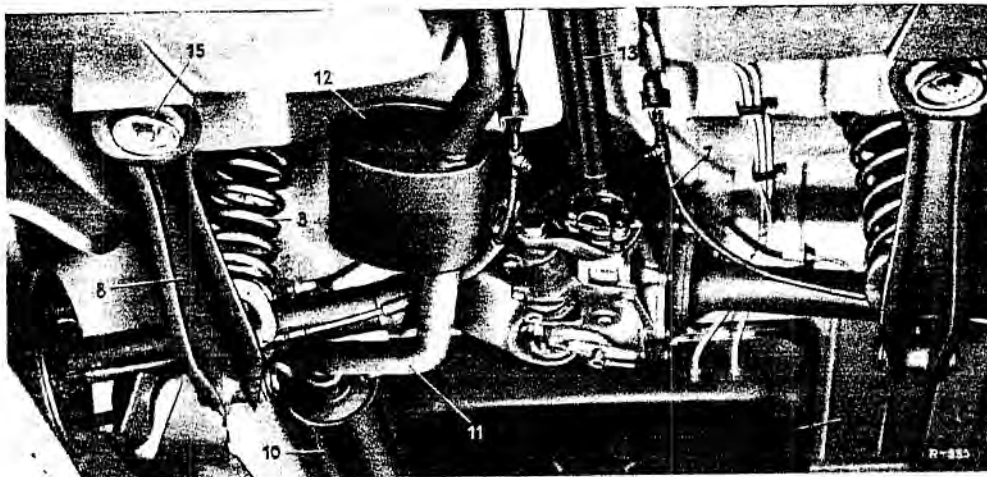


Fig. 35-1/1

- |                    |                         |                              |
|--------------------|-------------------------|------------------------------|
| 3 Rear spring      | 10 Main muffler         | 13 Rear propeller shaft      |
| 7 Rear brake cable | 11 Rear exhaust pipe    | 14 Fuel tank                 |
| 8 Torque arm       | 12 Intermediate muffler | 15 Front torque arm mounting |



Fig. 35-1/2

- |                                     |
|-------------------------------------|
| 1 Rubber ring                       |
| 2 Retainer on chassis base panel    |
| 3 Retainer on the rear exhaust pipe |
| 4 Main muffler                      |

4. Loosen the wing nut (8) for adjusting the handbrake on the relay lever (5). Detach the return spring (2) on the bolt of the equalizer (3) and on the bracket. Unscrew the hexagon nuts fastening the two rear brake cables (1) to the brackets on the chassis base panel and disconnect the brake cables (Fig. 35-1/3 and Job No. 42-19).

35-1/1

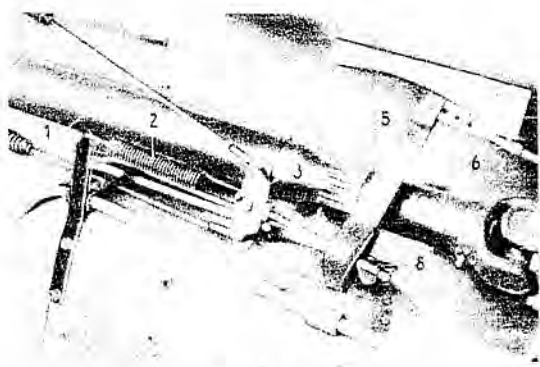


Fig. 35-1/3

2nd version

(For 1st version see Job No. 42-19)

- |                     |   |
|---------------------|---|
| 1 Rear brake cables | 6 Center brake cable                            |
| 2 Return spring     | 7 Relay lever guide                             |
| 3 Equalizer         | 8 Wing nut for the adjustment of the hand brake |
| 4 Tensioning screw  |   |
| 5 Relay lever       |   |

5. Unscrew the propeller shaft at the joint flange of the rear axle and push the rear propeller shaft forward (Fig. 35-1/4).
6. Remove the compensating spring (see Job No. 32-7). This does not apply to cars with air suspension.
7. Remove the left and right rear springs (see Job No. 32-5). On cars with air suspension unscrew the spring piston from the torque arm, but do not remove it from the spring bellows (see also Job No. 32-13).

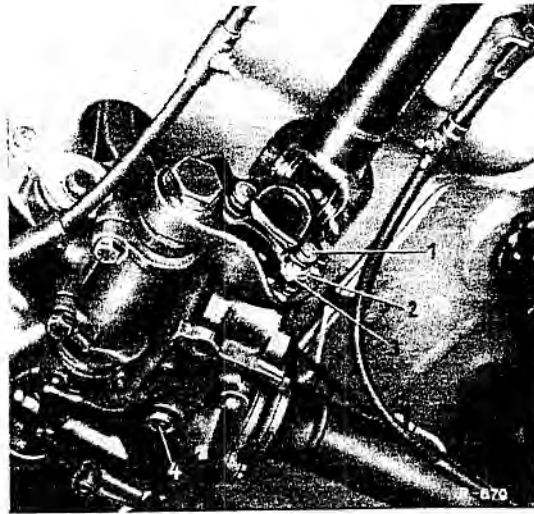


Fig. 35-1/4

- |                      |                  |
|----------------------|------------------|
| 1 Cheese head screws | 3 Hexagon nuts   |
| 2 Locking plates     | 4 Oil drain plug |

8. On cars with drum brakes detach the brake lines (4) from the wheel cylinders and the brake hoses (5) (Fig. 35-1/5). Remove the brake lines together with the brake hose retainers from the retainers on the axle tubes. On cars with disk brakes disconnect the brake hoses from the brake lines on the brake calipers (see Job Nos. 42-6 or 46-7).
9. Disconnect the torque arm mountings from the chassis base panel (see Job No. 35-1a).

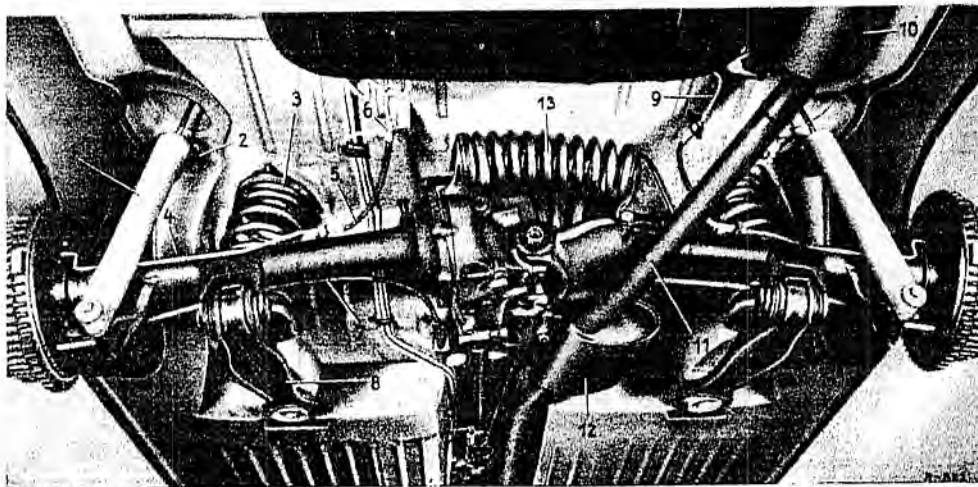


Fig. 35-1/5

- |                               |                       |
|-------------------------------|-----------------------|
| 1 Rear shock-absorber         | 4 Brake line          |
| 2 Rubber buffer for axle tube | 5 Brake hose          |
| 3 Rear spring                 | 6 Distributor fitting |

- |  |                         |
|--|-------------------------|
| 7 Rear brake cable                           | 10 Main muffler         |
| 8 Torque arm                                 | 11 Rear exhaust pipe    |
| 9 Brake line (connection to left brake hose) | 12 Intermediate muffler |
|  | 13 Compensating spring  |

- |  |                         |
|--|-------------------------|
| 7 Rear brake cable                           | 10 Main muffler         |
| 8 Torque arm                                 | 11 Rear exhaust pipe    |
| 9 Brake line (connection to left brake hose) | 12 Intermediate muffler |
|  | 13 Compensating spring  |

- |  |                         |
|--|-------------------------|
| 7 Rear brake cable                           | 10 Main muffler         |
| 8 Torque arm                                 | 11 Rear exhaust pipe    |
| 9 Brake line (connection to left brake hose) | 12 Intermediate muffler |
|  | 13 Compensating spring  |

- Screw out the hexagon screws (8) and (10) on the front link (9) of the cross strut (5) for the rear axle. Take off the front link, loosen the rear link (7) a little and push the cross strut backward (Fig. 35-1/6).

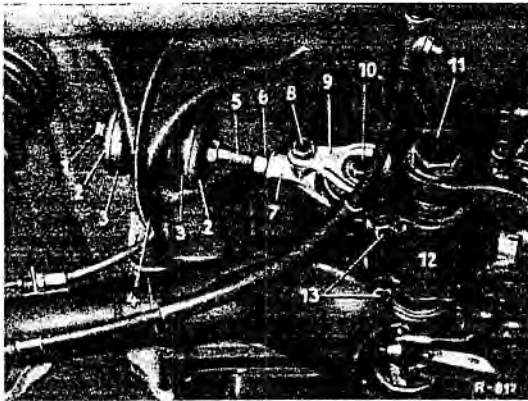


Fig. 35-1/6

- |                                    |   |
|------------------------------------|---|
| 1 Hexagon nut with lock nut        | 9 Front link  |
| 2 Cup                              | 10 Hexagon screw with spring washer                             |
| 3 Rubber buffer                    | 11 Hexagon screw for connecting pin of the rear axle suspension |
| 4 Retainer on chassis base panel   | 12 Support of the rear axle suspension                          |
| 5 Cross strut                      | 13 Hexagon screws (clamping screws)                             |
| 6 Hexagon nut (lock nut)           |   |
| 7 Rear link                        |   |
| 8 Hexagon screw with spring washer |   |

- On cars with air suspension disconnect the brake support mounting on the chassis base panel. To do this unscrew the castle nut in the interior of the car from under the rear seat and pull out the hexagon screw (4) (Fig. 35-1/10).

- Raise the two axle tubes a little and loosen the lower shock-absorber suspension right and left. Remove the hexagon nut or hexagon screw together with lock washer cup and washer. Push the shock-absorber off the bolt (Fig. 35-1/7).

- Raise the axle tubes until they are more or less horizontal. Fasten Supporting Bracket 111 589 07 61 to the rear axle and place the jack with Fixture 111 589 05 61 under the rear axle housing (Fig. 35-1/9).

- From the trunk compartment unscrew the hexagon screw (1) on the rubber mounting (3) of the rear axle suspension and remove with the lock washer and the upper tension disk (2) (Fig. 35-1/8).

- Lower the rear axle and remove from the jack.

**Caution!** When removing, installing or transporting the rear axle, supporting bracket 111 589 07 61 must be attached to prevent the axle tubes from dropping and thus to avoid damage to the rear axle housing and the sliding joint.

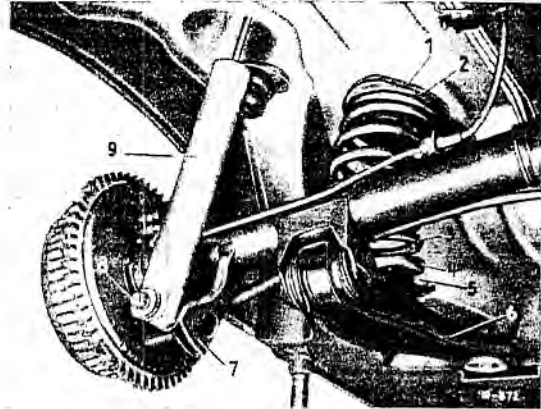


Fig. 35-1/7

- |  |   |
|--|---|
| 1 Upper spring plate on chassis base panel | 6 Torque arm                                  |
| 2 Upper rubber mounting                    | 7 Bracket for lower shock-absorber suspension |
| 3 Rear spring                              | 8 Lower shock-absorber suspension             |
| 4 Lower rubber mounting                    | 9 Shock-absorber                              |
| 5 Lower spring plate                       |   |

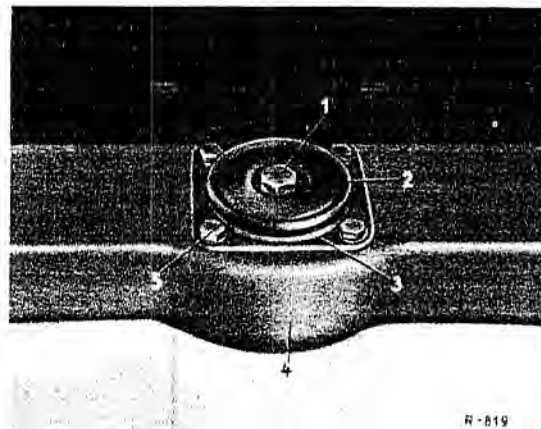


Fig. 35-1/8

- |   |
|---|
| 1 Hexagon screw with lock washer                                      |
| 2 Upper tension disk  |
| 3 Rubber mounting   |
| 4 Cross member on chassis base panel                                  |
| 5 Hexagon screw for fastening the rubber mounting to the cross member |

### Installation:

16. Check the distance "a" between the surface of the joint flange and the support of the rear axle suspension. Check whether the support of the rear axle suspension forms a right angle with the left axle tube. The distance "a" and the angle between the support and the axle tube can be adjusted after loosening the 2 clamping screws on the rubber mounting.

17. Check the spring plates and the rubber mountings or the spring pistons for the rear springs.

**Note:** If the spring plates are screwed off, look out for the correct position of the spring plates in accordance with the color code of the springs (see Job No. 32-0).

18. Check the step bearings for the torque arms at the chassis base panel and also their rubber rings and cups or mounting plates. Rub talc on the rubber rings.

19. Check the rubber buffers (3) for the cross strut (5) at the chassis base panel (Fig. 35-1/6). Check the rubber mounting (1) in the support (3) for the rear axle suspension (Fig. 35-1/9).

20. If necessary, remove the rubber mounting (3) of the rear axle suspension and check whether it can be used again. Fix the rubber mounting with the hexagon screws (5) to the chassis base panel (Fig. 35-1/8).

**Note:** On early models the lower tension disk is not connected to the rubber mounting (see Job No. 35-0).

21. Place the rear axle with Supporting Bracket 111 589 07 61 (4) on the Jack

Fixture 111 589 05 61 (5). Insert the conical Installing Arbor 111 589 00 61 (2) in the bracket (3) of the rear axle suspension (Fig. 35-1/9).

22. Lift the rear axle and insert the support into the rubber mounting (3). Put on the upper tension disk (2) making sure that the disk is properly seated in the dowel pin. Screw in the hexagon screw (1) with the lock washer, let down the jack and tighten the hexagon screw with the specified tightening torque (Fig. 35-1/8 and Job No. 35-0).

23. Slightly raise the two axle tubes and remove the supporting bracket.

24. Let down the axle tubes and install the shock-absorbers (see Job No. 32-3).

25. Fasten the cross strut (5) with the two links (7) and (9) and the hexagon nuts (8) and (10) to the support of the rear axle suspension (Fig. 35-1/6).

26. Attach the torque arms to the chassis base panel.

27. Connect the brake lines (see Job Nos. 42-6 or 7).

28. Install the left and right rear springs (see Job No. 32-5). On cars with air suspension attach the spring piston to the torque arm taking care to ensure that the dowel pin fixing the spring piston is properly seated in the torque arm.

Check the seat of the spring piston in the spring bellows (see also Job No 32-13).

29. Install the compensating spring (see Job No. 32-7). This does not apply to cars with air suspension.

30. On cars with air suspension attach the brake support to the side member (2). To

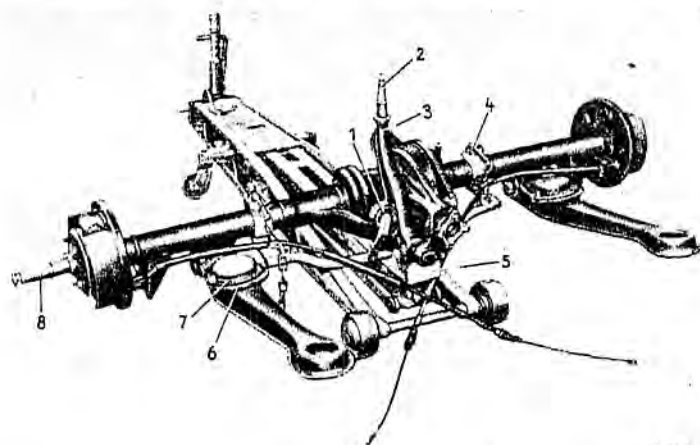


Fig. 35-1/9

- 1 Rubber mounting for cross strut
- 2 Conical Installing Arbor 111 589 07 61
- 3 Support of the rear axle suspension
- 4 Supporting Bracket 111 589 07 61
- 5 Jack Fixture 111 589 05 61
- 6 Lower rubber mounting for rear spring
- 7 Lower spring plate at the torque arm
- 8 Flange 111 589 01 63 for lifting the axle tubes

do this put the hexagon screw (4) together with cup and lower rubber buffer (5) through the lever for the brake support (3) from below.

Install the 2nd lower rubber buffer (5) together with cup and spacer tube (6) and the cup with the upper rubber buffer (7). Insert the hexagon screw (4) in the bore on the side member (2). Install the 2nd upper rubber buffer (7) together with cup (1), tighten the castle nut and cotter (Fig. 35-1/10).

33. Attach the rear brake cables (1) on the right and on the left to the bracket on the chassis base panel and to the equalizer (3). Tighten the hexagon nuts. Make sure that the rubber sleeves are seated correctly. Attach the return spring (2) (Fig. 35-1/3 and Job No. 42-19).

34. Fasten the propeller shaft the joint flange of the rear axle with the cheese head screws, new locking plates and, if necessary, new hexagon nuts (Fig. 35-1/3).

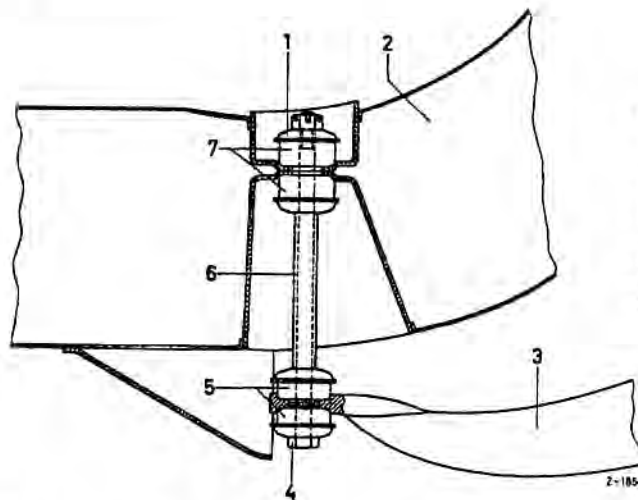


Fig. 35-1/10

- 1 Cup
- 2 Side member
- 3 Lever for brake support
- 4 Hexagon screw
- 5 Lower rubber buffer
- 6 Spacer tube
- 7 Upper rubber buffer

**Note:** The rubber buffers (5) and (7) should be installed on the hexagon screw (4) in such a way that their collars are carried in the bores provided for them. The low rubber buffers (5) are mounted on the lever for the brake support (3), the high rubber buffers (7) on the side member (2) (Fig. 35-1/10).

31. Install the rear exhaust pipe with the intermediate muffler and the main muffler, taking care not to damage the rubber rings of the rear suspension. If necessary replace the rubber rings. Make sure that the pipe clips are positioned properly and that the exhaust pipe is installed without forcing (Figs. 35-1/1 and 35-1/2).

32. On cars with air suspension install the torsion bar on the rear axle (see Job No. 32-9).

35. Install the brake drums and the rear wheels, lower the car and tighten the wheel nuts.

Check the oil level in the rear axle, and if necessary top up (for quantity and type of oil see Job No. 35-0).

36. Bleed the brakes.

37. Adjust the hand-brake (see Job No. 42-20).

38. After a short trial run check the center position and the axle positioning distance of the rear axle and if necessary correct (see Job No. 40-3).

**Note:** The center position and the axle positioning distance should not be checked till a trial run has been made; then, if necessary, it should be corrected.

However on cars with air suspension this test should be made **before** a trial run to avoid the danger of bellows rubbing against air chambers.

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Job No.
40-0

# Wheels and Adjustment of Wheels

General Data, Dimensions, and Tolerances

Modification marked\*

## A. Wheels

### Balancing of Wheels

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Available balancing weights weight in g	Stages in g	Permissible unbalance in g
from 20 to 120	from 10 to 10	20

### Tightening Torques

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE, 230 SL

Spherical collar nuts and spherical collar screws for disk wheel attachment	9—10 mkg
--	----------

## B. Adjustment of Wheels

**Wheel Adjustment Values in Curb Condition and under Test Load<sup>1)</sup>\***

Model	190 c 190 Dc 200 200 D 230	220 b 220 Sb 220 SEb Sedan	220 SEb/C 250 S 250 SE 300 SEb	230 S	230 SL 250 SL	300 SE Sedan 300 SE/C 300 SEL
Camber of front wheels	in curb condition	$+ 0^{\circ} 30'$			$0^{\circ} 10' + 20'$	$+ 0^{\circ} 20'$
	under test load	$0^{\circ} 20' - 20'$			$0^{\circ} + 20'$	$- 20'$
Toe-in (rolled average)	$2 \pm 1 \text{ mm or } 0^{\circ} 20' \pm 10'^2)$					
Track angularity at 20° lock of Inner wheel	appr. - 1°	appr. - 0° 30'				
Caster	with mech. steering	$3^{\circ} 30' \pm 15'$	$2^{\circ} 45' \pm 15'$	$3^{\circ} 30' \pm 15'^2)$		—
	with power steering	$4^{\circ} \pm 15'$				
King pin inclination	$5^{\circ} 30' \pm 10'$					
Control arm position of front axle. (Difference in level "a" between inner and outer pivot pins of lower control arm see Fig. 40-3/15)	See Table "Car Level"					
Permissible difference of control arm position between left and right	5 mm					
Pivot point distance (check distance "a" between axis of pivot pin for lower control arm and the ball pin lower edge at the steering arm and at the steering relay arm by means of fixture 111 589 12 21 00 (see Fig. 40-3/8 b). During the checking process the notch in the Fixture slide should move within the tolerance range (steering gear arm or steering relay arm moved to center control arm pivot).	$5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$4 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$0 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$4 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	
Pivot point distance (checking by means of measuring bolt). Difference in level "a" between the axis of the pivot point for the lower control arm and center measuring pin at center steering gear arm and steering relay arm (see Fig. 40-3/8 or 40-3/8 a) (Wheels or steering in the straight-ahead position)	$49.5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$48.5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$49.5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$44.5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	$48.5 \begin{smallmatrix} + 1 \\ - 3 \end{smallmatrix} \text{ mm}$	
Permissible difference in level of the pivot point distance between steering gear arm and steering relay arm	3 mm					
Axle positioning distance, permissible difference left and right	front axle	5 mm				
	rear axle	3 mm				
Camber of rear wheels	See Table "Car Level"					
Permissible toe-in (+) and toe-out (-) of rear wheels	$\pm 2 \text{ mm or } \pm 0^{\circ} 20'$					
Distance of fulcrum of rear axle tubes from car center	36 mm					
Permissible deviation of rear axle from center position	2 mm					
Permissible wheelbase difference left and right	8 mm					

<sup>1)</sup> For loading data see Table "Load for Vehicle Measurement"

<sup>2)</sup> Optimal toe-in 2 mm or 0° 20'.

**Car Level at the Front Axle\***

Model	in curb condition		under test load	
	axle load <sup>1)</sup> approx. kp	control arm position mm	approx. kp axle load <sup>1)</sup>	control arm position mm
<b>Standard Springs</b>				
190 c, 200	635	93 + 10 — 15	715	57 + 10 — 15
190 Dc, 200 D	685		765	
230	665		745	
220 b	685		765	
220 Sb, 230 S	700		780	
220 SEb Sedan	720		800	
220 SEb Coupé	730	89 + 10 — 15	810	53 + 10 — 15
220 SEb Convertible	789		880	
250 S	720	93 + 10 — 15	800	57 + 10 — 15
250 SE Sedan	745		825	
250 SE Coupé	750	89 + 10 — 15	830	63 + 10 — 15
250 SE Convertible	795		875	
300 SEb	825	93 + 10 — 15	905	57 + 10 — 15
230 SL <sup>2)</sup>	700	88 + 5 — 10	750	65 + 5 — 10
250 SL <sup>2)</sup>	730		780	
<b>Special Version:</b> Harder springs for bad road conditions, police radio cars, station wagons and ambulances <sup>3)</sup> , sedans with long wheel base				
190 c, 200	635	97 ± 10	715	70 ± 10
190 Dc, 200 D	685		765	
200 D Sedan long wheel base	770		850	
230	665		745	
220 b	665		765	
220 Sb, 230 S	700		780	
220 SEb Sedan	720	800		
220 SE Coupé	730	92 ± 10	810	65 ± 10
220 SEb Convertible	780		860	
250 S	720	97 ± 10	800	70 ± 10
250 SE Sedan	745		825	
250 SEb Coupé	750	92 ± 10	830	65 ± 10
250 SE Convertible	795		875	
300 SEb	825	97 ± 10	905	70 ± 10
230 SL <sup>2)</sup>	700	84 + 5 — 10	750	65 + 5 — 10
250 SL <sup>2)</sup>	730		780	

<sup>1)</sup> Additional load for sliding roof approx. 10 kp, for power steering approx. 10 kp, automatic transmission approx. 15 kp.

<sup>2)</sup> Car with coupé roof and roadster top, without coupé roof approx. 5 kp less.

<sup>3)</sup> On station wagons, front axle load increases by approx. 15 kp, on ambulances with standard wheel base by approx. 25 kp, on ambulances with longer wheel base (400 mm) by approx. 50 kp.

## Car Level at the Rear Axle \*

Cars without level control

Model	in curb condition		under test load	
	axle load <sup>1)</sup> approx. kp	rear wheel camber	axle load <sup>1)</sup> approx. kp	rear wheel camber
<b>Standard Springs</b>				
190 c	620	+ 1° 30' ± 30'	735	- 0° 45' ± 30'
190 Dc	630		745	
200, 200 D, 230, 220 b	650		765	
220 Sb, 220 SEb Sedan	660		775	
220 SEb Coupé	700	+ 1° 30'	895	- 1° 15' ± 30'
220 SEb Convertible	740		855	
230 SL <sup>2)</sup>	650	+ 1° 45' ± 30'	800	- 1° 45' ± 30'
250 SL <sup>2)</sup>	675	+ 1° 30' ± 30'	825	- 1° 45' ± 30'
<b>Special Version: Harder springs for bad road conditions</b>				
190 c	620	+ 2° 15' ± 30'	735	+ 0° 30' ± 30'
190 Dc	630		745	
200, 200 D, 230, 220 b	650		765	
220 Sb, 220 SEb Sedan	660		775	
220 SEb Coupé	710	+ 1° 30' ± 30'	825	+ 1° 30' ± 30'
220 SEb Convertible	750		865	
230 SL <sup>2)</sup>	650	+ 1° 30' ± 30'	800	+ 1° 30' ± 30'
250 SL <sup>2)</sup>	675		825	
<b>Special Version: Harder springs for police radio cars</b>				
190 c	780	+ 1° 30' ± 30'	895	- 0° 45' ± 30'
190 Dc	790		905	
220 b	810		925	
220 Sb, 220 SEb	820		935	
<b>Special Version: Harder springs for station wagons</b>				
190 c	760	+ 2° ± 30'	880	+ 1° ± 30'
190 Dc	770		890	
<b>Special Version: Harder springs for ambulances</b>				
190 c	900	+ 2° ± 30'	1020	+ 0° 15' ± 30'
190 Dc	910		1030	
220 b	930		1050	

<sup>1)</sup> Additional load for sliding roof approx 10 kp, for fixture for trailer approx. 20 kp.

<sup>2)</sup> Car with coupé roof and roadster top; without coupé roof approx. 40 kp less.

## Car Level at the Rear Axle\*

Cars with level control

Model	in curb condition		under test load	
	axle load <sup>1)</sup> approx. kp	rear wheel camber	axle load <sup>1)</sup> approx. kp	rear wheel camber
<b>Standard Springs</b>				
190 c	620	+ 0° 30' ± 1°	735	- 0° 45' ± 30'
190 Dc	630		745	
200, 200 D, 230, 220 b	650		765	
220 Sb, 220 SEb Sedan 230 S	660	0° ± 1°	775	
220 SEb Coupé	710		825	
220 SEb Convertible	750		865	
250 S	725		840	
250 SE Sedan	740		855	
250 SE Coupé	750		865	
250 SE Convertible	800		915	
300 SEb	750		865	
<b>Special Version: Harder springs for bad road conditions</b>				
190 c	620	+ 1° ± 1°	735	+ 0° 30' ± 1°
190 Dc	630		745	
200, 200 D, 230, 220 b	650		765	
220 Sb, 220 SEb Sedan 230 S	660	+ 0° 45' ± 1°	775	
220 SEb Coupé	710	+ 0° 30' ± 1°	825	
220 SEb Convertible	750		865	
250 S	725	+ 0° 45' ± 1°	840	
250 SE Sedan	740		855	
250 SE Coupé	750	+ 0° 30' ± 1°	865	
250 SE Convertible	800		915	
300 SEb	750	+ 0° 45' ± 1°	865	
<b>Special Version: Harder springs for police radio cars</b>				
190 c	780	+ 0° 30' ± 1°	895	+ 0° 30' ± 1°
190 Dc	790		905	
200, 200 D, 230, 220 b	810		925	
220 Sb, 220 SEb	820		935	
250 S	880		995	
250 SE	900		1015	
<b>Special Version: Harder springs for sedans with long wheel base</b>				
200 D	715	+ 0° 30' ± 1°	815	+ 0° 30' ± 1°

<sup>1)</sup> Additional load for sliding roof approx. 10 kp, for fixture for trailer approx. 20 kp.

<sup>2)</sup> Cars with longer wheel base (400 mm).

## Car Level at the Rear Axle\* (Continuation)

### Cars with level control

Model	in curb condition		under test load	
	axle load <sup>1)</sup> approx. kp	rear wheel camber	axle load <sup>1)</sup> approx. kp	rear wheel camber
<b>Special Version: Harder springs for station wagons</b>				
190 c	760	+ 0° 30' ± 1°	880	+ 0° 30' ± 1°
190 Dc	770		890	
200, 200 D, 230 S	780			
<b>Special Version: Harder springs for ambulances</b>				
190 c	900	+ 0° 30' ± 1°	1020	+ 0° 30' ± 1°
190 Dc	910		1030	
200, 200 D, 220 b 230, 230 S	920		1040	
200, 200 D, 230, 230 S long <sup>2)</sup>	960		1080	

1) Additional load for sliding roof approx. 10 kp, for fixture for trailer approx. 20 kp.

2) Cars with longer wheel base (400 mm).

### Car Level on Cars with Air Suspension \*

	Standard Level <sup>1)</sup>		Higher Level <sup>4)</sup> Checking values
	Adjustment values <sup>2)</sup>	Checking values <sup>3)</sup>	
<b>Models 300 SE Sedan, 300 SE/C<sup>5)</sup></b>			
Front axle control arm position	57 ± 2 mm	57 ± 10 mm	—
Rear wheel camber	- 0° 45' ± 15'	- 0° 45' ± 1°	—
<b>Models 300 SEL, 300 SE/C<sup>6)</sup></b>			
Front axle control arm position	57 ± 2 mm	57 ± 10 mm	107 ± 10 mm
Rear wheel camber	- 0° 45' ± 15'	- 0° 45' ± 1°	+ 3° ± 1°

1) The standard car level is adjusted in curb condition by changing the links at the level adjustment valves (left and right at the front axle and in the center of the rear axle).

2) Actuate level adjustment valves by hand until the prescribed values are obtained.

3) The tolerance difference between adjustment values and checking values results from the free play of the level adjustment valves. The values obtained by manual operation of valves are maintained only when the car is traveling.

4) The values for the higher car level are only given for checking purposes, not for level adjustment.

5) Cars up to August 1965 (Chassis end No. 008 908).

6) Cars as from August 1965 (Chassis end No. 008 909).

## Load for Vehicle Measurement\*

Under normal circumstances the car is measured in curb condition. It is only when extensive repairs have been carried out after an accident that additional measurement under test load may be necessary.

### Measurement of Car in Curb Condition

curb condition = car in working order, with oil and water plus full fuel tank plus spare wheel and tool kit. If the fuel tank is not full, weight must be put in the trunk compartment (1 liter fuel = 0.75 kp).

### Measurement under Test Load

Car Version	Load distribution <sup>1)</sup>
Sedan, Coupé, Convertible	2 x 65 kp on the front seats 1 x 65 kp on the rear seat
Sports car	2 x 75 kp on the front seats 40 kp in the trunk compartment
Station wagon, hearse, ambulance	2 x 65 kp on the front seats 1 x 65 kp on the rear seat or stretcher
<b>Hydropneumatic compensating spring at rear axle</b> (For test values see Page 40-0/10, 11 or 32-0/13) To check the hydropneumatic compensating spring it is advisable to put the load in the trunk compartment rather than on the seats.	
Test	Trunk compartment load <sup>1)</sup>
Car level under test load	approx. 100 kp (3 sand bags 32.5 kp each)
Performance and leakage test	approx. 200 kp (6 sand bags 32.5 kp each)

<sup>1)</sup> Before being loaded the car must be in curb condition.

## Camber Adjustment of Front Wheels

Models 190 c to 300 SEL

Eccentric adjustment at steering knuckle		Additional camber adjustment on pivot pin of upper control arm by means of shims	
Eccentric adjustment range <sup>1)</sup>	Alteration in wheel camber	Shim thickness	Camber alteration on wheel by 1 shim
± 2.5 mm	appr. ± 0° 35'	1.0 mm	appr. ± 0° 15'
		2.0 mm	appr. ± 0° 30'

<sup>1)</sup> The highest position of the eccentric is marked by a notch on the hexagon head.

## Camber Adjustment of Rear Wheels

Models 190 c to 300 SEL

Camber alteration on wheel by turning the spring plate one notch (2 mm)	appr. 0° 10'
Camber alteration on wheel when lower or higher upper rubber mounting is installed (6 mm)	appr. 0° 30'
On cars with level control (Car level under test load)*	
Change of rear wheel camber by installing a 3 mm disk, Part No. 108 326 00 76, or another left ball joint (3 mm longer) on the hydropneumatic compensating spring	appr. 0° 30'

## Caster Adjustment

Models 180 c to 300 SEL

Caster adjustment at steering knuckle		Front axle version	Caster adjustment through eccentric bolts on flat springs supporting front axle	
Permissible adjustment of threaded bushing to either side	Caster alteration on wheel		Flat spring adjustment of 1 mm results in a caster alteration on wheel of	Overall adjustment range of the caster through the eccentric bolt
1.5 mm	appr. $\pm 0^\circ 20'$	1. <sup>2)</sup>	appr. $0^\circ 15'$	$\pm 1^\circ 30'$
		2. <sup>2)</sup>	appr. $0^\circ 10'$	+ $1^\circ 30'$ up to $-0^\circ 30'$

<sup>2)</sup> Longitudinal support on top

<sup>2)</sup> Longitudinal support downward

## Change of Control Arm Position at Front Axle

Models 180 c to 300 SEL

Change of difference in level "a" (see Fig. 40-3/15)	
Change of rubber washer or rubber mounting for front spring by	results in a change of difference in level "a" of
2 mm	appr. 4 mm
2.5 mm	appr. 5 mm

40-0/8



# Balancing of Wheels

Job No.

40-2

## a) General

The new two-part balancing weights consist of the balancing weight proper (2) and a special retaining spring (1) (Fig. 40-2/1).

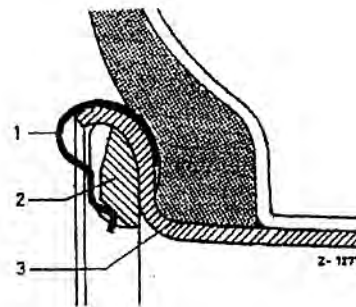
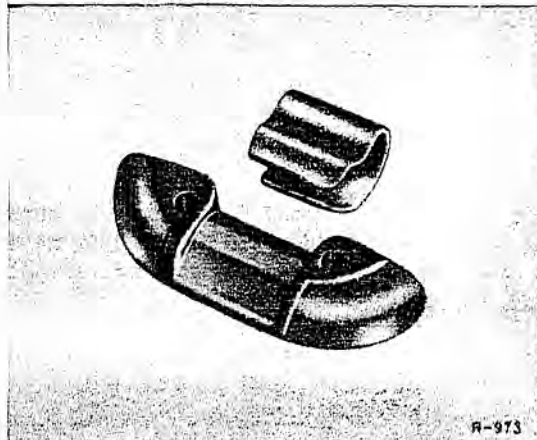


Fig. 40-2/1

- 1 Retaining spring
- 2 Balancing weight
- 3 Rim of disk wheel

The retaining spring is first attached to the wheel flange and the balancing weight is then inserted in the retaining spring. The subsequent insertion of the balancing weight increases the clamping action of the retaining spring to such an extent that the balancing weight is held with absolute safety. The retaining spring cannot be pushed out by the kneading action of the tire since it is very deeply supported in the balancing weight and for that reason the clamping action greatly increases when it is pushed out.

These new balancing weights remain just as firmly in position as the previous types which were fastened in the slots of the rims. For this reason the new disk wheels have no slots. Direct balancing is now possible, so that the mathematical resolution of the established unbalance into the two components relating to two slots is no longer necessary. The new balancing weights can also be used for the older types of slotted disk wheels. In this case care should be taken that the balancing weight is not fitted directly over a slot because in this case the retaining spring will not produce the necessary clamping action. The remaining unbalance in this case is of no practical significance. **Before the wheels are balanced all balancing weights already on the wheels must always be removed.**

## b) Installation Instructions

Install the retaining spring by hand, pressing the bead away from the wheel flange with the fixture attached to the balancing machine (Fig. 40-2/2).

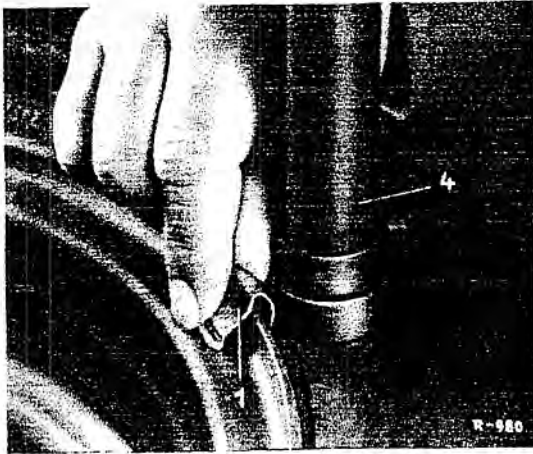


Fig. 40-2/2

- 1 Retaining spring
- 4 Fixture on the balancing machine

Then lift the retaining spring by means of Spring Lifter 111 589 15 63 and insert the balancing weight (Fig. 40-2/3), making sure that the retaining spring exerts sufficient pressure on the balancing weight against the wheel flange. If a retaining spring is slightly bent, it can be reshaped by compressing it; if it is badly bent, it should always be replaced.

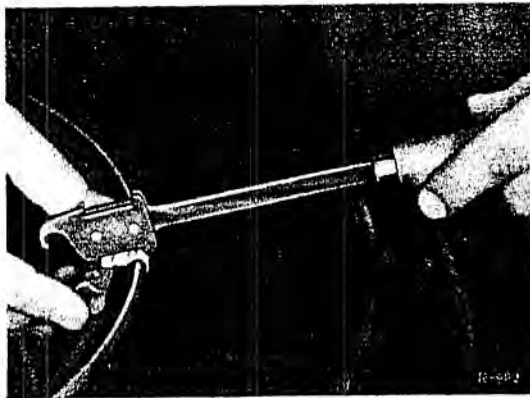


Fig. 40-2/3

Spring Lifter 111 589 15 63

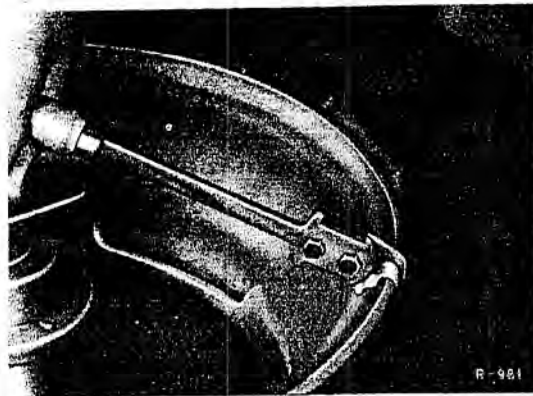


Fig. 40-2/4

To remove the balancing weight, lift the retaining spring by means of the spring lifter. Then pull the retaining spring off the wheel flange by means of the spring lifter. To do this, insert the lug at the front part of the spring lifter into the bore in the retaining spring (Fig. 40-2/4). During this operation, the tire bead need not be pushed away. It is not advisable to remove the balancing weight together with the retaining spring since this would bend the spring.

# Adjustment of Wheels

Job No.

40-3

Modification: 2nd Version Front Axle (Addition)

Previous regulations and instructions continue to apply to the general section of this chapter. The car should be tested only when carrying the so-called test load, that is to say the load which corresponds most closely to the position of the car in relation to the surface of the road and to the normal load of the car. The load values and the adjustment data are given Job No. 40-0.

## A. Front Wheel Camber

The front wheel camber is adjusted at the steering knuckle by turning the eccentric bolt (1) (Fig. 40-3/1). To do this, back out the hexagon screw (2) and remove together with the locking plate (3). After the hexagon nut has been unscrewed, the camber can be adjusted to the prescribed value by turning the eccentric bolt to the left or to the right. The highest point of the eccentric bolt is marked by a notch on the hexagon head.

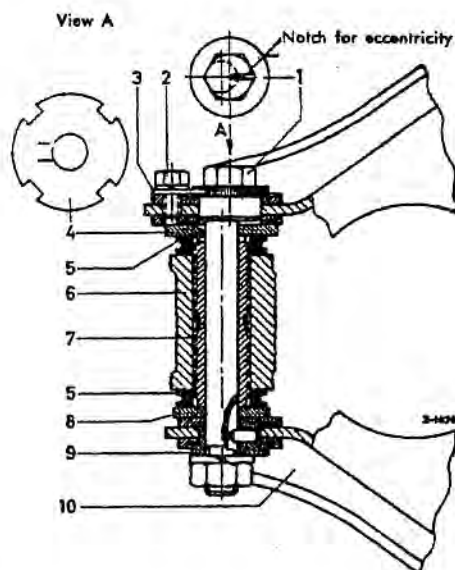


Fig. 40-3/1

- 1 Eccentric bolt for camber adjustment
- 2 Hexagon screw with lock washer
- 3 Locking plate
- 4 Adjusting washer for caster adjustment
- 5 Rubber sealing ring
- 6 King pin
- 7 Threaded bolt
- 8 Washer
- 9 Eccentric bushing with drive pin
- 10 Upper control arm

If in special cases the camber adjustment at the steering knuckle is not sufficient to achieve the prescribed values at the left and right side, the camber can be changed by installing or removing shims (3) between the pivot pin (6) for the upper control arm (2) and the front axle support (7) (Fig. 40-3/2).

In the case of the 1st version front axle a shim 1 mm thick is normally inserted between the front axle support and the pivot pin and between the locking plate and the hexagon screw (Fig. 40-3/2). In the case of the 2nd version front axle a shim 2 mm thick is normally inserted between the front axle support and the pivot pin (Fig. 40-3/2a).

**Note:** a) If a shim between the front axle support and the pivot pin is removed, it must be inserted between the locking plate and the hexagon screw.

In any case shims with a total thickness of at least 2 mm must be used. The shims should under no circumstances be omitted since there is a danger that the screw will foul the front spring.

40-3/1

b) After tightening (for prescribed tightening torque see Job No. 33-0), the hexagon screws should be locked. When repairs are carried out, the locking plate should be installed in such a way that the lug can be tapped down at the top of the screw head and not at the bottom, as shown in the picture.

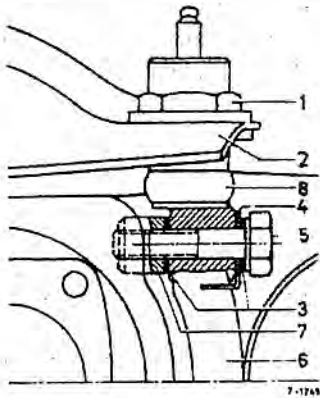


Fig. 40-3/2

1st version front axle

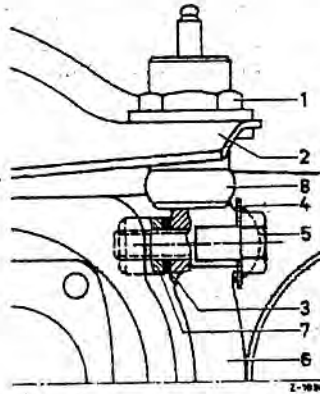


Fig. 40-3/2a

2nd version front axle

- 1 Threaded bushing for upper control arm
- 2 Upper control arm
- 3 Shim
- 4 Locking plate
- 5 Hexagon screw (M 12×1.5×40)
- 6 Pivot pin for lower control arm
- 7 Front axle support
- 8 Rubber sealing ring

## B. Rear Wheel Camber

The rear wheel camber is adjusted by turning the lower spring plate (5) and by installing upper rubber mountings (2) of varying thickness. (Fig. 40-3/3).

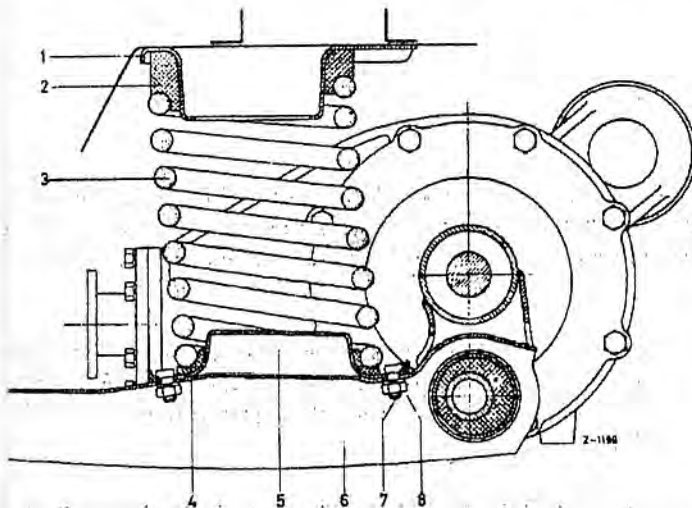


Fig. 40-3/3

- 1 Upper spring plate on chassis base panel
- 2 Upper rubber mounting
- 3 Rear spring
- 4 Lower rubber mounting
- 5 Lower spring plate
- 6 Torque arm
- 7 Screw for fastening the spring plate to the torque arm
- 8 Hexagon nuts with lock washers

At the same time the differences in the installed lengths of the rear springs can be compensated by varying the position of the spring plate and by using rubber mountings of different thicknesses. Three different positions of the spring plate and rubber mountings of three different thicknesses are available (see Job No. 32-0 and Job No. 32-5).

To adjust the rear wheel camber remove the rear spring (see Job No. 32-5). Then unscrew the lower spring plate from the torque arm and adjust accordingly or use a new upper rubber mounting (see table in Job No. 32-0).

**Note:** If in special cases the camber adjustment at the rear spring by changing the notch position of the lower spring plate and by changing the upper rubber mounting is not sufficient, the camber can be further adjusted by changing the rubber rings for the compensating spring. It should be noted however, that this has an influence on the camber of both rear wheels (see Job No. 32-0).

### C. Caster

The caster can be adjusted by swivelling the front axle support on the eccentric bolts at the flat springs for the front axle longitudinal support (Figs. 40-3/4 and 4a). Differences in the caster between the left and right sides can be compensated by turning the threaded bolt (7) on top of the steering knuckle (Fig. 40-3/5).

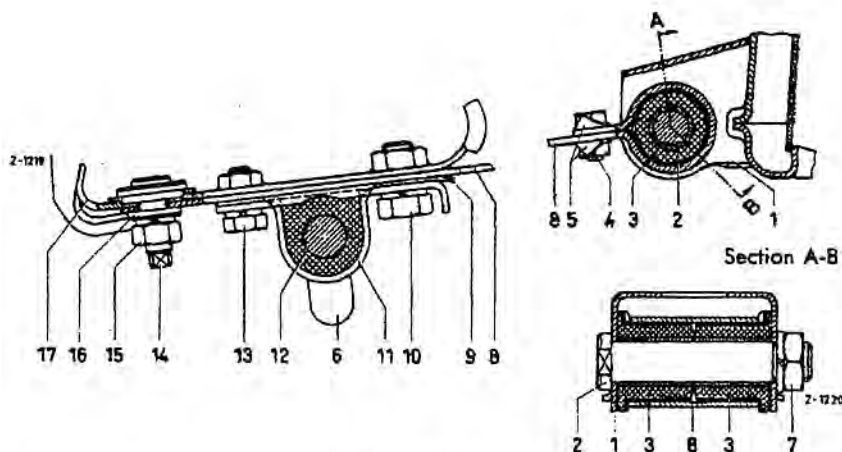


Fig. 40-3/4

Longitudinal support of 1st version front axle

- |   |   |                                 |
|---|---|---------------------------------|
| 1 Bearing bracket on front axle support | 9 Locking plate                                 | 15 Hexagon nut with lock washer |
| 2 Bolt                                  | 10 Hexagon screw (M 14×1.5×25) with lock washer | 16 Washer                       |
| 3 Rubber mounting for flat spring       | 11 Bracket for rubber mounting                  | 17 Chassis base panel           |
| 4 Hexagon screw with nut                | 12 Rubber mounting for torsion bar              | 18 Spacer ring                  |
| 5 Locking plate                         | 13 Hexagon screw (M 12×1.5×25) with lock washer | 19 Spacer tube                  |
| 6 Torsion bar                           | 14 Eccentric bolt                               |                                 |
| 7 Hexagon nut with lock washer          |   |                                 |
| 8 Flat spring                           |   |                                 |

In this way the caster can only be adjusted evenly on both sides. **A more extensive unilateral adjustment would put too much stress on the flexible suspension parts and this must be avoided at all costs**, since a smooth running of the wheels depends on a tension-free suspended front axle.

Before adjusting the caster by means of the eccentric bolt at the flat spring, loosen the four hexagon screws fastening the support of the rear engine suspension. This is necessary to avoid putting too much stress on the rubber mounting of the engine suspension when swiveling the front axle support. To adjust the caster loosen the hexagon screws (10) and (13) on the right and left of the flat spring and also the hexagon nut (lock nut) (15) for the eccentric bolt (14). On the 2nd version front axle remove the lateral support strut on the front axle support.

To adjust the caster, mark the flat spring mounting on the chassis base panel on the left and on the right. Then adjust the eccentric bolt evenly at both sides with Special Wrench 111 589 00 09 or 111 589 02 09, checking the caster at the same time. Afterwards check the axle positioning distance of the front axle. Make sure that, when the front axle support is being adjusted with the eccentric bolt, the difference in the axle positioning distance between the left and right sides does not become excessive (see Table in Job No. 40-0).

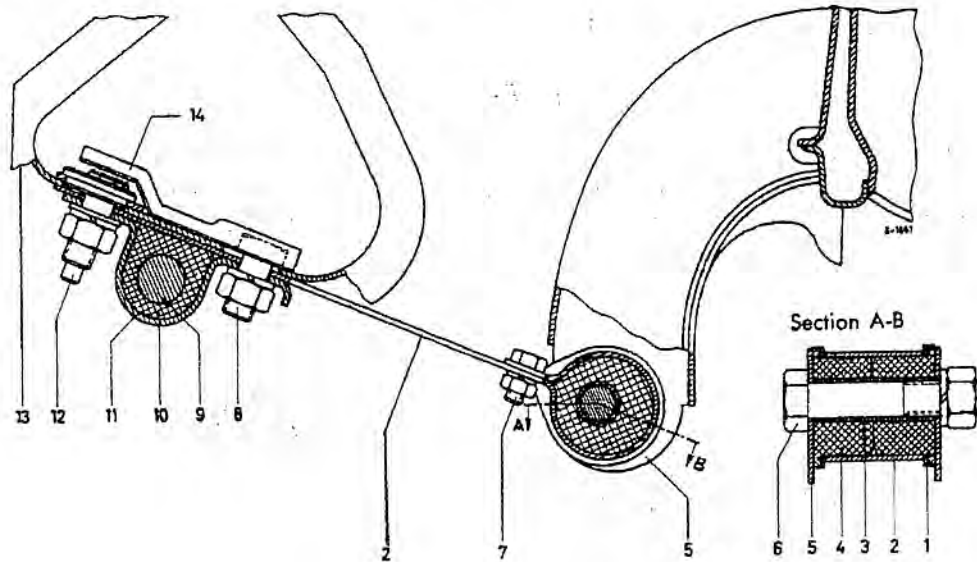


Fig. 40-3/4a

Longitudinal support of 2nd version front axle

- |   |  |
|---|--|
| 1 Spacer ring   | 8 Square screw with nut and lock washer        |
| 2 Flat spring   | 9 Torsion bar                                  |
| 3 Spacer tube   | 10 Rubber mounting for torsion bar             |
| 4 Rubber mounting   | 11 Bracket for rubber mounting                 |
| 5 Bearing bracket at front axle support                   | 12 Eccentric with nut, lock washer, and washer |
| 6 Hexagon screw with nut and lock washer                  | 13 Bearing bracket on chassis base panel       |
| 7 Hexagon screw (clamping screw) with nut and lock washer | 14 Cog for square screw and eccentric          |

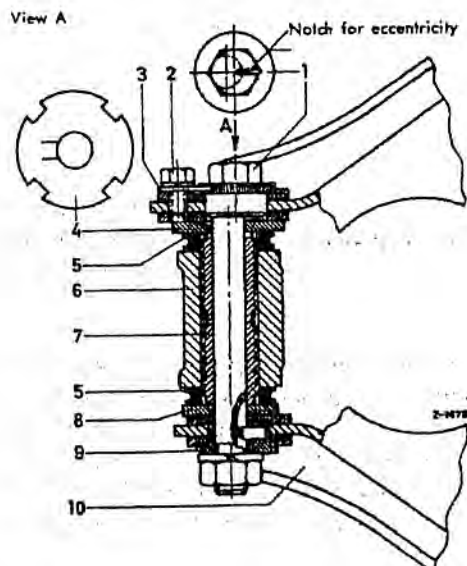


Fig. 40-3/5

- |  |
|--|
| 1 Eccentric bolt for camber adjustment   |
| 2 Hexagon screw with lock washer         |
| 3 Locking plate                          |
| 4 Adjusting washer for caster adjustment |
| 5 Rubber sealing ring                    |
| 6 King pin                               |
| 7 Threaded bolt                          |
| 8 Washer                                 |
| 9 Eccentric bushing with drive pin       |
| 10 Upper control arm                     |

Tighten the hexagon screws or hexagon nuts fastening the flat springs with the prescribed tightening torque (see Job No. 33-0). After adjusting the caster at the flat springs, reinstall the lateral support strut without forcing it into position (see also Job No. 33-1).

To compensate differences in the caster between the left and right sides, loosen the hexagon nut of the eccentric bolt (1) and turn the threaded bolt (7) with Special Wrench 180 589 00 05 at the adjusting washer (4) (Fig. 40-3/5). No more than the permissible adjustment should be made at the steering knuckle, since the rubber ring (5) would be crushed on the one side whereas on the other side there would no longer be a perfect seal (see Table Job No. 40-0).

It is not permissible to adjust the caster by turning the upper control arm pivot pin in the threaded bushings.

The caster should be measured with Camber and Caster Gage 180 589 02 21 by measuring the front wheel camber with the wheels at 20° right and left lock.

If it is necessary to adjust the caster by means of the eccentric bolts on the flat springs for the front axle longitudinal support, Caster Gage 111 589 03 23 should be fitted to the two threaded bushings of the pivot pin for the lower control arm (Fig. 40-3/6).

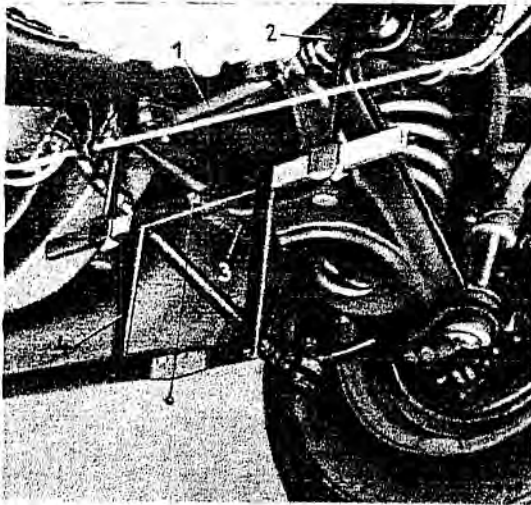


Fig. 40-3/6

- 1 Pivot pin for lower control arm
- 2 Slide bar fastening the gage to the threaded bushing of the pivot pin
- 3 Lower control arm
- 4 Caster Gage 111 589 03 23

**Note:** The measurement of the caster at the pivot pin for the lower control arm only serves as a rough check while adjustments are being made at the flat springs. To determine the caster accurately, it must be measured at the wheel.

#### D. Front Wheel Track

The toe-in is adjusted by adjusting the length of the two tie-rods while the steering system is in the straight-ahead position and the check screw is installed (see Job Nos. 46-1 and 4).

In the case of the steering linkage of the 1st version front axle the ball head on the tie-rod is locked by means of a hexagon nut, with the left-hand thread on the steering gear arm or steering relay arm side. In addition, the lock nut with left-hand thread is marked with notches (see also Job No. 46-9).

In the case of the steering linkage of the 2nd version front axle the ball head is clamped to the tie-rod by a hexagon screw. The tie-rods should be mounted in such a way that the **left-hand thread** – seen in the direction of travel – is located on the **left-hand side** (see Job No. 46-9). It is advisable to check the position of the steering gear arm and the steering relay arm in the straight-ahead position before the toe-in is adjusted. To do this, place Check Gage 111 589 17 23 on the corresponding pair of pivot pins for the lower control arms. Check the distance from the ball studs of the tie-rod from this point (Fig. 40-3/7). The tolerance is  $\pm 3$  mm (see also "Position of Steering Gear Arm" in Job No. 46-0).

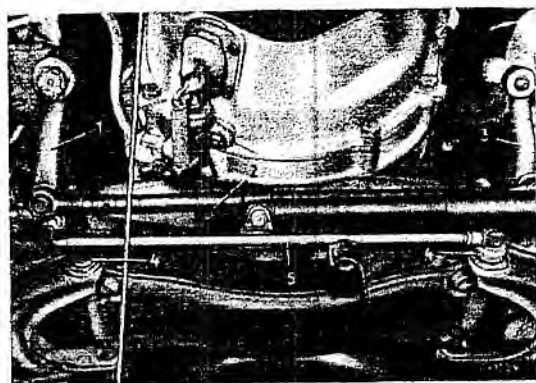


Fig. 40-3/7

- 1 Steering gear arm
- 2 Center tie-rod
- 3 Steering relay arm
- 4 Threaded bushing for pivot pin of lower control arm
- 5 Check Gage 111 589 17 23

After having adjusted the toe-in, check with the wheels at full left and right lock whether the stop face of the steering knuckle rests against the steering knuckle support. The steering nut limit stops in relation to the steering housing are an emergency arrangement to prevent damage to the steering gear.

### E. Pivot Point Distance

To measure the pivot point distance, use distance "a" between the axis of the pivot pin for the lower control arm and the center of the measuring bolt (Figs. 40-3/8 and 8a). The steering gear arm and the steering relay arm must be in the straight-ahead position, i. e. the position corresponding to the center position of the steering system when the car is traveling straight ahead.

In the case of the steering linkage for the 1st version front axle the center tie-rod is detached from the levers and Measuring Bolt 111 589 01 21 (4) is installed instead (Fig. 40-3/8). If the pivot point distance is correct, there must be alignment between the extended axis of the pivot pin (1) for the lower control arm and the center of the measuring bolt (for tolerance see Job No. 40-0).

In the case of the steering linkage for the 2nd version front axle the tie-rod is detached from the steering gear arm and the steering relay arm and Measuring Bolt 111 589 07 21 (4) is installed instead (Fig. 40-3/8a). The prescribed check dimension is given in Job No. 40-0.

For measuring the pivot point distance, use Caster Gage 111 589 03 23 (5) which is fitted to the two threaded bushings (3) on the pivot pin (1) for the lower control arm (see Fig. 40-3/8). It is now easy to determine the pivot point distance from the strap of the gage by fitting a set-square. Distance "b" from the lower edge of the strap of the gage to the center of the measuring bolt (4) is 120 or 170 mm (Figs. 40-3/8 and 8a).

In special cases, e. g. after an accident, the distance "c" from the center of the front axle support to the center of the measuring bolt (4) on the steering gear arm and on the steering relay arm should also be measured in the straight-ahead position (for dimensions see Table in Job No. 40-0). To measure distance "c" first determine the front axle support by dividing the center distance between holes on the pivot pin (1) (Fig. 40-3/6). The distance between holes on the pivot pin is 140 mm.



Fig. 40-3/8

Pivot point distance for 1st version front axle  
(Checking with measuring bolt)

- A Center front wheel or center front axle support
- a Pivot point distance
- b Distance between lower edge of caster gage strap and measuring bolt center
- c Distance between center front axle support and measuring bolt center
- 1 Pivot pin for lower control arm
- 2 Front axle support
- 3 Threaded bushing on the pivot pin
- 4 Measuring Bolt 111 589 07 21
- 5 Caster Gage 111 589 03 23

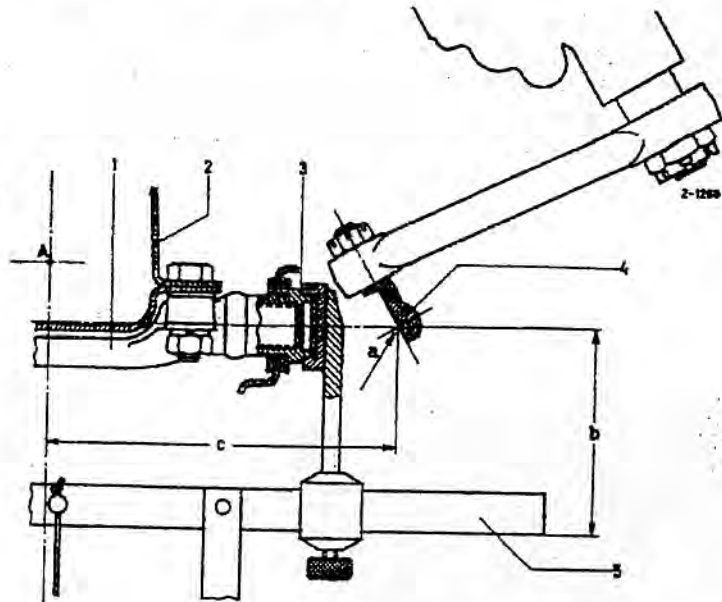
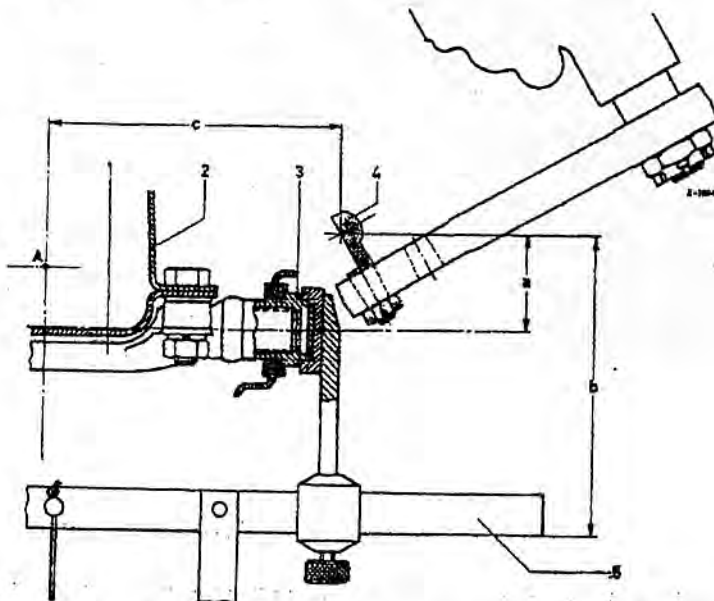


Fig. 40-3/8a

Pivot point distance for 2nd version front axle  
(Checking with measuring bolt)

- A Center front wheel or center front axle support
- a Pivot point distance
- b Distance between lower edge of caster gage strap and measuring bolt center
- c Distance between center front axle support and measuring bolt center (for special cases only)
- 1 Pivot pin for lower control arm
- 2 Front axle support
- 3 Threaded bushing on the pivot pin
- 4 Measuring Bolt 111 589 07 21
- 5 Caster Gage 111 589 03 23

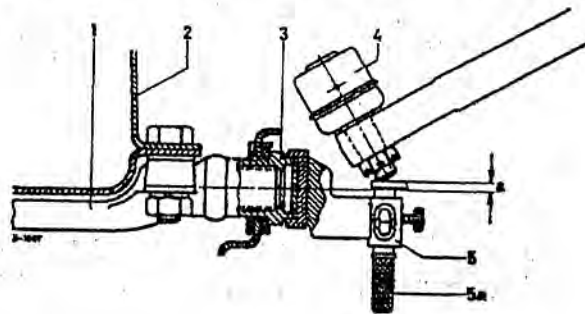


To provide a simple check for the pivot point distance on cars with 2<sup>nd</sup> version front axle, the Fixture 111 589 12 21 00 has been developed, which is designed for a pivot point distance of  $49^{+1}_{-3}$  mm. This fixture measures not the direct pivot point but the distance "e" from the axis of the

Fig. 40-3/8b

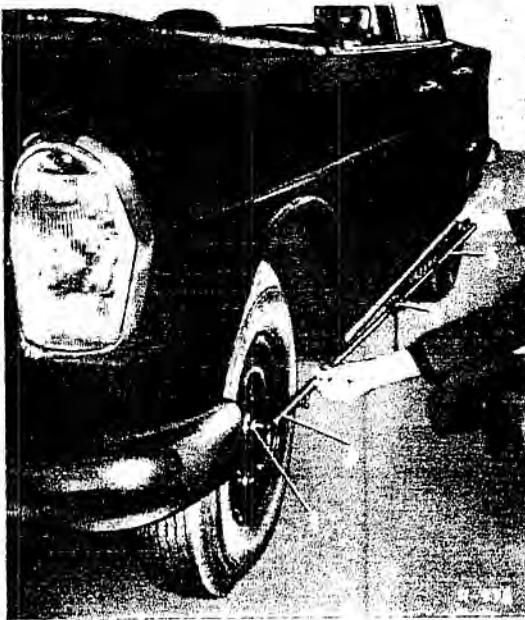
Pivot point distance for 2nd version front axle  
(Checking with fixture)

- a Pivot point distance
- 1 Pivot pin
- 2 Front axle support
- 3 Threaded bushing
- 4 Tie-rod ball head
- 5 Fixture 111 589 12 21 00
- 5a Slide



pivot pin for the lower control arm to the lower edge of the tie-rod ball pin (Fig. 40-3/8b). This distance corresponds to a distance of  $4.5 \pm \frac{1}{3}$  mm from center pivot pin to lower edge ball pin. The steering gear arm or steering relay arm should be swiveled in such a way that it points to the center of the pivot pin. The fixture is put on the threaded bushing of the lower control arm and the slide (5a) is pushed upward until it rests against the ball pin. If the pivot point is correct, the mark on the slide should be within the tolerance field of the fixture.

## F. Wheelbase



The measuring points for the wheelbase "a" are the center of the wheel spindle of the front axle and the center of the rear axle shaft (see Fig. 40-3/10).

The wheelbase is measured with the complete Check Gage 111 589 02 23. To do this fit the front part of the gage at the center of the wheel spindle and the rear part at the center of the rear axle shaft (Fig. 40-3/9).

The wheelbase can only be measured accurately if the toe-in is correctly adjusted and the steering system is fixed in the center position by the check screw.

Fig. 40-3/9

- 1 Wheel spindle center
- 2 Rear axle shaft center
- 3 Front part of Check Gage 111 589 02 23
- 4 Center part of Check Gage 111 589 02 23
- 5 Rear part of Check Gage 111 589 02 23

## G. Axle Positioning Distance

The check bore 'P' below in the second cross member at the chassis base panel is used for checking the axle positioning distance of the front and rear axles (Fig. 40-3/10). From this measuring point the distance 'b' to the front axle and the distance 'c' to the rear axle are measured to the right and left.

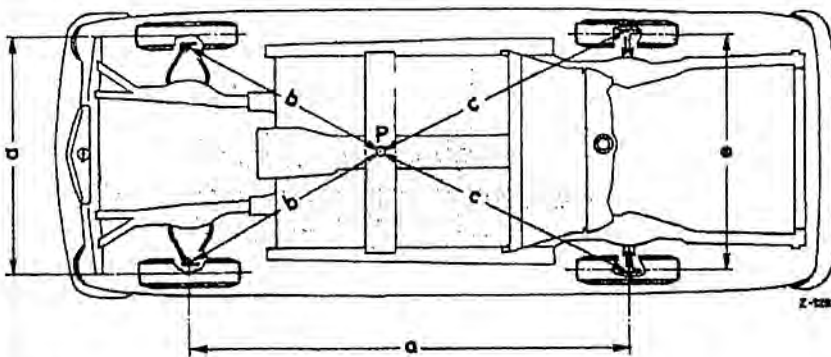


Fig. 40-3/10

- a Wheelbase
- b Front axle positioning distance
- c Rear axle positioning distance
- d Front axle track
- e Rear axle track
- P Check bore in the second cross member on the chassis base panel

The permissible differences between left and right should not be exceeded.

In the case of the front axle the axle positioning distance can be corrected to a limited extent by adjusting the eccentric bolt on the flat spring for the longitudinal support of the front axle support, but care should be taken not to put too much stress on the rubber mounting. If any considerable difference in the axle positioning distance is discovered, the front axle support and the control arms should be checked.

In the case of the rear axle, too great a difference in the axle positioning distance can be corrected by adjusting the cross strut (5) for the rear axle suspension, but care should be taken that the center position of the rear axle is not changed more than is permissible (see Fig. 40-3/14).

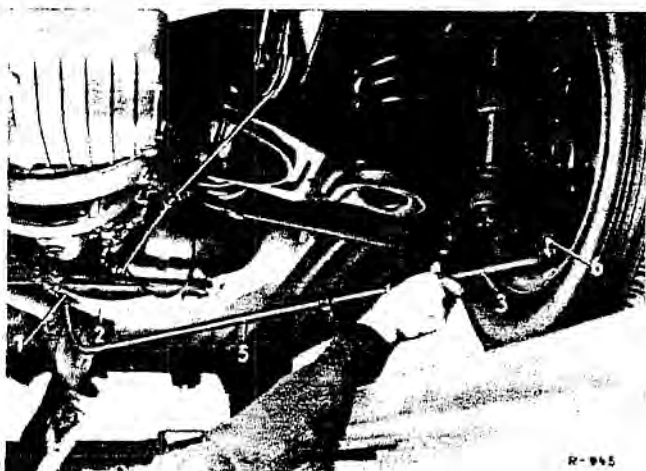


Fig. 40-3/11

- 1 Check bore in cross member
- 2 2nd Cross member on chassis base panel
- 3 Front part of Check Gage 111 589 02 23
- 4 Rear part of Check Gage 111 589 02 23
- 6 Center of king pin

Insert the check gage in the check bore (1) in the cross member at the chassis base panel and measure the distance from the center (6) of the king pin left and right (Fig. 40-3/11).

To check the axle positioning distance of the rear axle use the rear part (5) and the center part (4) of Check Gage 111 589 02 23 (Fig. 40-3/12).

The gage is fitted to the check bore (1) in the cross member (2) on the chassis base panel. Then the distance left and right from the center (6) of the rear axle shaft is measured on the left and on the right (Fig. 40-3/12).



Fig. 40-3/12

- 1 Check bore in cross member
- 2 2nd cross member on chassis base panel
- 4 Center part of Check Gage 111 589 02 23
- 5 Rear part of Check Gage 111 589 02 23
- 6 Center in rear axle shaft

## H. Center Position of the Rear Axle

Besides the correct axle positioning distance also the center position of the rear axle is of importance. It is checked with Check Gage 111 589 00 21 (Fig. 40-3/13).

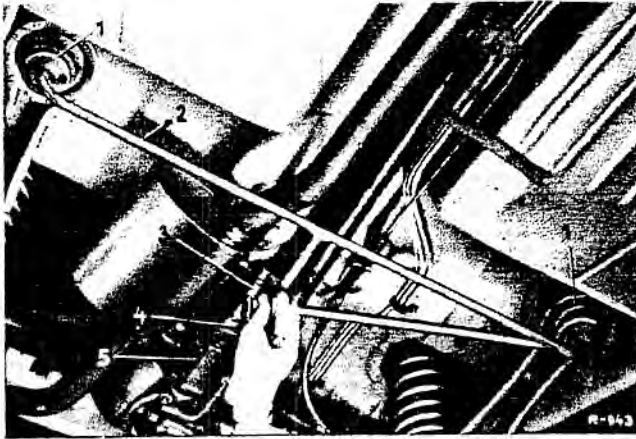


Fig. 40-3/13

- 1 Front mountings of the torque arms
- 2 Check Gage 111 589 00 21
- 3 Measuring bolt of gage
- 4 Hexagon screw in connecting pin
- 5 Support of rear axle suspension

The check gage is fitted on the right and left in the cups at the front mountings (1) of the torque arms. If the center position is correct, the measuring bolt of the gage points at the center of the hexagon screw of the connecting pin of the rear axle suspension (Fig. 40-3/13).

To adjust the center position and the axle positioning distance of the rear axle, loosen the hexagon nut (lock nut) (6) and the hexagon nut with lock nut on the cross strut (5). Then turn the cross strut in or out as required (Fig. 40-3/14).

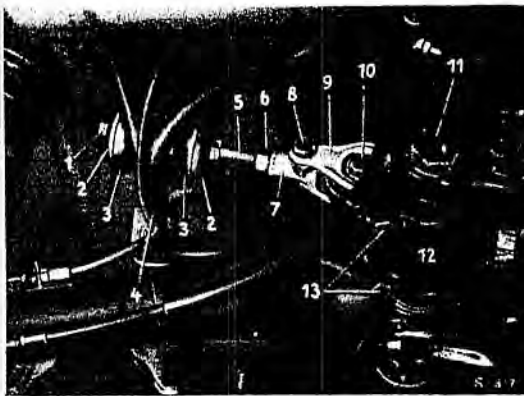


Fig. 40-3/14

- 1 Hexagon nut with lock nut
- 2 Rubber buffer
- 3 Cup
- 4 Bracket on chassis base panel
- 5 Cross strut
- 6 Hexagon nut (lock nut)
- 7 Rear link
- 8 Hexagon screw with spring washer
- 9 Front link
- 10 Hexagon screw with spring washer
- 11 Hexagon screw for connecting pin of rear axle suspension
- 12 Support of rear axle suspension
- 13 Hexagon screws (clamping screws) for the support on the rubber mounting

## I. Control Arm Position of the Front Axle

The position of the control arms is of very great importance for the riding qualities of the car and the free movement of the wheels at full lock. It depends on the trim dimension of the front springs and the load in the car. The control arm position is measured by determining on the lower control arm the difference in level "a" between the inner fulcrum at the pivot pin (2) and the threaded bolt (4) for the lower connection of the steering knuckle to the control arm (Fig. 40-3/14).

The difference in level "a" should be measured under test load. For specified values see Tables in Job No. 40-0.

Two measurements are necessary. Before the first measurement is taken, the car should be lifted at the front bumper and then let down. Before the second measurement is taken, the car should be pressed down in front and then be released to its normal position. The measurement value is the mean value of these two measurements.

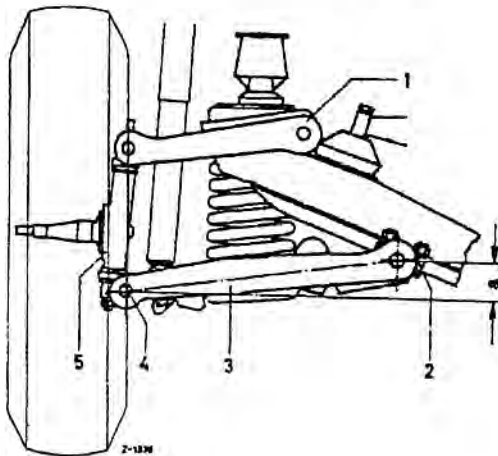


Fig. 40-3/15

- a Difference in level
- 1 Upper control arm
- 2 Pivot pin for the lower control arm
- 3 Lower control arm
- 4 Threaded bolt for connecting the steering knuckle to the lower control arm
- 5 Steering knuckle

As a rule, the specified control arm position can be achieved by installing the rubber washers associated with the individual front springs as listed in the Table "Front Springs, Corresponding Color Code" in Job No. 32-0. In certain cases it may be necessary to install different rubber washers or rubber mountings. But in the case of the rubber washers it should be remembered that their total height must not exceed 12 mm since otherwise the spring is no longer properly centered.

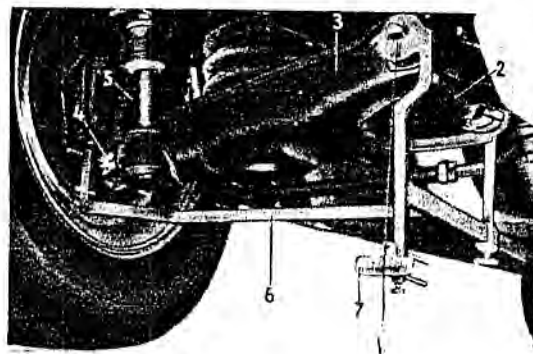


Fig. 40-3/16

- 2 Pivot pin for the lower control arm
- 3 Lower control arm
- 4 Threaded bolt for connecting the steering knuckle to the lower control arm
- 5 Steering knuckle
- 6 Tester 111 589 03 21
- 7 Scale of Tester

R-1027

The difference in level is read off the scale (7) of the Tester in mm. One graduation of the scale corresponds to a change in height of 2 mm (Fig. 40-3/15).

Whenever the control arm position is changed by installing other rubber washers or rubber mountings or front springs, it is imperative that both camber and toe-in of the front wheels should be checked afterwards.

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## Disk Wheels

Modification: Rim sections and mid-centering added

### A. Rim

Some time ago, the rim section of the disk wheels was modified. The hump on the outer rim shoulder (hump shoulder) considerably improves the bead seating and, in the case of a puncture, prevents the tire from being forced over the rim (Fig. 40-4/2). The shape of the inside rim shoulder was modified at the same time (ledge shoulder). On Model 230 SL a rim is used for the radial tires which has a hump shoulder on both sides (Fig. 40-4/3).



Fig. 40-4/1  
Previous rim section



Fig. 40-4/2  
Present rim section



Fig. 40-4/3  
Rim section for

Since more force is required to remove the tire from the disk wheel with the new rim section, it is recommended to use a special tire removal device.

All rims have an 11.5 mm  $\phi$  valve hole and will only take thin-stem rubber valves.

### B. Ornamental Hub Cap

On the previous version of the disk wheel the hub cap is clipped on to the sprung pins (4) by three clips (Fig. 40-4/4), whereas the present version of the cap is clipped on to three spherical shouldered pins riveted to the disk wheel (Fig. 40-4/5). The hub cap can only be mounted properly and securely, especially on the unsprung pins of the disk wheel, if the cap is not damaged. The rolled outer edge must on no account be bent since bent caps do not provide a firm contact on all three points and are liable to be noisy. After fitting the hub cap, give a light twist.

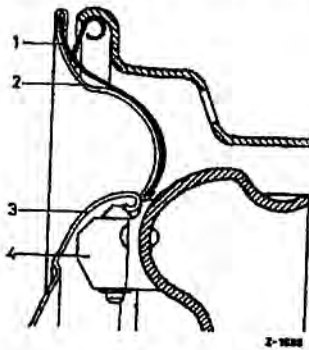


Fig. 40-4/4  
1st version

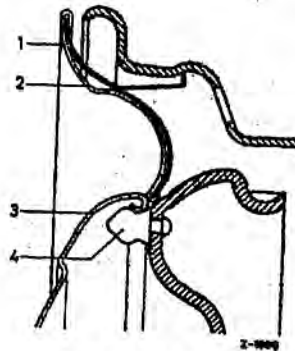


Fig. 40-4/5  
2nd version

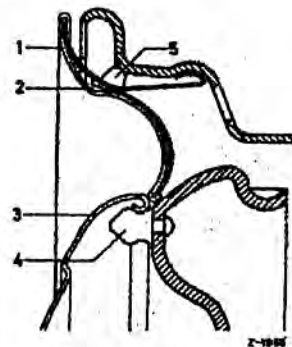


Fig. 40-4/6  
3rd version

- 1 Retaining spring for ornamental wheel cover
- 2 Ornamental wheel cover
- 3 Ornamental hub cap
- 4 Pin for ornamental hub cap
- 5 Rubber buffer

### C. Ornamental Wheel Cover

The ornamental wheel cover is fastened to the disk wheel by steel retaining springs. The 1<sup>st</sup> version wheel cover has four rolled retaining springs (1) which press against the rim edge (Fig. 40-4/4). The 2<sup>nd</sup> version wheel cover has four claw-type retaining springs which press against the rim shoulder (Fig. 40-4/5). The 3<sup>rd</sup> version ornamental wheel cover has four retaining springs bent at the front. The wheel cover is supported against the rim shoulder by rubber buffers (5) on the retaining springs (Fig. 40-4/5). The ornamental wheel covers can be used on all types of disk wheels. It is also possible to attach the 2<sup>nd</sup> and 3<sup>rd</sup> version retaining springs subsequently to the wheel cover. To change the retaining springs use Special Tool 111 589 11 61.

### D. Attachment of Disk Wheels

The disk wheel previously used was centered by five spherical collar nuts on the wheel fixing bolts and was pressed against the flange of the front wheel hub or rear axle shaft. Since accurate concentric running of the wheels is of extreme importance at high speeds, the new version disk wheel is provided with an internal recess and is centered on the front wheel hub and the rear axle shaft. The wheels are now fastened by means of spherical collar screws (Figs. 40-4/7 and 8).

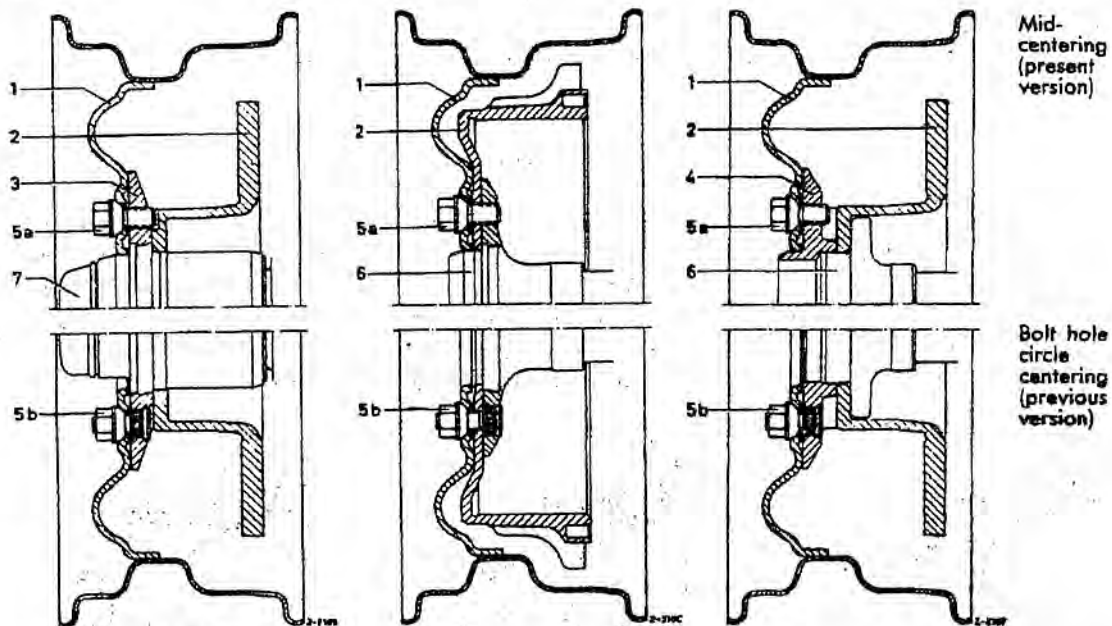


Fig. 40-4/7

Front axle

Model 190 c, 190 Dc  
220 b, 220 Sb  
220 SEb, 300 SE  
230 SL

- 1 Disk wheel
- 2 Brake disk or brake drum
- 3 Front wheel hub
- 4 Wheel fixing disk

Fig. 40-4/8

Rear axle

Model 190 c, 190 Dc  
220 b, 220 Sb  
220 SEb, 230 SL

- 5a Spherical collar screw
- 5b Wheel fixing bolt with spherical collar nut
- 6 Rear axle shaft
- 7 Hub cap

**Note:** Mid-centering disk wheels can also be fitted to the front wheel hubs and rear axle shafts without mid-centering. Vice versa, disk wheels without mid-centering (e. g. a set of available winter tires) can still be fitted. However, 1<sup>st</sup> version 15" disk wheels (Part No. 186 400 17 02) with 18 mm wheel fixing holes require larger spherical collar screws (Part No. 112 401 00 70) (see Table "Attachment of Disk Wheels" in Job No. 40-0).



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Figure 1



Figure 2

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To facilitate installation of the mid-centering disk wheels, the wheel cap (7) of the front wheel hub and the fitting piece on the rear axle shaft have been given a conical shape (Figs. 40-4/7 and 8). To facilitate alignment of the disk wheel fixing holes with the tapped holes in the front wheel hub and the rear axle shaft, the centering bolt (1) should be inserted in the topmost hole before the wheel is fitted. This centering bolt is located in a clamp in the trunk compartment right beside the combination wrench (Figs. 40-4/9 and 10).

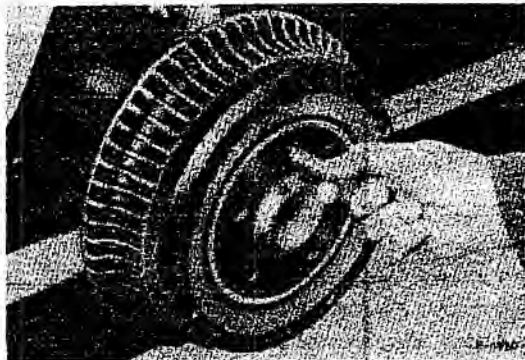


Fig. 40-4/9

1 Centering bolt

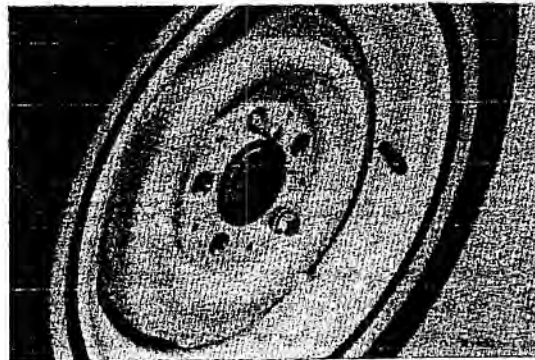


Fig. 40-4/10

## Adjustment of Car Level on Cars with Air Suspension System

Job No.

40-5

**Note:** The correct car level corresponds to the car design height. The car design height is determined on the front axle by the lower control arm position and on the rear axle by the rear wheel camber. For details about measurements see Job No. 40-3.

1. Put car over a measuring pit. The front and rear wheels should be placed on ball plates with a lateral movement.
2. Connect a pressure gage to the air reservoir and measure the pressure in the air reservoir (see Job No. 32-12, Section A).

**Note:** During these adjustment operations the working pressure should not be less than 12 atm.  
If necessary, fill up the system (see Job No. 32-12, Section A).

3. Detach the connecting rods (10) on the two leveling valves of the front axle and on the leveling valve of the rear axle. To do this, unscrew the hexagon nut on the lower ball joints (Figs. 40-5/1 and 40-5/2).

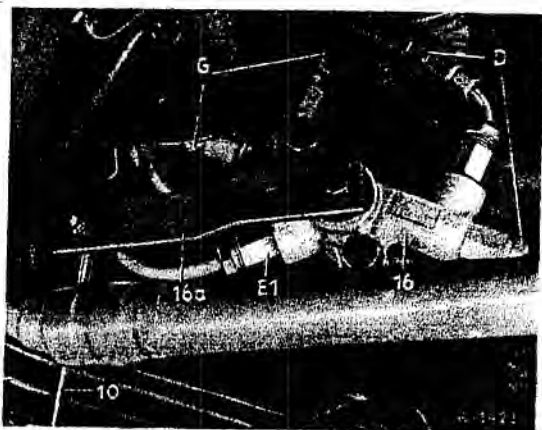


Fig. 40-5/1

- D Pressure line (reduced working pressure) from valve unit to front leveling valves
- E1 Connecting line from front leveling valve to air chamber
- G Exhaust line from front leveling valve to valve unit
- 10 Connecting rod
- 16 Front leveling valve, left
- 16a Lever

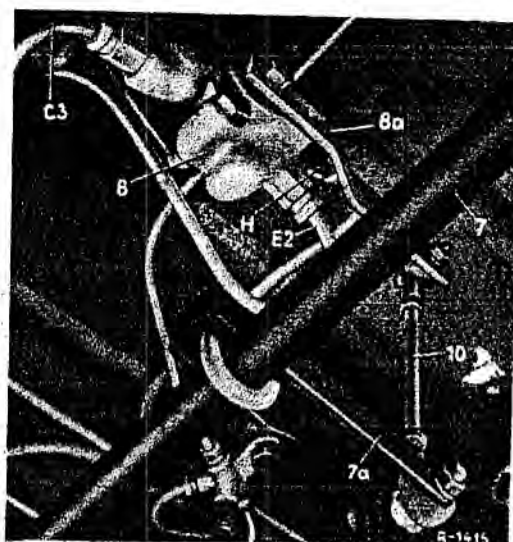


Fig. 40-5/2

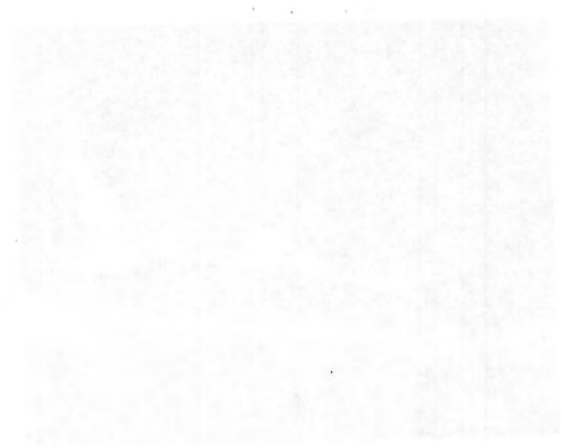
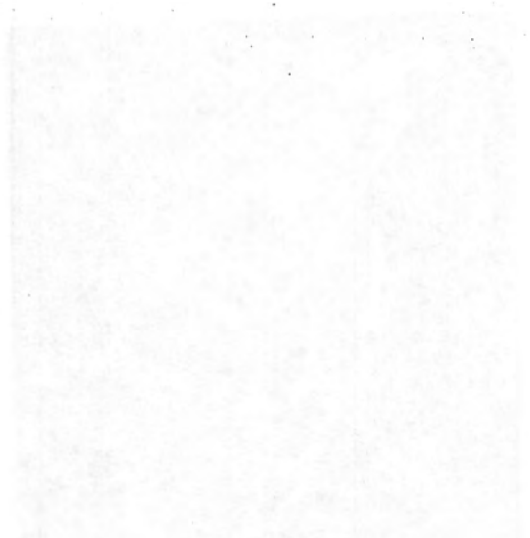
- C3 Pressure line (full working pressure) from valve unit to rear leveling valve
- E2 Connecting line from rear leveling valve to air chamber
- H Exhaust line from rear leveling valve to valve unit
- 7 Torsion bar on rear axle
- 7a Lever on torsion bar
- 8 Rear leveling valve
- 8a Lever

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Job No.
41-0

## Propeller Shaft

### General Data, Dimensions, and Tolerances

*Modification: Models as from August 1965 added; other modifications marked \**

#### Torque Readings

Models 190 c to 300 SEL

Hexagon nuts for the fitting bolts at the front end of the shaft plate	4.3 mkg
Hexagon nuts for the cylindrical bolts at the universal joints	4.3 mkg <sup>1)</sup> *
Grooved nut on the joint flange of the front propeller shaft	12 mkg
Clamping nut on the front propeller shaft or intermediate shaft	20 mkg

<sup>1)</sup> For attaching the universal joints use only hexagon nuts of quality 8 G (Part No. 000 936 01 00 14) for the cheese head screws.

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# Removal and Installation of Propeller Shaft

Job No.
41-1

Modification: Completely Revised

## Removal:

1. Mark the position of the support (12) of the rear engine suspension in relation to the chassis base panel. Support the transmission, then unscrew the engine support (11) at the transmission and the support (12) on the chassis base panel and remove together with the rubber mounting (Fig. 41-1/1).

danger that the seals on the universal joint spider are damaged and that the universal joint becomes unserviceable because of premature wear.

4. Unscrew the two hexagon screws (6) fastening the bearing bracket (3) for the propeller shaft intermediate bearing to the chassis base panel (Fig. 41-1/5).

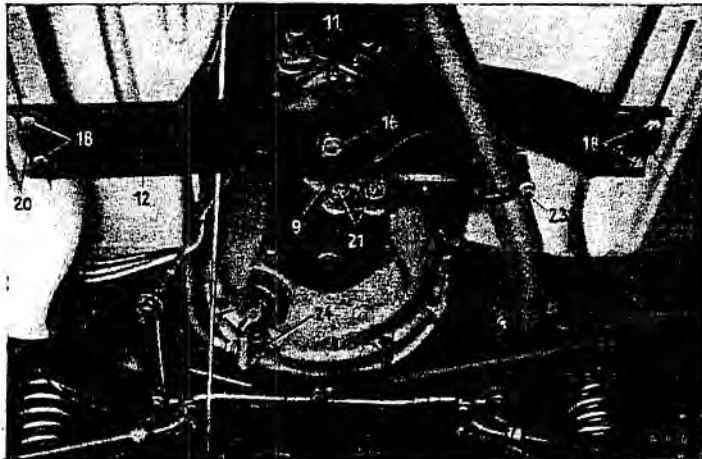


Fig. 41-1/1

- 9 Mounting plate for exhaust pipe support bracket
- 11 Engine support with rubber mounting
- 12 Support of rear engine suspension
- 16 Hexagon screws for fastening the support (12) to the chassis base panel
- 20 Position marking
- 21 Hexagon screws for the exhaust pipe support bracket (23)
- 23 Bracket with pipe clip and clamping screw for exhaust pipe support
- 24 Extraction cylinder for clutch actuating mechanism

2. Unscrew the castle nuts or self-locking nuts of the fitted screws (1) and (2) from the three-way flange of the transmission and from the shaft plate (3). Remove the screws together with the washers (Fig. 41-1/2).
3. After tapping up the locking plates (2), unscrew the hexagon nuts (3) of the four cheese head screws (1) which fasten the rear propeller shaft to the joint flange of the rear axle and remove the screws (Fig. 41-1/3).

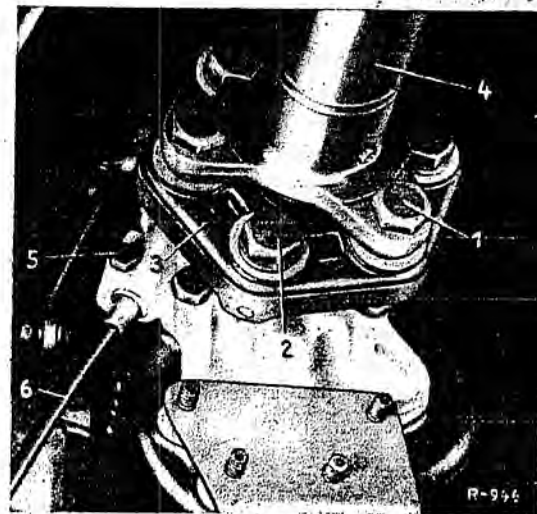


Fig. 41-1/2

- 1 Fitted screws for propeller shaft of the shaft plate
- 2 Locking plates
- 3 Shaft plate
- 4 Front propeller shaft
- 5 Hexagon screw (clamping screw)
- 6 Speedometer drive shaft

**Note:** For turning and holding the propeller shaft while loosening the nuts use a wrench which can be made in the shop in accordance with Fig. 41-1/4. If an unsuitable tool is inserted in the universal joint instead of this wrench there is a

5. Push the propeller shaft back a little and remove backward (Fig. 41-1/6). Remove the shaft plate (11) and pull the rubber sealing ring (3) from the journal of the transmission main shaft (Fig. 41-1/9).

**Note:** To remove the propeller shaft it is not necessary to detach the front and center brake cables.

6. Check the shaft plate.

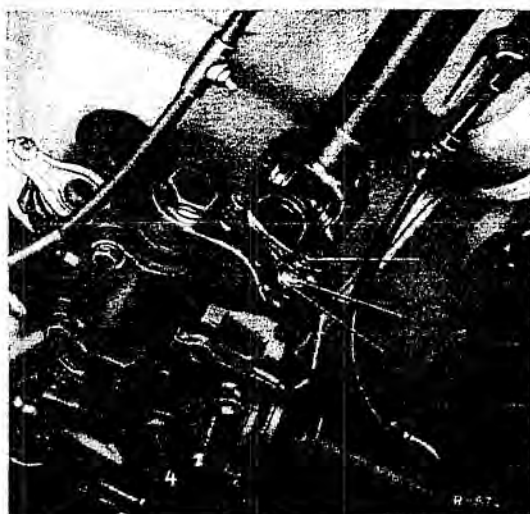
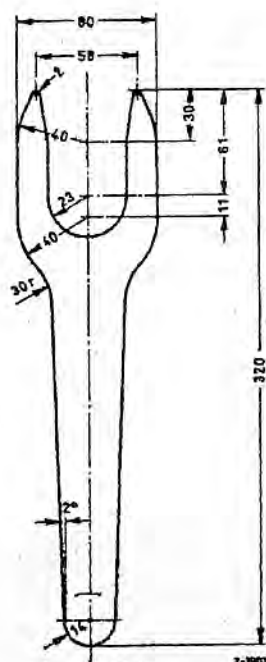


Fig. 41-1/3

- |                      |                  |
|----------------------|------------------|
| 1 Cheese head screws | 3 Hexagon nuts   |
| 2 Locking plates     | 4 Oil drain plug |

**Installation:**

7. Check the transmission three-way flange and the joint flange on the rear axle for run-out (see Job Nos. 26-0 and 25-0). For this purpose fasten Tester 136 589 04 21 00 to the transmission and to the rear axle housing (Figs. 41-1/7 and 41-1/8).
8. If the run-out is excessive, try changing the position of the flange on the transmission main shaft or on the drive pinion. If this does not improve the situation the flanges can be re-turned (see Job Nos. 26-0, 35-0 and 35-8).
9. Attach the shaft plate (11) to the transmission three-way flange with the three short fitted screws (see Job No. 41-0), remembering the washers (10a) between the screw head and the shaft plate (11) (Fig. 41-1/9). Tighten the castle nuts or self-locking nuts and cotter the castle nuts (for tightening torque see Job No. 41-0).



4 mm thick  
Edges broken

Fig. 41-1/4

**Note:** Before using the self-locking nuts again check whether they are serviceable: the polyamide locking ring in the nut must be in such a condition that it is impossible to screw the nut on the screw by hand.

**During installation it is important to make sure that the double links of the shaft plate are under tensile stress in the direction of rotation of the engine.**

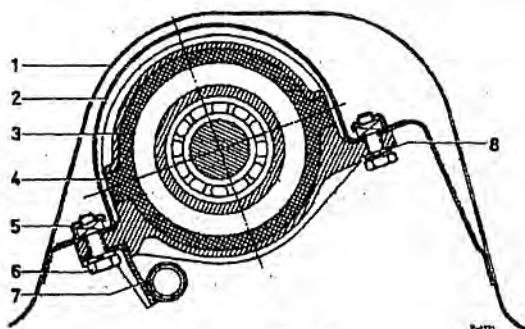


Fig. 41-1/5

- |                           |                                  |
|---------------------------|----------------------------------|
| 1 Chassis base panel      | 6 Hexagon screw with lock washer |
| 2 Propeller shaft housing | 7 Cable bracket                  |
| 3 Bearing bracket         | 8 Washer                         |
| 4 Rubber mounting         |                                  |
| 5 Cage nut                |                                  |

For identification purposes the first bore of the double link is provided with a small nose "a" which must always point





Fig. 41-1/6

- 1 Front propeller shaft
- 2 Propeller shaft intermediate bearing
- 3 Rear propeller shaft

in the direction of the transmission. The bore (1) opposite the small nose must be connected to the transmission three-way flange (Fig. 41-1/10).

10. Check the rubber sealing ring (3) and push it on the transmission main shaft journal (Fig. 41-1/9).
11. Install the propeller shaft, at the same time carefully pushing the locating ball in the center cross on the transmission main shaft journal. Screw in the hexagon screws (6) on the intermediate bearing but do not tighten them yet. (Fig. 41-1/5).
12. Fasten the front propeller shaft plate. To do this insert the three long fitted screws (see Job No. 41-0) and fit the washers (10b) (Fig. 41-1/9). Tighten the castle nuts for tightening torque see Job No. 41-0).

**Note:** The fitted screws with cotted castle nuts are interchangeable with the self-locking nuts as a set.

13. Screw the rear propeller shaft to the joint flange of the rear axle. Use new locking plates for the cheese head screws and if necessary use new nuts (Fig. 41-1/3).
14. Install the rear engine suspension (see Job No. 24-1).
15. Tighten the two hexagon screws (6) on the propeller shaft intermediate bearing, taking care to ensure that the brake cable bracket (7), if installed, is in the correct position (Fig. 41-1/5).

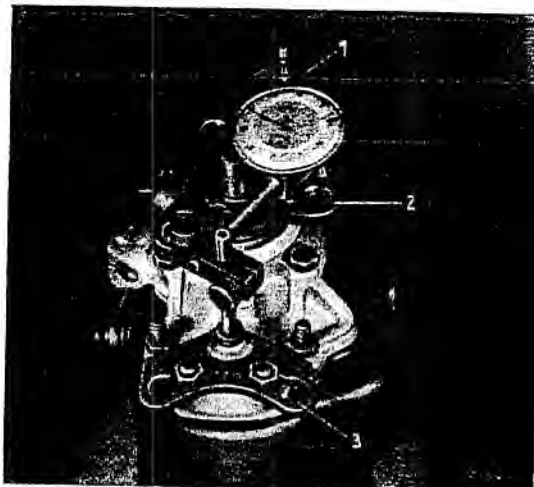


Fig. 41-1/7

- 1 Dial gage
- 2 Three-way flange
- 3 Tester 136 589 04 21 00

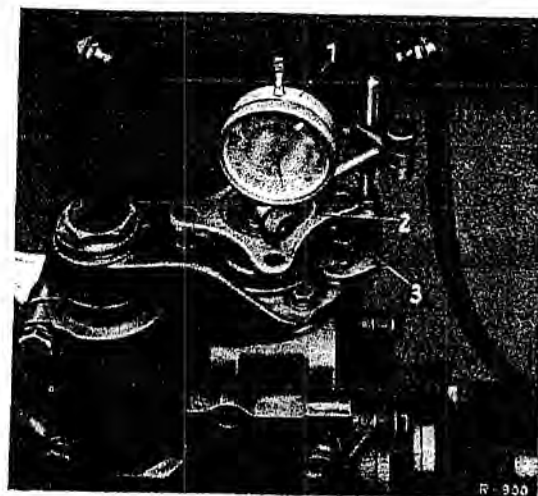


Fig. 41-1/8

- 1 Dial gage
- 2 Joint flange
- 3 Tester 136 589 04 21 00

16. Press grease into the grease fittings on the propeller shaft:

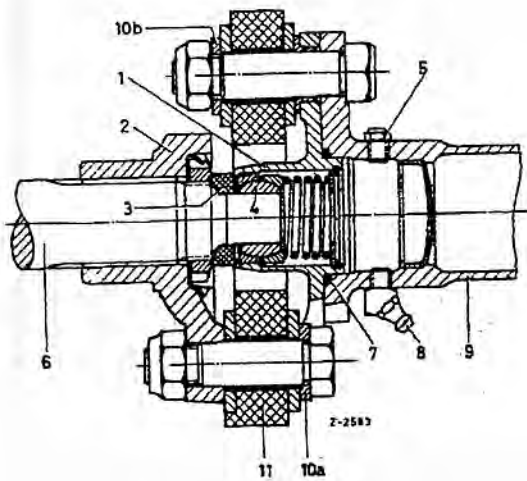


Fig. 41-1/9

- |   |                             |
|---|-----------------------------|
| 1 Center cross                                    | 6 Transmission main shaft   |
| 2 Three-way flange on the transmission main shaft | 7 Rubber sealing ring       |
| 3 Rubber sealing ring                             | 8 Piston rim grease fitting |
| 4 Locating ball                                   | 9 Front propeller shaft     |
| 5 Relief valve                                    | 10a 10b Washer              |
|   | 11 Shaft plate              |

a) Grease fitting (8) for the center cross on the front propeller shaft (Fig. 41-1/9).

The relief valve (5) permits air to escape during lubrication. As soon as grease emerges from the relief valve lubrication is completed.

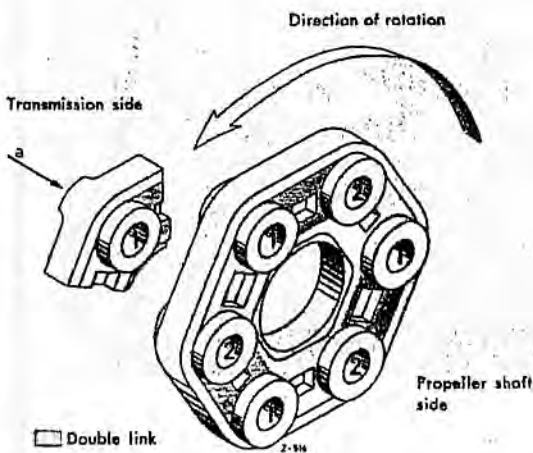


Fig. 41-1/10

- 1 Connect to three-way flange of the transmission
- 2 Connect to three-way flange of the propeller shaft

b) Grease fitting (19), if installed, for the annular grooved bearing (10) of the propeller shaft intermediate bearing (Fig. 41-1/11).

c) Grease fitting (23) on the slip coupling of the rear propeller shaft (Fig. 41-1/11). The slip coupling of the rear propeller shaft must not be overlubricated. If during lubrication grease emerges at the end of the splines lubrication is completed. If it becomes obvious during lubrication that the slip coupling is moving in the splines because of axial thrust, lubrication should be stopped immediately since otherwise the shaft plate would be strained.

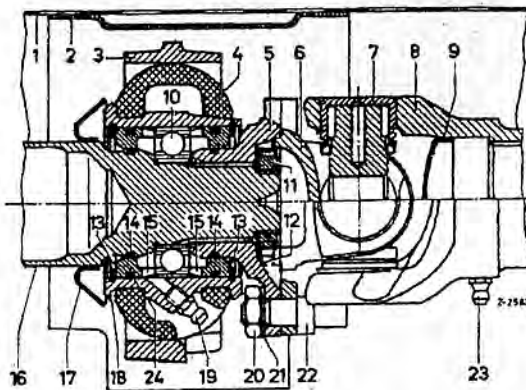


Fig. 41-1/11

Intermediate bearing requiring maintenance

- |   |                          |
|---|--------------------------|
| 1 Chassis base panel                        | 11 Grooved nut           |
| 2 Propeller shaft housing                   | 12 Locking plate         |
| 3 Bearing bracket                           | 13 Snap ring             |
| 4 Rubber mounting                           | 14 Sealing ring          |
| 5 Joint flange on the front propeller shaft | 15 Spacer ring           |
| 6 Joint flange on the rear propeller shaft  | 16 Front propeller shaft |
| 7 Needle bearing for universal joint        | 17 Boot                  |
| 8 Slip coupling of rear propeller shaft     | 18 Bearing housing       |
| 9 Cover                                     | 19 Grease fitting        |
| 10 Annular grooved bearing                  | 20 Hexagon nut           |
|   | 21 Locking plate         |
|   | 22 Cheese head screw     |
|   | 23 Grease fitting        |
|   | 24 Rubber sealing ring   |

d) The universal joints on the rear propeller shaft require no maintenance — in other words, during assembly the joints are given a supply of grease sufficient for their service life and subsequent lubrication is unnecessary. These universal joints have no grease fittings on the universal joint spider (Fig. 41-1/11).

**Changes in the Removal and Installation Procedures for Propeller Shafts with Clamp Nut on the Models as from August 1965**

Models 200, 200 D, 230, 230 S, 250 S, 250 SE, 300 SEb, 300 SEL as well as 300 SE/C and 230 SL as from August 1965 are equipped with split two-part or three-part propeller shafts (Figs. 41-1/12 and 13).

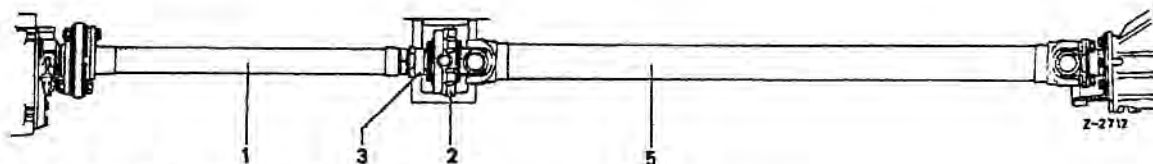


Fig. 41-1/12 Two-part propeller shaft

- |                         |                        |
|-------------------------|------------------------|
| 1 Front propeller shaft | 3 Clamp nut            |
| 2 Intermediate bearing  | 5 Rear propeller shaft |

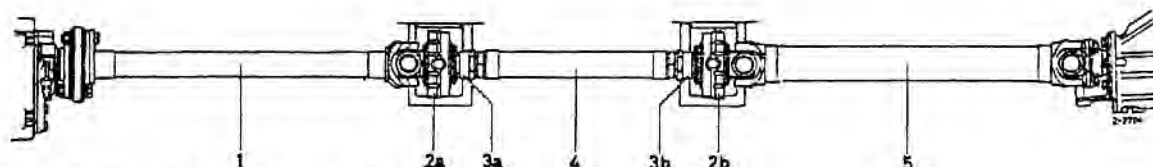


Fig. 41-1/13 Three-part propeller shaft

- |                             |                        |
|-----------------------------|------------------------|
| 1 Front propeller shaft     | 4 Intermediate shaft   |
| 2a, 2b Intermediate bearing | 5 Rear propeller shaft |
| 3a, 3b Clamp nut            |                        |

**Removal:**

When split two-part propeller shafts with clamp nut instead of the previous slip coupling are removed, the clamp nut (3) must be backed off; the individual parts of the propeller shaft can then be pushed together and pulled out of the centering on the transmission (Fig. 41-1/12).

In the case of the three-part propeller shaft only the front clamp nut (3a) on the intermediate shaft (4) need be backed off (Fig. 41-1/13).

To provide better access to the clamp nut on some models it may be necessary to remove the heel screening plate on the propeller-shaft housing above the propeller shaft.

**Installation:**

The clamp nut (3) or (3a and 3b) and the screws for the attachment of the intermediate bearing (2) or (2a and 2b) should not be fully tightened before the propeller shaft has been completely installed. The car must stand on its wheels in curb condition and must be pushed back and forward several times. This is the only way to cause the propeller shaft to adjust to its proper length and to guarantee correct installation without forcing.

Before tightening the clamp nuts (3a and 3b) on the intermediate shaft of the three-part propeller shaft take care to ensure that the intermediate shaft (4) does not knock against either the front or the rear intermediate bearing. The intermediate shaft must have the same distance at both ends from the intermediate bearings (for tightening torque of clamp nut see Job No. 41-0).

The propeller shafts with clamp nut are self-lubricating with the exception of the center cross of the front propeller shaft.

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# Tandem Master Cylinder

Job No.

42-3a

## A. General

*Modification: 4th version added*

The tandem master cylinder is installed in cars which are equipped with a two-circuit brake system. The housing of the tandem master cylinder contains two pressure chambers which work independently of one another. If one brake circuit should develop a leak the tandem master cylinder ensures sufficient brake action in the remaining brake circuit.

In the 1<sup>st</sup> version of the tandem master cylinder the rear pressure chamber or the push rod circuit is connected to the front wheel brake and the front pressure chamber or floating circuit to the rear wheel brake (Fig. 42-3a/1).

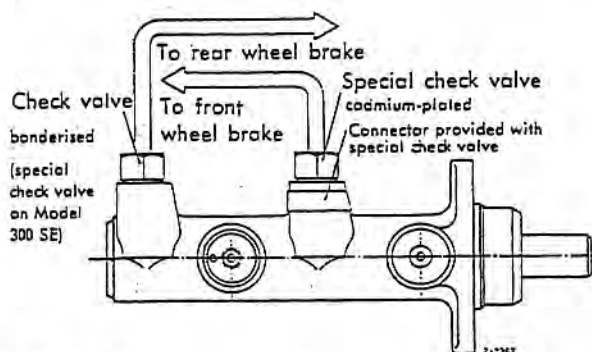


Fig. 42-3a/1

1<sup>st</sup> version

In the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> versions the rear pressure chamber is connected to the rear wheel brake and the front pressure chamber to the front wheel brake (Fig. 42-3a/2).

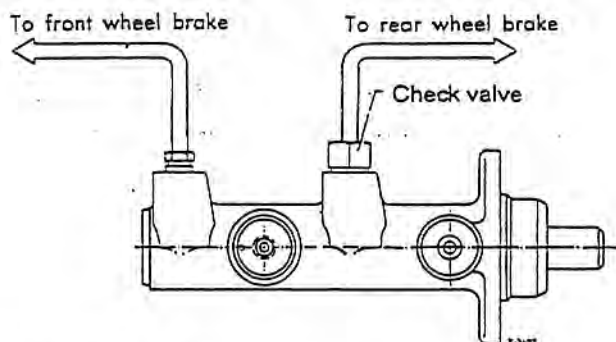


Fig. 42-3a/2

2<sup>nd</sup> and 3<sup>rd</sup> version

On cars with drum brakes the connector on the tandem master cylinder for the brake line to the rear wheel brake is bonderised and on cars with disk brakes the connector is cadmium-plated.

**Note:** The 2<sup>nd</sup> version tandem master cylinder has been installed on cars with the following chassis end numbers:

	left-hand drive	right-hand drive
Model 190 c	106 922	107 477
Model 190 Dc	178 057	179 100
Model 220 b	064 207	063 880
Model 220 Sb	145 390	144 454
Model 220 SEb/sedan	072 639	071 887
Model 220 SEb/C	072 738	072 959
Model 230 SL	008 144	007 972
Model 300 SE	007 380	

3<sup>rd</sup> version tandem master cylinders were installed in Models 250 S, 250 SE, 300 SEb, and 300 SEL from the start.

4<sup>th</sup> version tandem master cylinders are installed in models 250 S, 250 SE, 300 SEb, 300 SEL, and 250 SL from September 1967.

42-3a/1

The difference in the external appearance of the main cylinder is that the 2<sup>nd</sup> and 3<sup>rd</sup> versions have no special check valve for the front wheel brake and are provided with two connecting bores for the left and right front wheel brakes. Instead of the special check valve for the front wheel brake this version has been provided with calibrated bores (Fig. 42-3a/3/4).

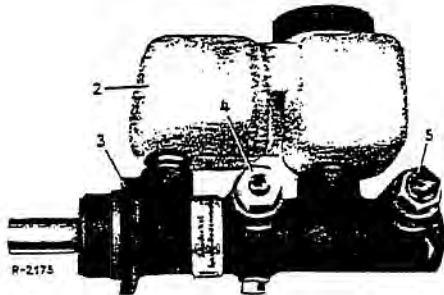


Fig. 42-3a/3

1<sup>st</sup> version

- 2 Reservoir
- 3 Housing
- 4 Special check valve
- 5 Check valve (special check valve on model 300 SE)

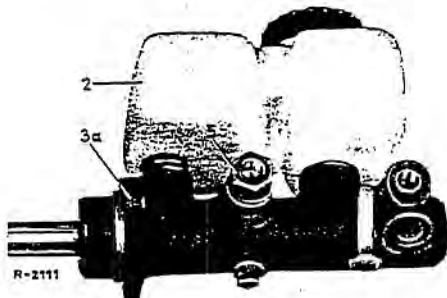


Fig. 42-3a/4

2<sup>nd</sup> and 3<sup>rd</sup> version

- 2 Reservoir
- 3a Housing
- 5 Check valve (special check valve on models equipped with disk brakes also on the rear axle)
- 25 Screw plug with copper sealing ring

Note: If the first version tandem master cylinder is subsequently replaced by the 2<sup>nd</sup> or 3<sup>rd</sup> version the connection on the housing which points downward at an angle is closed by means of a screw plug (25) (Fig. 42-3a/4).

## B. Construction

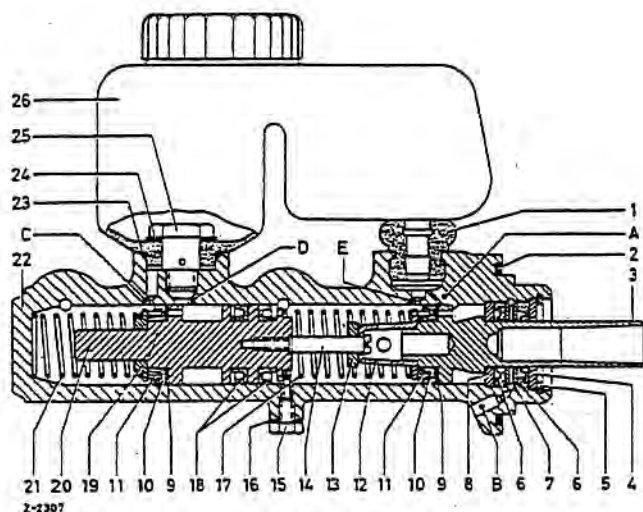
### 1<sup>st</sup> Version

The open end of the housing (22) contains the piston stop ring (5), the piston stop washer (4), the first vacuum seal (6), the spacer ring with drain groove, the second vacuum seal (6), and the support ring (8). The circular space between the two vacuum seals has a drain outlet via the leak port (B), so that no brake fluid can get into the power brake.

The piston (3) of the push rod circuit is provided with a piston cup washer (9) and primary cup (10). The thrust ring (11) engages the primary cup and is peened on the piston stem. The pressure spring (17) presses the piston against the support ring (8) via the spring retainer (12). The rear piston (3) is coupled to the intermediate piston (20) of the floating circuit by means of the connecting screw (14). A piston stop washer (13) is located between the spring retainer (12) and the intermediate piston. The intermediate piston carries the ring cups (18), which seal the two chambers of the tandem master cylinder off against one another, and in addition the piston cup washer (9) and the primary cup (10). The pressure spring (21) presses the intermediate piston against the stop screw (15) via the spring retainer (19). The housing carries the transparent reservoir (26), which is attached to the housing at the front by means of a hollow screw (25). Sealing is provided by an O-Ring (23) and the reservoir plug (1). The reservoir is divided by a comparatively high partition so that each chamber has its own reservoir (Fig. 42-3a/5).

The push rod circuit lift is 19 mm and the floating circuit lift is 13 mm.

Fig. 42-3a/5



- |                             |   |
|-----------------------------|---|
| 1 Plug                      | 15 Stop screw for intermediate piston     |
| 2 O-ring                    | 16 Sealing ring (copper)                  |
| 3 Piston (push rod circuit) | 17 Pressure spring                        |
| 4 Piston stop washer        | 18 Ring cup                               |
| 5 Piston stop ring          | 19 Spring retainer                        |
| 6 Vacuum seal               | 20 Intermediate piston (floating circuit) |
| 7 Spacer ring               | 21 Pressure spring                        |
| 8 Support ring              | 22 Housing                                |
| 9 Piston cup washer         | 23 O-ring                                 |
| 10 Primary cup              | 24 Spring washer                          |
| 11 Thrust ring              | 25 Hollow screw                           |
| 12 Spring retainer          | 26 Reservoir                              |
| 13 Piston stop washer       |   |
| 14 Connecting screw         |   |

- |  |
|--|
| A Refill port (push rod circuit)       |
| B Leak port                            |
| C Compensating port (floating circuit) |
| D Refill port (floating circuit)       |
| E Compensating port (push rod circuit) |

**2nd Version**

The 2nd version tandem master cylinder consists of the following parts:

The piston (3a) together with the piston cup washer (9a), the primary cup (10a), the thrust ring (11a) and the pressure spring (17a) with its spring retainer (12a). The intermediate piston (20a) is provided with two ring cups (18a) and like the piston (3a) with a piston cup washer (9a), a primary cup (10a), and a thrust ring (14a).

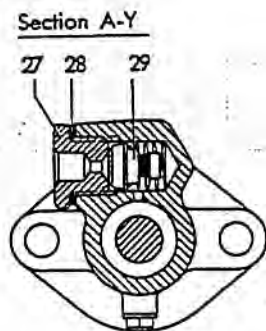
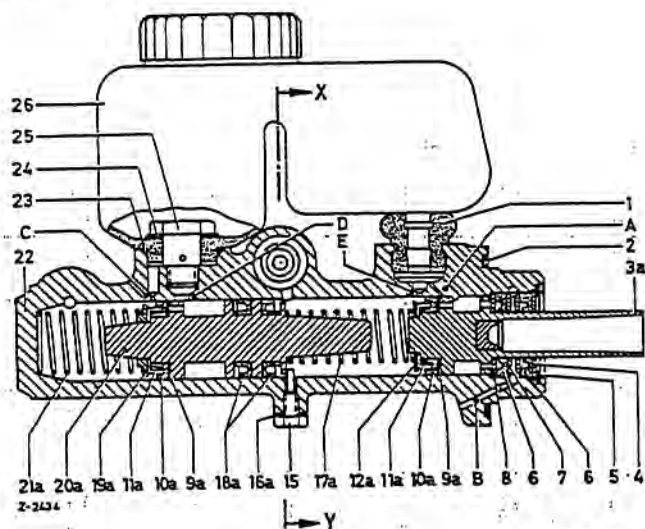


Fig. 42-3a/6

- |                              |  |  |
|------------------------------|--|--|
| 1 Plug                       | 15 Stop screw for intermediate piston      | 25 Hollow screw  |
| 2 O-ring                     | 16a Sealing ring (copper)                  | 26 Reservoir   |
| 3a Piston (push rod circuit) | 17a Pressure spring                        | 27 Connector (bondersized on cars with drum brakes, cadmium-plated on cars with disk brakes) |
| 4 Piston stop washer         | 18a Ring cup                               | 28 Sealing ring  |
| 5 Piston stop ring           | 19a Spring retainer                        | 29 Check valve   |
| 6 Vacuum seal                | 20a Intermediate piston (floating circuit) | A Refill port (push rod circuit)   |
| 7 Spacer ring                | 21a Pressure spring                        | B Leak port  |
| 8 Support ring               | 22 Housing                                 | C Compensating port (floating circuit)   |
| 9a Piston cup washer         | 23 O-ring                                  | D Refill port (floating circuit)   |
| 10a Primary cup              | 24 Spring washer                           | E Compensating port (push rod circuit)   |
| 11a Thrust ring              |  |  |
| 12a Spring retainer          |  |  |

The arrangement of the pressure spring (21a) with spring retainer (19a), the stop screw (15), the support ring (8), the vacuum seals (6), the spacer ring (7), the piston stop washer (4), and the reservoir (26) is the same as in the first version. The piston (3a) and the intermediate piston (20a) are connected

via the rear pressure spring (17a). Since this pressure spring is weaker than the pressure spring (21a) the intermediate piston will only move when the pressure of the pressure spring (17a) has increased as a result of the piston movement to an extent when the initial tension of the pressure spring (21a) and the friction resistance of the cups has been overcome (Fig. 42-3a/6).

The push rod circuit lift is 12 mm and the floating circuit lift is 20 mm.

### 3rd Version

The construction of the 3rd version tandem master cylinder resembles that of the 1st version. The only difference is in the arrangement of the connecting screw (14) and spring retainer (12): the connecting screw is screwed into the piston (3) of the push rod circuit and the spring retainer is supported against the intermediate piston (20) of the floating circuit. The arrangement of the check valve (29) or the special check valve is the same as in the 2nd version master cylinder.

The push rod circuit lift is 13 mm and the floating circuit lift is 19 mm.

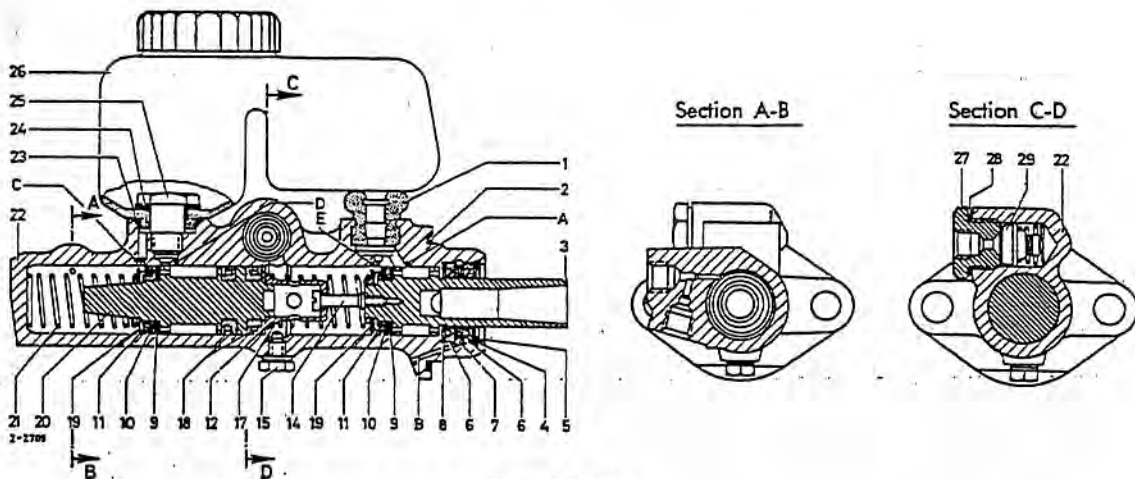


Fig. 42-3a/6a

- |                             |   |  |  |
|-----------------------------|---|--|--|
| 1 Plug                      | 11 Thrust ring                            | 21 Pressure spring   | 28 Sealing ring                        |
| 2 O-ring                    | 12 Spring retainer                        | 22 Housing   | 29 Check valve or special check valve  |
| 3 Piston (push rod circuit) | 14 Connecting screw                       | 23 O-ring  | A Refill port (push rod circuit)       |
| 4 Piston stop washer        | 15 Stop screw for intermediate piston     | 24 Spring washer   | B Leak port                            |
| 5 Piston stop ring          | 16 Sealing ring (copper)                  | 25 Hollow screw  | C Compensating port (floating circuit) |
| 6 Vacuum seal               | 18 Ring cup                               | 26 Reservoir   | D Refill port (floating circuit)       |
| 7 Spacer ring               | 19 Spring retainer                        | 27 Connector (bondersised on cars with drum brakes, cadmium-plated on cars with disk brakes) | E Compensating part (push rod circuit) |
| 8 Support ring              | 20 Intermediate piston (floating circuit) |  |  |
| 9 Piston cup washer         |   |  |  |
| 10 Primary cup              |   |  |  |



#### 4<sup>th</sup> Version

The internal construction of this tandem master cylinder is the same as that of the 3<sup>rd</sup> version. The change is in the reservoir, which is no longer bolted to the housing but is plugged to it. The most important change is the warning device installed in the reservoir; when the fluid level reaches a predetermined low, a red light in the instrument cluster indicates a leak in the brake system. The warning device is actuated by a float in each of the reservoir chambers.

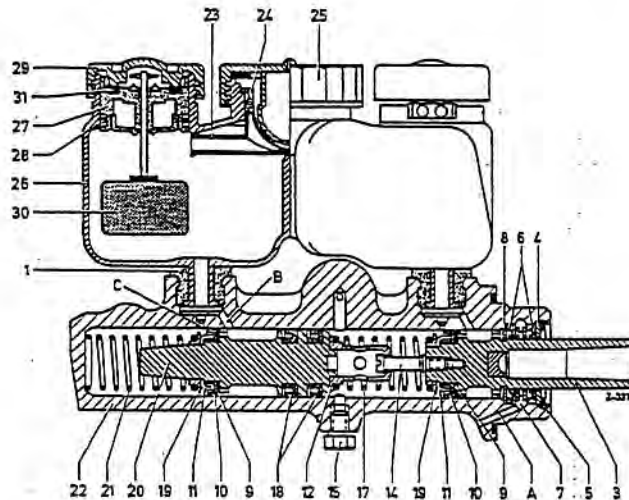


Fig. 42-3a/7a

- |                             |                                 |
|-----------------------------|---------------------------------|
| 1 Plug                      | 20 Piston (intermediate piston) |
| 3 Piston (push rod circuit) | 21 Pressure spring              |
| 4 Piston stop washer        | 22 Housing                      |
| 5 Piston stop ring          | 23 Splash guard                 |
| 6 Vacuum seal               | 24 Strainer                     |
| 7 Spacer ring               | 25 Screw cap                    |
| 8 Support ring              | 26 Reservoir                    |
| 9 Piston cup washer         | 27 Contact insert               |
| 10 Primary cup              | 28 O-ring                       |
| 11 Thrust ring              | 29 Cover cap                    |
| 12 Spring retainer          | 30 Float                        |
| 14 Connecting screw         | 31 Sealing ring                 |
| 15 Stop screw               | A Leak port                     |
| 17 Pressure spring          | B Filling port                  |
| 18 Ring cup                 | C Compensating port             |
| 19 Spring retainer          |                                 |

### C. Principle of Operation

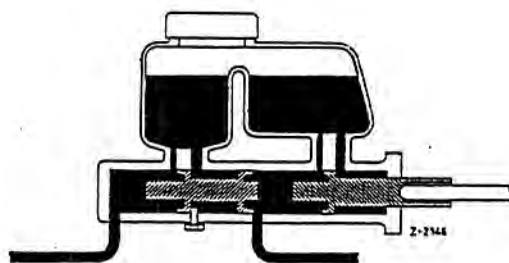


Fig. 42-3a/7

Tandem master cylinder  
in non-applied position

When the brake pedal is depressed, action is as follows:

### 1<sup>st</sup> and 3<sup>rd</sup> Version Tandem Master Cylinder

The piston (3) and the intermediate piston (20) move forward together. It is only when the primary cup (10) passes beyond the compensating port (C) that pressure is built up in the two circuits. (The pressure spring (17) in the push rod circuit is considerably stronger than the spring (21) in the floating circuit. As a result, the two pistons move together until pressure has been built up in the front chamber) (Fig. 42-3a/5).

### 2<sup>nd</sup> Version Tandem Master Cylinder

At first the piston (3a) moves forward alone until the pressure of the weaker pressure spring (17a) is equal to the initial tension of the pressure spring (21a) and also the friction resistance of the cups. After that the two pistons move together. Pressure for the brake circuits does not build up until the intermediate piston (20a) has passed beyond the compensating port (C) (Fig. 42-3a/6).

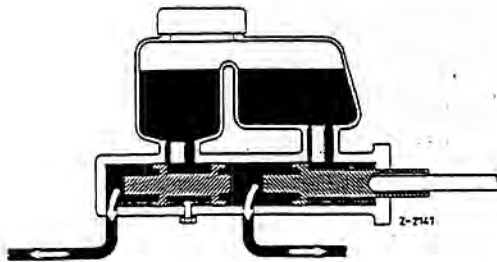


Fig. 42-3a/8

Both brake circuits in operation

If a leak should develop — e. g. in the brake circuit which is connected to the rear pressure chamber (brake hose burst, line worn through) — no pressure can build up in this pressure chamber, since the brake fluid will escape via the leak port.

On the 1<sup>st</sup> and 3<sup>rd</sup> version tandem master cylinder the piston (3) will be moved forward until it rests against the intermediate piston (20) with its piston stop washer (13) and pushes the intermediate piston forward. Corresponding to the pedal load on the brake pedal and the servo support, pressure will now build up in the front pressure chamber which in the 1<sup>st</sup> version actuates the rear wheel brakes and in the 3<sup>rd</sup> version the front wheel brakes (Figs. 42-3a/5 and 9).

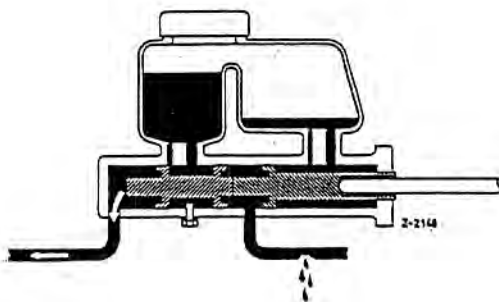


Fig. 42-3a/9

Leak in the brake circuit connected to the rear pressure chamber.

On the 2<sup>nd</sup> version the piston (3a) after overcoming the pressure of the pressure spring (17a) pushes the intermediate piston (20a) directly forward and produces the pressure in the brake circuit for the front wheel brake; the pressure depends on the pedal load and on the power brake (Figs. 42-3a/6 and 42-3a/9).

If a leak should develop in the brake circuit connected to the front pressure chamber, the two pistons will move forward until the head of the intermediate piston comes to rest against the housing wall. It is only now that pressure will build up in the rear pressure chamber which is then transmitted through the lines to the front wheel brake or the rear wheel brake (Figs. 42-3a/6 and 42-3a/10).

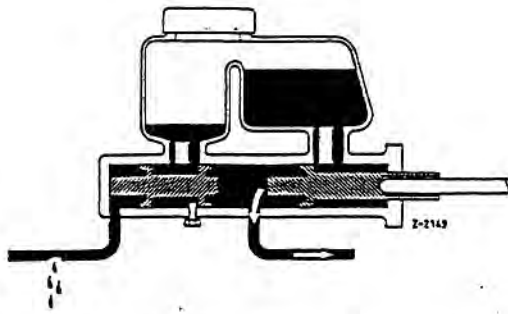


Fig. 42-3a/10

Leak in the brake circuit connected to the front pressure chamber.

Note: The principle of operation of the 4<sup>th</sup> version tandem master cylinder is the same as that of the 3<sup>rd</sup> version.

Fig. 42-3a/10a shows the arrangement of the warning device in the reservoir.

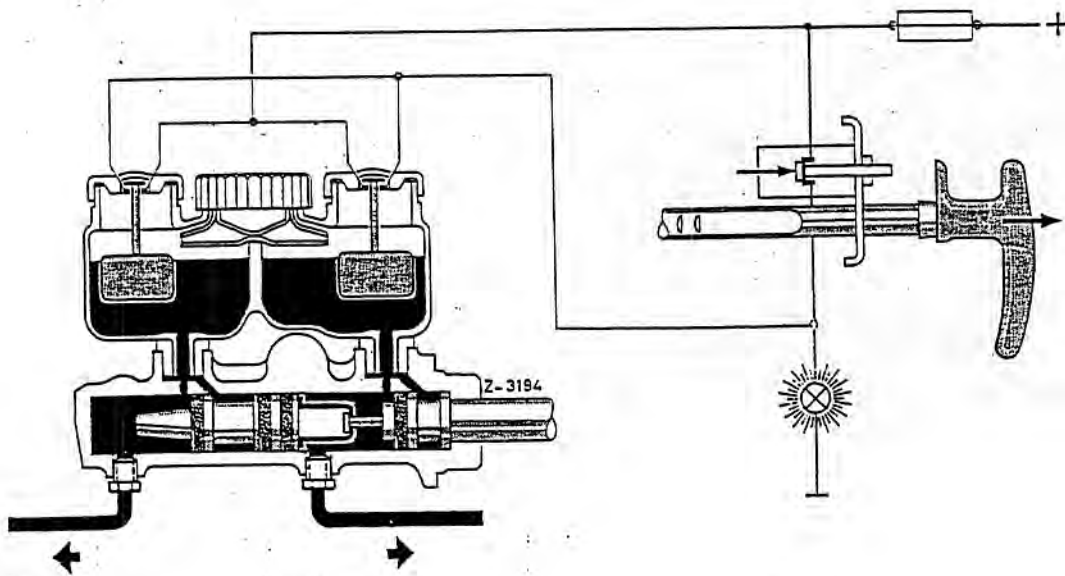


Fig. 42-43a/10a

Tandem Master Cylinder with Warning Device

Failure of any brake circuit is immediately noticeable because the brake pedal travel becomes considerably longer. This longer travel is due to the fact that when leakage occurs at a point in the brake circuit connected to the rear pressure chamber, the piston of the push rod circuit must be moved without producing any effect until it comes to rest against the intermediate piston (Fig. 42-3a/9).

When there is a failure of the brake circuit connected to the front pressure chamber, the intermediate piston of the floating circuit has to be moved without producing any effect until it comes to rest against the housing of the tandem master cylinder (Fig. 42-3a/10).

This means that whenever leakage occurs either in the front wheel or the rear wheel brake circuit, hydraulic pressure can build up in the still operative brake circuit only when the non-effective part of the piston travel has been overcome.

It goes without saying that braking action is correspondingly lower when one circuit is out of action. Reduced braking action is particularly noticeable when there is a failure in the front wheel brakes and the car can only be braked with the rear wheels.

## D. Removal and Installation of Tandem Master Cylinder

### Removal

1. On all models with the exception of models 190 c, 200, 230 SL, and 250 SL remove the battery. On models 300 SE, 300 SEb, and 300 SEL also remove the reservoir for the high pressure oil pump.
2. Pump the brake fluid out of the reservoir (2) via an opened bleed screw in the front wheel and rear wheel brake circuits, making sure that both chambers of the reservoir are emptied (Fig. 42-3a/11).

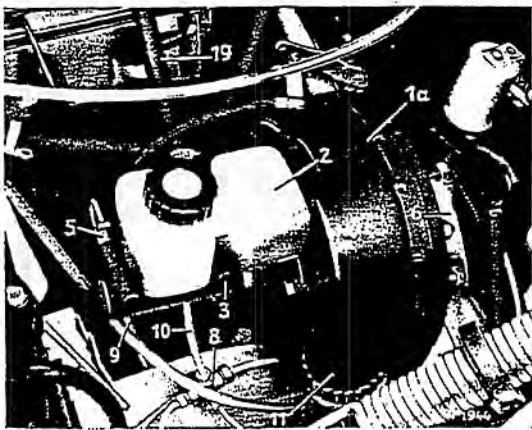


Fig. 42-3a/11

Arrangement on Models 190 c. and 190 Dc, 1st version

- |                           |                                      |
|---------------------------|--------------------------------------|
| 1a Power brake T 51/100   | 9 Brake line to rear wheel brake     |
| 2 Reservoir               | 10 Brake line to distributor fitting |
| 3 Tandem master cylinder  | 11 Reservoir for supply cylinder     |
| 5 Residual pressure valve | 19 Vacuum hose                       |
| 6 Intermediate flange     |                                      |
| 8 Distributor fitting     |                                      |

3. In the case of the 1<sup>st</sup> version tandem master cylinder detach the brake lines (9) and (10) from the master cylinder (Figs. 42-3a/11 and 42-3a/12).

In the case of the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> version tandem master cylinder detach both brake lines to the front wheel brake and the brake line to the rear wheel brake.

On cars with a common reservoir (2) for the brake system and the hydraulic clutch actuation, detach the connecting hose (22) between the reservoir and the feed line of the supply cylinder (Fig. 42-3a/16).

In the case of the 4<sup>th</sup> version tandem master cylinder disconnect the plug connection from the contact inserts; to do this prise off the positioning lugs with a small screwdriver.

**Note:** Close the brake lines by means of the rubber caps of the bleed screws, and the tandem master cylinder connections by means of dummy plugs.

4. Detach the tandem master cylinder (5) from the power brake (1) and remove, paying attention to the O-ring (10) located in the groove of the tandem master cylinder (Fig. 42-3a/13).

**Installation:**

If the 1<sup>st</sup> version tandem master cylinder is replaced by the 2<sup>nd</sup> or 3<sup>rd</sup> version (with the brake circuits connected the other way round) the brake line (10) to the distributor fitting (8) of the front wheel brake should be connected to the floating circuit pressure chamber and the brake line (9) to the rear wheel brake should be connected to the push rod pressure chamber. The second connection on the master cylinder which points downward should be closed with a screw plug (25) and a copper sealing ring Part No. 000 997 50 30 (Fig. 42-3a/12).

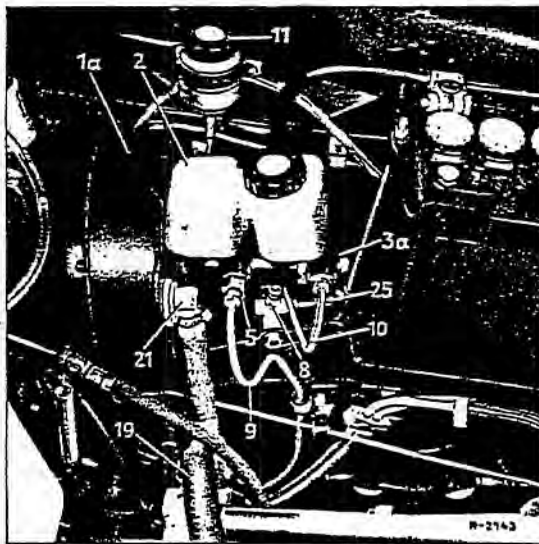


Fig. 42-3a/12

- 1a Power brake T 51/100
- 2 Reservoir
- 3a Tandem master cylinder
- 5 Connector
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 10 Brake line to front wheel brake distributor fitting
- 11 Reservoir for supply cylinder
- 19 Vacuum hose
- 21 Right-angle connector
- 25 Screw plug

5. Make sure that the leak port in the flange of the master cylinder is not clogged since this leak port serves to provide a drain via the vacuum cup of the rear piston for any brake fluid that may escape and thus prevents brake fluid from getting into the power brake.
6. Clean the sealing surface on the front of the power brake.
7. Put the O-ring (10) in the groove and attach the tandem master cylinder (5) to the power

brake (1). Tighten the hexagon nuts with a torque of 1.8—2 mkg (Fig. 42-3a/13).

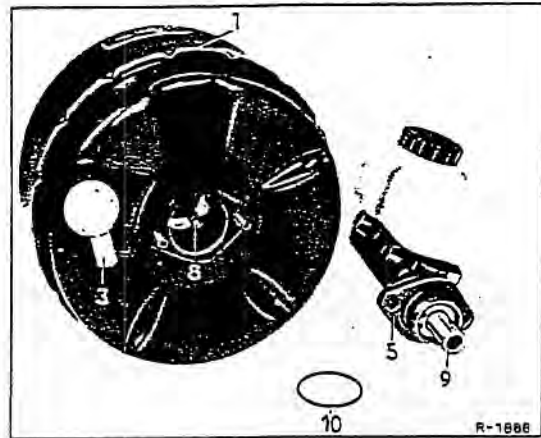


Fig. 42-3a/13

- 1 Power brake
- 3 Check valve
- 5 Tandem master cylinder
- 8 Push rod of power brake
- 9 Piston (push rod circuit)
- 10 O-ring

**Note:** Always replace the O-ring since the connection between the tandem master cylinder and the power brake must always be completely vacuum-tight.

8. Attach the brake lines to the tandem master cylinder and the vacuum hose to the power brake.

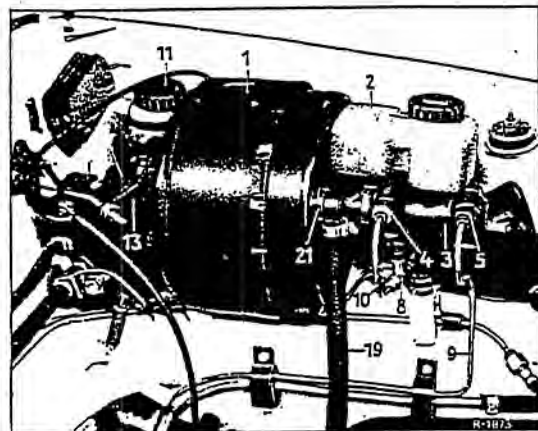


Fig. 42-3a/14

**Arrangement on model 230 SL**

- 1 Power brake T 51/200
- 2 Reservoir
- 3 Tandem master cylinder
- 4 Special check valve
- 5 Check valve
- 7 Bearing bracket
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 10 Brake line to distributor fitting
- 11 Reservoir for supply cylinder
- 13 Bracket for oil pressure gage
- 16 Piston rod for power brake
- 19 Vacuum hose
- 21 Right-angle connector

**Note:** Please make sure that on cars with drum brakes the brake line to the rear wheel brake is attached to the check valve of the tandem master cylinder. In order to provide identification of the check valve and special check valve on the 1<sup>st</sup> version master cylinder the valves have been marked as follows: Check valve bonderised (dark gray), special check valve cadmium-plated.

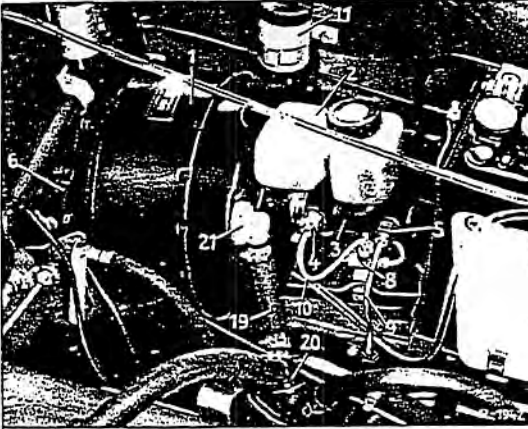


Fig. 42-3a/15

Arrangement on models 220 b, 220 Sb, 220 SEb

- |                          |                                      |
|--------------------------|--------------------------------------|
| 1 Power brake T 51/200   | 9 Brake line to rear wheel brake     |
| 2 Reservoir              | 10 Brake line to distributor fitting |
| 3 Tandem master cylinder | 11 Reservoir for supply cylinder     |
| 4 Special check valve    | 19 Vacuum hose                       |
| 5 Check valve            | 20 Evaporator jar                    |
| 6 Intermediate flange    | 21 Check valve                       |
| 8 Distributor fitting    |                                      |

On the second and third version master cylinder the connector is bonderised when a check valve is installed and it is cadmium-plated when a special check valve is installed.

9. Fill the reservoir with brake fluid, making sure that both chambers are completely filled. Bleed the brake system and check for leaks.

**Note:** If the system is bled without a bleeding device, the relevant bleed screw must always be closed before the brake lever is released. This prevents air from being sucked in via the thread of the bleed screw.

10. Whenever the battery or the reservoir for the high-pressure pump was removed, reinstall the battery or the reservoir.

11. Connect the plug connection to the contact inserts.

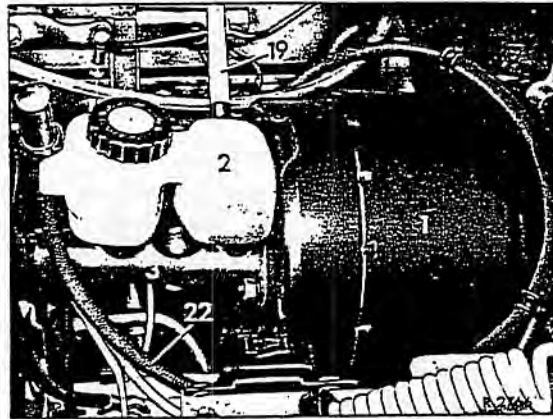


Fig. 42-3a/16

Arrangement on models 300 SEb and 300 SEL

- |                                       |
|---------------------------------------|
| 1 Power brake T 51/200                |
| 2 Reservoir                           |
| 3 Tandem master cylinder              |
| 19 Vacuum hose                        |
| 22 Connecting hose to supply cylinder |

## E. Disassembly, Checking and Reassembly of Tandem Master Cylinder

### 1st Version

#### Disassembly:

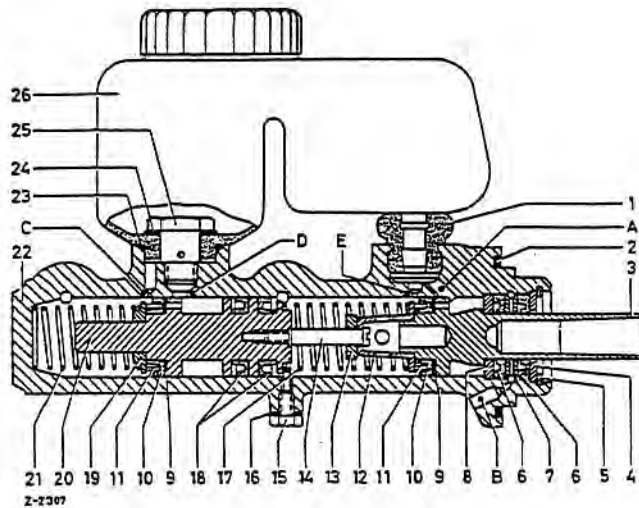


Fig. 42-3a/17

- |                             |   |
|-----------------------------|---|
| 1 Plug                      | 15 Stop screw for intermediate piston     |
| 2 O-ring                    | 16 Sealing ring (copper)                  |
| 3 Piston (push rod circuit) | 17 Pressure spring                        |
| 4 Piston stop washer        | 18 Ring cup                               |
| 5 Piston stop ring          | 19 Spring retainer                        |
| 6 Vacuum seal               | 20 Intermediate piston (floating circuit) |
| 7 Spacer ring               | 21 Pressure spring                        |
| 8 Support ring              | 22 Housing                                |
| 9 Piston cup washer         | 23 O-ring                                 |
| 10 Primary cup              | 24 Spring washer                          |
| 11 Thrust ring              | 25 Hollow screw                           |
| 12 Spring retainer          | 26 Reservoir                              |
| 13 Piston stop washer       |   |
| 14 Connecting screw         |   |

- A Refill port (push rod circuit)  
 B Leak port  
 C Compensating port (floating circuit)  
 D Refill port (floating circuit)  
 E Compensating port (push rod circuit)

1. Unscrew the hollow screw (25) from the housing (22) and remove together with the spring washer (24) (Figs. 42-3a/17 and 42-3a/18).

2. Lift the reservoir (26) out of the plug (1) and remove the O-ring (23) from the housing (Fig. 42-3a/17).

3. Unscrew the check valve and the special check valve from the housing.

**Note:** The tandem master cylinder for Model 300 SE has two special check valves.

4. Slightly depress the piston (3) with a drift (31), unscrew the stop screw (15) from the housing and remove together with the sealing ring (16) (Figs. 42-3a/17 and 19).

5. Remove the piston stop ring (5) from the housing, slightly depressing the piston with the drift in the process. Then take the piston out of the housing together with the piston stop washer (4), the two vacuum seals (6), the spacer ring (7) and the support ring (8) (Figs. 42-3a/17 and 42-3a/21).

**Note:** On the 1st series of tandem master cylinders the thrust ring (11) was loose on the piston (3). On later cylinders the thrust ring was peened on the piston in such a way that the primary cup (10) and the piston cup washer (9) can no longer be removed from the piston.

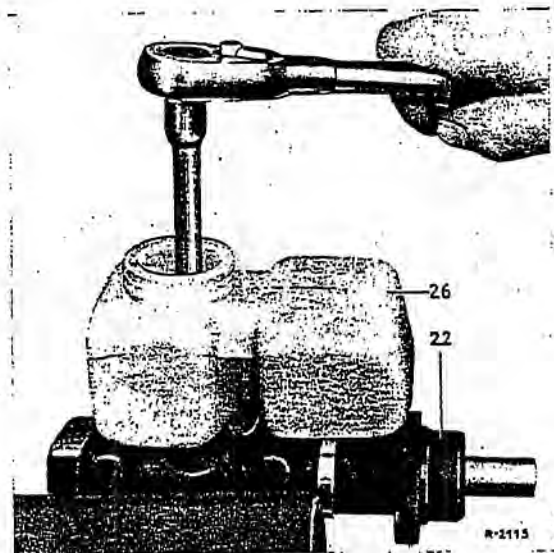
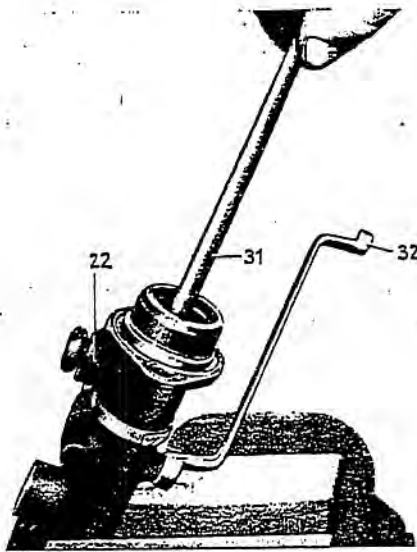


Fig. 42-3a/18

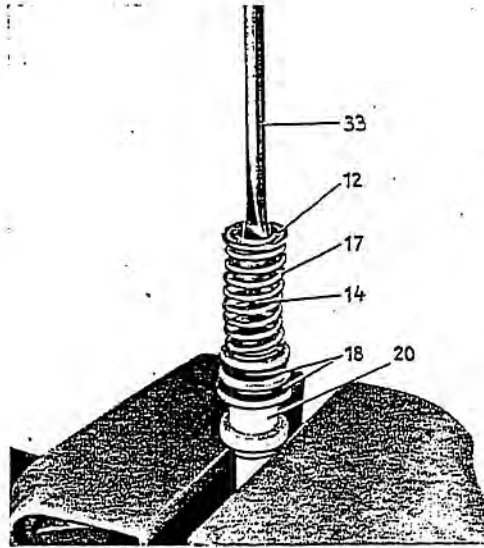
- 22 Housing of tandem master cylinder  
 26 Reservoir



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Fig. 42-3a/19

- 22 Housing of tandem master cylinder
- 31 Drift
- 32 Box wrench



R-2119

Fig. 42-3a/20

- 12 Spring retainer
- 14 Connecting screw
- 17 Pressure spring
- 18 Ring cup
- 20 Intermediate piston
- 33 Screwdriver

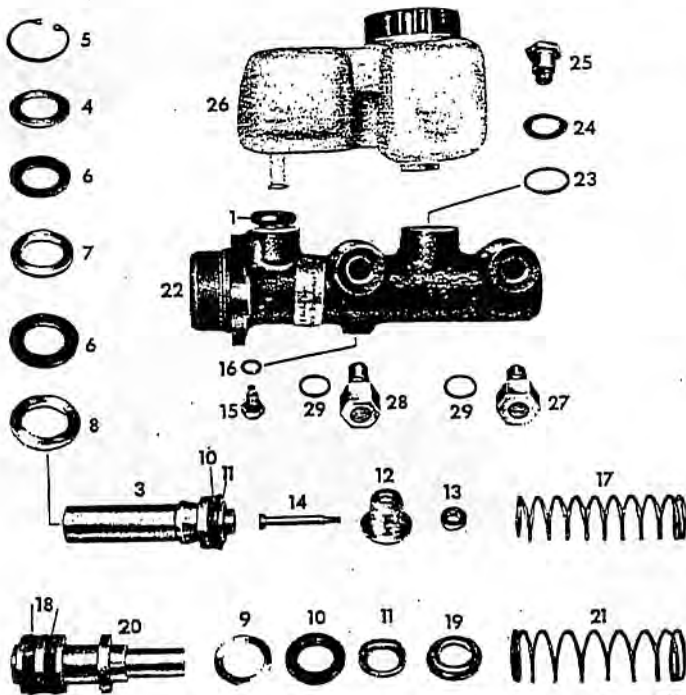
6. Knock out the intermediate piston (20) assembly by lightly knocking the housing on a piece of wood.

7. Unscrew connecting screw (14) from the intermediate piston (20) and remove the piston stop washer (13), the spring retainer (12), and

the pressure spring (17) (Figs. 42-3a/20 and 42-3a/21).

**Checking:**

8. Thoroughly clean all parts in methylated spirits.



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Fig. 42-3a/21

- 1 Plug
- 3 Piston (push rod circuit)
- 4 Piston stop washer
- 5 Piston stop ring
- 6 Vacuum sealing ring
- 7 Spacer ring
- 8 Support ring
- 9 Piston cup washer
- 10 Primary cup
- 11 Thrust ring
- 12 Spring retainer
- 13 Piston stop washer
- 14 Connecting screw
- 15 Stop screw for intermediate piston
- 16 Sealing ring (copper)
- 17 Pressure spring
- 18 Ring cup
- 19 Spring retainer
- 20 Intermediate piston (floating circuit)
- 21 Pressure spring
- 22 Housing
- 23 O-ring
- 24 Spring washer
- 25 Hollow screw
- 26 Reservoir
- 27 Check valve (special check valve on Model 300 SE)
- 28 Special check valve
- 29 Sealing ring



- Check the bore in the housing for scores and corrosion. Rust marks may be removed with polishing cloth. **Scored or rusty housings must not be repaired; install a new tandem master cylinder.**

#### Reassembly:

- Screw the connecting screw (14) into the intermediate piston (20) together with the piston stop washer (13), the pressure spring (17) and the spring retainer (12) (Figs. 42-3a/20 and 22).

**Note:** Do not leave out the piston stop washer (13) which is a stroke limitation for the piston of the push rod circuit (Fig. 42-3a/17).

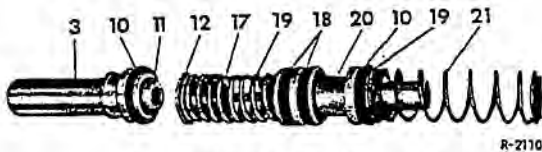


Fig. 42-3a/22

- |                             |                        |
|-----------------------------|------------------------|
| 3 Piston (push rod circuit) | 18 Ring cup            |
| 10 Primary cup              | 19 Spring retainer     |
| 11 Thrust ring              | 20 Intermediate piston |
| 12 Spring retainer          | (floating circuit)     |
| 17 Pressure spring          | 21 Pressure spring     |

- Clamp the housing in a vise in such a way that the bore points downward at an angle (Fig. 42-3a/23).

- Insert the fitting sleeve (29) in the housing (22).

**Note:** The fitting sleeve can be made of light metal in the shop in accordance with the dimensions given in Fig. 42-3a/24.

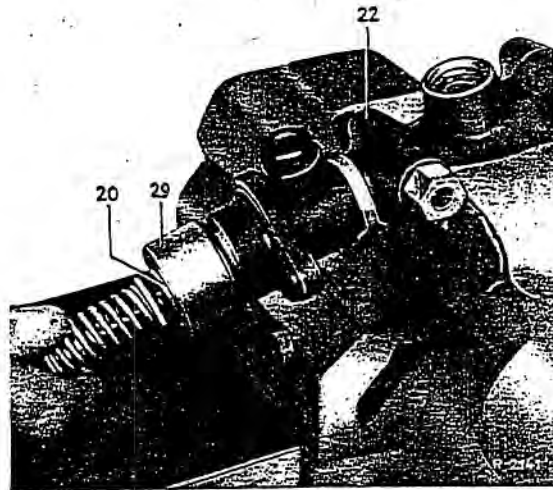


Fig. 42-3a/23

- |                                      |
|--------------------------------------|
| 20 Intermediate piston               |
| 22 Housing of tandem master cylinder |
| 29 Fitting sleeve                    |

- Slide the piston cup washer (9), the primary cup (10), the thrust ring (11), and the spring retainer (19) together with the pressure spring (21) on the intermediate piston. Lightly rub the primary cup (10) and the two ring cups (18) with ATE brake paste or brake fluid (Figs. 42-3a/17 and 21).

- Slide the intermediate piston assembly (20) into the housing. **Do not use force** since otherwise the cups may be damaged (Fig. 42-3a/23).

**Note:** If no fitting sleeve is available the intermediate piston must be installed with utmost care, since the cup might easily be damaged. (Move piston end in a circle).

- Clamp the master cylinder in a vise in such a way that the bore points upward. Depress the intermediate piston with the drift (31) until it reaches the stop in the housing (32); then screw the stop screw (15) with a new copper sealing ring (16) into the housing (Figs. 42-3a/17 and 42-3a/19).

16. Rub the shank of the piston (3) lightly with silicone grease (manufacturers Wacker-Chemie, Munich). Then install the piston in the housing (Fig. 42-3a/19).

**Note:** Install also this piston with the help of the fitting sleeve and rub the cup with brake paste or brake fluid before installation.

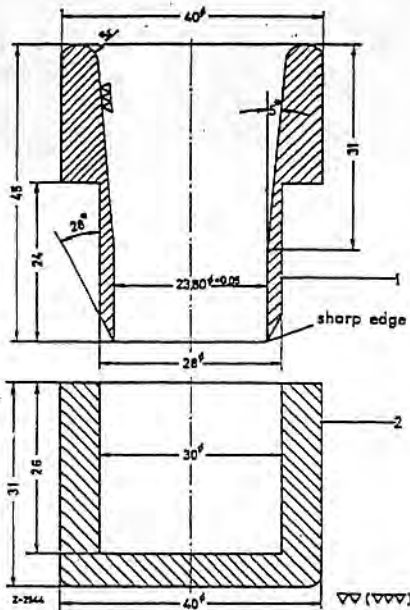


Fig. 42-3a/24

1 Fitting sleeve 2 Protective sleeve

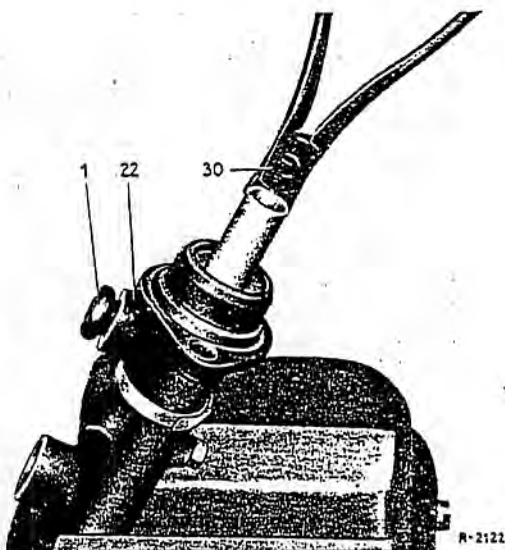


Fig. 42-3a/25

1 Plug  
22 Housing  
30 Locking pliers

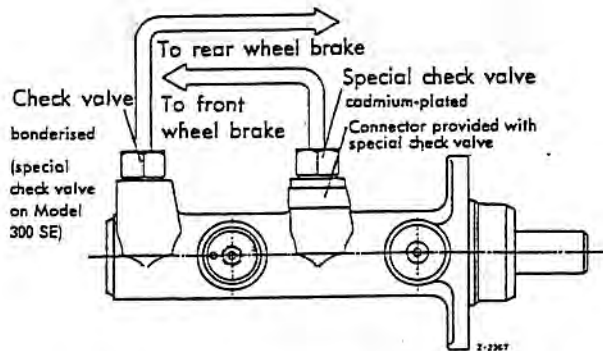


Fig. 42-3a/26

Arrangement of check valves

17. First insert the support ring (8) in the housing (Fig. 42-3a/17). Then lightly rub the vacuum seals (6) with silicone grease and install one vacuum seal. Press the seal home with a blunt instrument. Now install the spacer ring (7) in such a way that the radial bore points toward the leak port (B). Then insert the second vacuum seal and the piston stop washer (4) together with the piston stop ring (5), at the same time pressing the piston lightly into the housing by means of a drift (Fig. 42-3a/25).

**Note:** The vacuum seal prevents brake fluid from overflowing into the vacuum cylinder of the power brake. The sealing lips must therefore point in the direction of the primary cup.

18. Screw the check valve and the special check valve into the housing, using new copper sealing rings (Fig. 42-3a/26).

**Note:** Model 300 SE has two special check valves. For identification purposes the check valves are bonderised and the special check valves cadmium-plated.

19. Insert the O-ring (23) in the housing (22) and press the reservoir (26) into the plug (1). Then attach the reservoir to the master cylinder by means of the hollow screw (25) together with the spring washer (24) (Fig. 42-3a/17).

**Note:** Do not tighten the hollow screw too much since this would damage the thread in the housing.

2<sup>nd</sup> Version

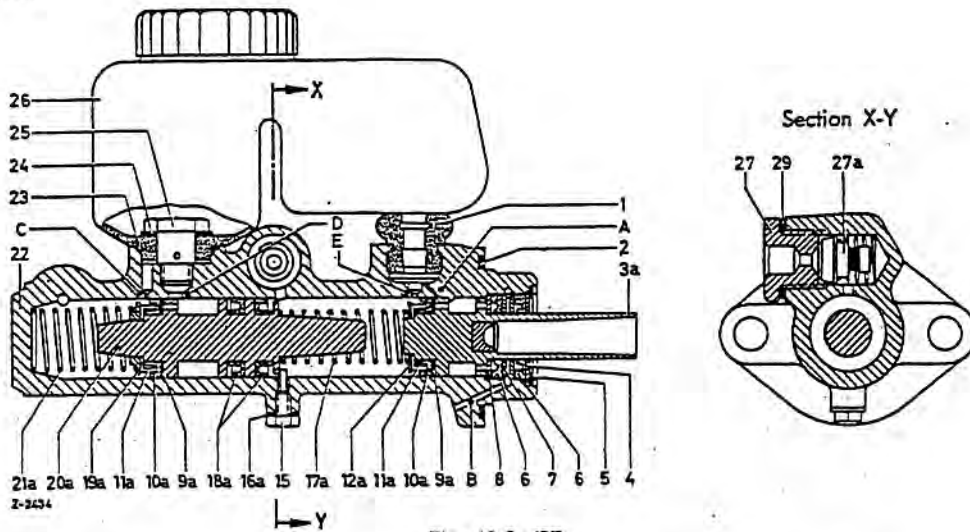


Fig. 42-3a/27

- |                              |                                       |  |                             |
|------------------------------|---------------------------------------|--|-----------------------------|
| 1 Plug                       | 8 Support ring                        | 16a Sealing ring (copper)                  | 22 Housing                  |
| 2 O-ring                     | 9a Piston cup washer                  | 17a Pressure spring                        | 23 O-ring                   |
| 3a Piston (push rod circuit) | 10a Primary cup                       | 18a Ring cup                               | 24 Spring washer            |
| 4 Piston stop washer         | 11a Thrust ring                       | 19a Spring retainer                        | 25 Hollow screw             |
| 5 Piston stop ring           | 12a Spring retainer                   | 20a Intermediate piston (floating circuit) | 26 Reservoir                |
| 6 Vacuum seal                | 15 Stop screw for intermediate piston | 21a Pressure spring                        | 27 Connector                |
| 7 Spacer ring                |                                       |  | 27a Check valve with spring |
|                              |                                       |  | 29 Sealing ring             |

Disassembly:

1. Apart from a few details the disassembly operations for the tandem master cylinder are exactly as described in the previous paragraphs 1 to 6. On the 2<sup>nd</sup> version the check valve (27a) is separated from the connector (27) in the master cylinder (Figs. 42-3a/27 and 28).

Checking:

2. Thoroughly clean all parts in methylated spirits.
3. Check the bore in the housing for scores and corrosion. Rust marks may be removed with polishing cloth. **Scored or rusty housings must not be repaired; install a new tandem master cylinder.**

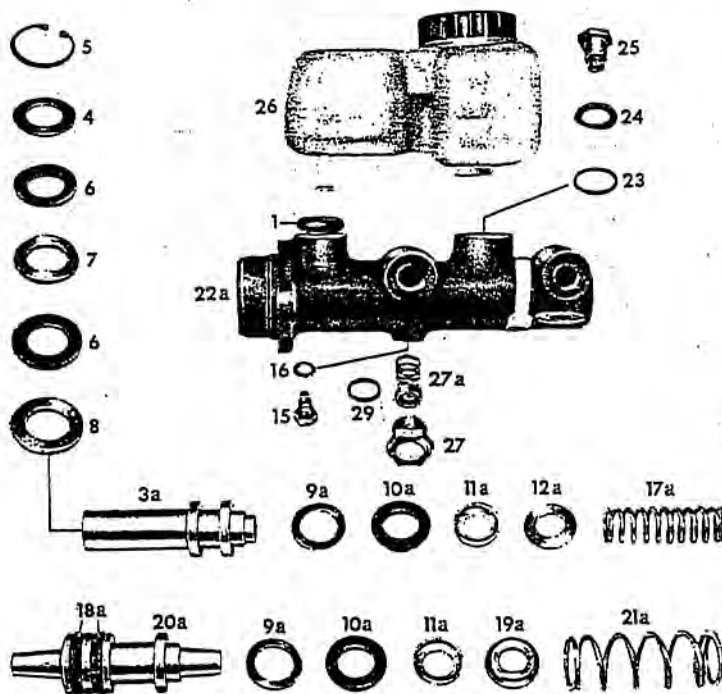


Fig. 42-3a/28

- |  |                             |
|--|-----------------------------|
| 1 Plug                                     | 22a Housing                 |
| 3a Piston (push rod circuit)               | 23 O-ring                   |
| 4 Piston stop washer                       | 24 Spring washer            |
| 5 Piston stop ring                         | 25 Hollow screw             |
| 6 Vacuum sealing ring                      | 26 Reservoir                |
| 7 Spacer ring                              | 27 Connector                |
| 8 Support ring                             | 27a Check valve with spring |
| 9a Piston cup washer                       | 29 Sealing ring             |
| 10a Primary cup                            |                             |
| 11a Thrust ring                            |                             |
| 12a Spring retainer                        |                             |
| 15 Stop screw for intermediate piston      |                             |
| 16a Sealing ring (copper)                  |                             |
| 17a Pressure spring                        |                             |
| 18a Ring cup                               |                             |
| 19a Spring retainer                        |                             |
| 20a Intermediate piston (floating circuit) |                             |
| 21a Pressure spring                        |                             |

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### Reassembly:

4. Clamp the housing in a vise in such a way that the bore points downward at an angle (Fig. 42-3a/23).
5. Insert the fitting sleeve (29) in the housing (22) (Fig. 42-3a/28).
6. Lightly coat all cups of both pistons with ATE brake paste or brake fluid.
7. Slide the piston cup washer (9a), the primary cup (10a), the thrust ring (11a), and the spring retainer (19a) together with the pressure spring (21a) on the intermediate piston (20a). (Figs. 42-3a/27 to 29).
8. Slide the intermediate piston assembly (20a) into the housing. **Do not use force** since otherwise the cups may be damaged (Fig. 42-3a/29).

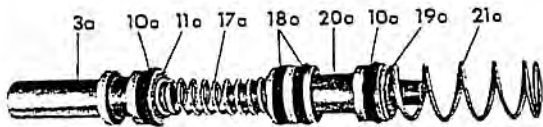


Fig. 42-3a/29

- |                              |                         |
|------------------------------|-------------------------|
| 3a Piston (push rod circuit) | 18a Ring cup            |
| 10a Primary cup              | 19a Spring retainer     |
| 11a Thrust ring              | 20a Intermediate piston |
| 17a Pressure spring          | 21a Pressure spring     |

**Note:** If no fitting sleeve is available the intermediate piston must be installed with the utmost care, since the cup might easily be damaged. (Move piston end in a circle).

9. Clamp the master cylinder in a vise in such a way that the bore points upward. Depress the intermediate piston with the drift (31) until it reaches the stop in the housing (22); then screw the stop screw (15) with a new copper sealing ring (16) into the housing (see Fig. 42-3a/19).

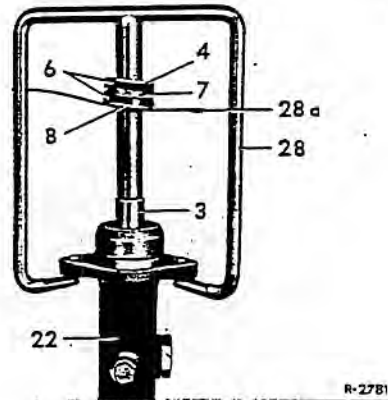


Fig. 42-3a/30

- |                      |                       |
|----------------------|-----------------------|
| 3 Piston             | 8 Support ring        |
| 4 Piston stop washer | 22 Housing            |
| 6 Vacuum seal        | 28 Tensioning fixture |
| 7 Spacer ring        | 28a Retaining wire    |

10. Lightly rub the shank of the piston (3a) with silicone grease and install the piston in the housing together with the pressure spring (17a) and the spring retainer (12a). Then remove the fitting sleeve (Figs. 42-3a/27 to 29).
11. Install in the proper order the support ring (8), one vacuum seal (6), the spacer ring (7), washer (4) and the piston stop ring (5) on the tensioning fixture (28). Then press the piston assembly into the housing by means of the tensioning fixture and engage the tensioning fixture in the fixing holes of the housing (Fig. 42-3a/30).

**Note:** The tensioning fixture can be made in the shop in accordance with the dimensions given in Fig. 42-3a/31. The retaining wire (3) holds the piston assembly to facilitate the positioning of the individual parts. The tensioning fixture shown in Fig. 42-3a/30 was not yet provided with such a retaining wire.

12. Install in the housing (22a) first the support ring (8), and then a vacuum seal (6), the spacer ring (7), the second vacuum seal (6) and the piston rod washer (4). If necessary press the vacuum seal into the housing with a blunt instrument. Finally insert the piston stop ring (5) (Fig. 42-3a/27).

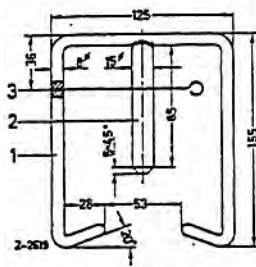


Fig. 42-3a/31

Tensioning fixture

1 Bracket      2 Drift      3 Retaining wire

**Note:** Lightly coat the sealing lips of the vacuum seal with silicone grease before installation. The sealing lips must point toward the primary cup.

13. Remove the tensioning fixture from the housing.

14. Install the check valve (27a) together with the spring in the housing in such a way that the rubber cap of the valve points toward the connector (27a). Then screw the connector into the housing together with a new copper sealing ring (29) (Figs. 42-3a/27 and 28).

**Note:** This version of the tandem master cylinder does not require a special check valve for the front wheel disk brake since the bores in the housing are calibrated.

On all models equipped with disk brakes on the rear axle, replace the standard check valve in the tandem master cylinder by a special check valve.

(Connector for check valve bonderised, connector for special check valve cadmium-plated).

15. Install the reservoir in the housing, for which see para 19 in the previous section.

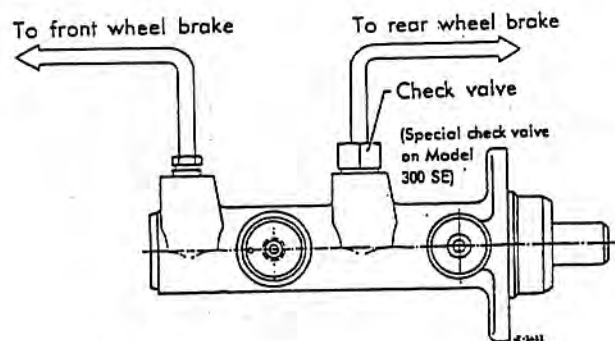


Fig. 42-3a/32

3<sup>rd</sup> Version

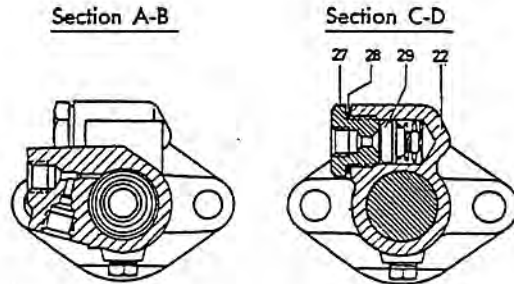
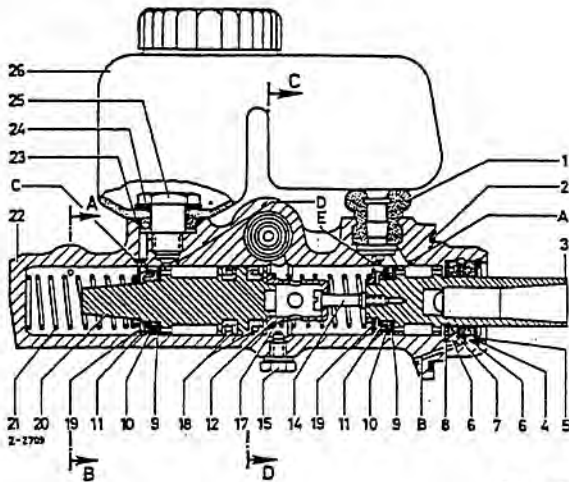


Fig. 42-3a/33

- |                             |   |                            |  |
|-----------------------------|---|----------------------------|--|
| 1 Plug                      | 11 Thrust ring                            | 21 Pressure spring         | A Refill port (push rod circuit)       |
| 2 O-ring                    | 12 Spring retainer                        | 22 Housing                 | B Leak port                            |
| 3 Piston (push rod circuit) | 15 Stop screw for intermediate piston     | 23 O-ring                  | C Compensating port (floating circuit) |
| 4 Piston stop washer        | 16 Sealing ring (copper)                  | 24 Spring washer           | D Refill port (floating circuit)       |
| 5 Piston stop ring          | 17 Pressure spring                        | 25 Hollow screw            | E Compensating port (push rod circuit) |
| 6 Vacuum seal               | 18 Ring cup                               | 26 Reservoir               |  |
| 7 Spacer ring               | 19 Spring retainer                        | 27 Connector               |  |
| 8 Support ring              | 20 Intermediate piston (floating circuit) | 28 Sealing ring            |  |
| 9 Piston cup washer         |   | 29 Check valve with spring |  |
| 10 Primary cup              |   |                            |  |

Disassembly:

1. Apart from a few details the disassembly procedures for the tandem master cylinder are exactly as described in paras 1-6 for the 1<sup>st</sup> version tandem master cylinder.

2. Unscrew the connecting screw (14) from the piston (3b) and remove the spring retainer (12b) together with the pressure spring (17b) (Fig. 42-3a/34).

Checking:

3. The procedures are identical with those described in the preceding sections for the 1<sup>st</sup> and 2<sup>nd</sup> version tandem master cylinders.

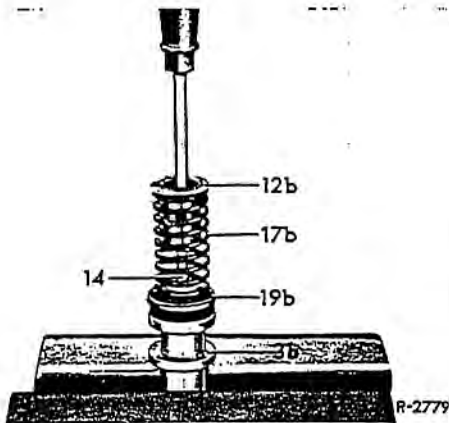


Fig. 42-3a/34

- 3b Piston
- 12b Spring retainer
- 14 Connecting screw
- 17b Pressure spring
- 19b Spring retainer

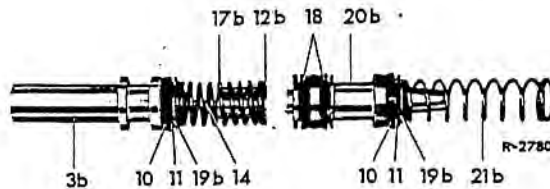


Fig. 42-3a/35

- 3b Piston
- 10 Primary cup
- 11 Thrust ring
- 12b Spring retainer
- 14 Connecting screw
- 18 Ring cup
- 19b Spring retainer
- 20b Intermediate piston
- 21b Pressure spring

**Reassembly:**

4. Screw the connecting screw (14) into the piston together with the pressure spring (17b) and the spring retainer (12b) (Fig. 42-3a/34).
5. Apart from the installation of the check valve or the special check valve further reassembly

procedures are the same as in the case of the 1<sup>st</sup> version tandem master cylinder (see paras 10 to 19).

6. For the installation of the check valve and special check valve see para 14, 2<sup>nd</sup> version tandem master cylinder.

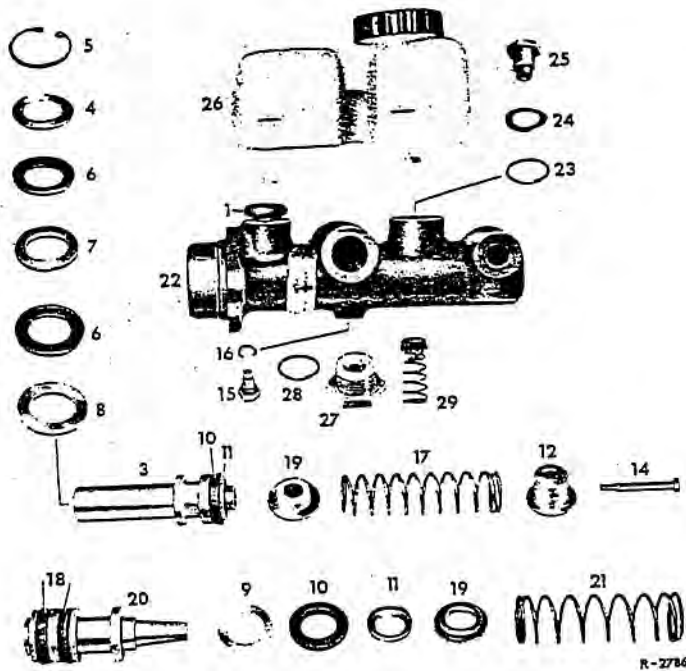


Fig. 42-3a/36

- 1 Plug
- 3 Piston (push rod circuit)
- 4 Piston stop washer
- 5 Piston stop ring
- 6 Vacuum sealing ring
- 7 Spacer ring
- 8 Support ring
- 9 Piston cup washer
- 10 Primary cup
- 11 Thrust ring
- 12 Spring retainer
- 14 Connecting screw
- 15 Stop crew for intermediate piston
- 16 Sealing ring (copper)
- 17 Pressure spring
- 18 Ring cup
- 19 Spring retainer
- 20 Intermediate piston (floating circuit)
- 21 Pressure spring
- 22 Housing
- 23 O-ring
- 24 Spring washer
- 25 Hollow screw
- 26 Reservoir
- 27 Connector
- 28 Sealing ring
- 29 Check valve or special check valve with spring

**4<sup>th</sup> Version**

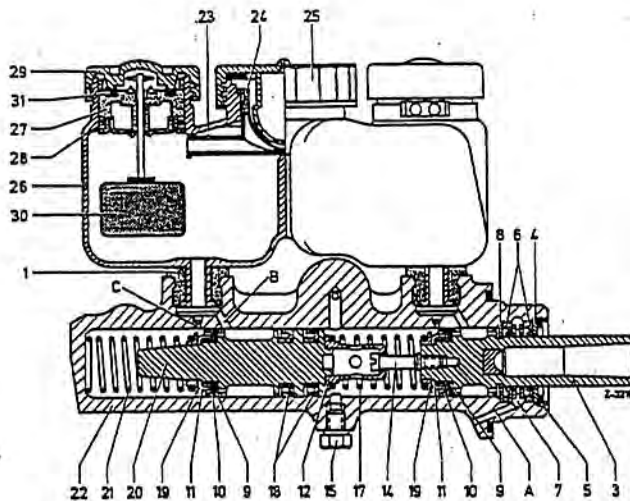


Fig. 42-3a/36 a

- |                             |                                 |
|-----------------------------|---------------------------------|
| 1 Plug                      | 20 Piston (intermediate piston) |
| 3 Piston (push rod circuit) | 21 Pressure spring              |
| 4 Piston stop washer        | 22 Housing                      |
| 5 Piston stop ring          | 23 Splash guard                 |
| 6 Vacuum sealing ring       | 24 Strainer                     |
| 7 Spacer ring               | 25 Screw cap                    |
| 8 Support ring              | 26 Reservoir                    |
| 9 Piston cup washer         | 27 Contact insert               |
| 10 Primary cup              | 28 O-ring                       |
| 11 Thrust ring              | 29 Cover cap                    |
| 12 Spring retainer          | 30 Float                        |
| 14 Connecting screw         | 31 Sealing ring                 |
| 15 Stop screw               | 17 Pressure spring              |
| 17 Pressure spring          | 18 Ring cup                     |
| 18 Ring cup                 | 19 Spring retainer              |
| 19 Spring retainer          |                                 |

**Disassembly:**

1. Apart from a few details — see the following paras 2, 3, 4 or 5 to 8 — the disassembly and reassembly procedures for the tandem master cylinder are exactly the same as for the 1<sup>st</sup> and 3<sup>rd</sup> version tandem master cylinder.
2. Lift the reservoir (26) out of the plugs (1) (Fig. 42-3 a/36 a).
3. Remove screw cap (25), strainer (24) and splash guard (23) (Fig. 42-3 a/36 a).
4. Unscrew both cover caps (29) and take out contact inserts (27). Remove O-ring (28) from the contact inserts (Fig. 42-3 a/36 b).

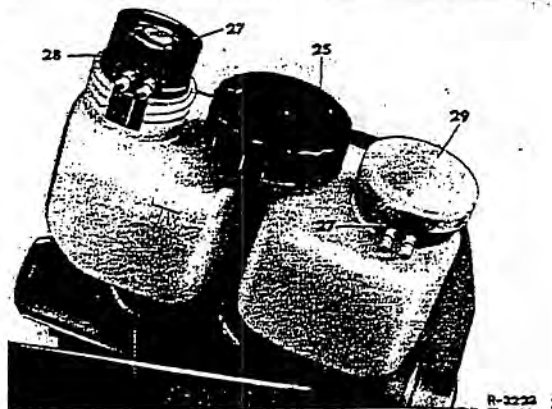


Fig. 42-3 c/36 b

- 22 Housing
- 25 Screw cap
- 26 Reservoir
- 27 Contact inserts
- 28 O-ring
- 29 Cover cap

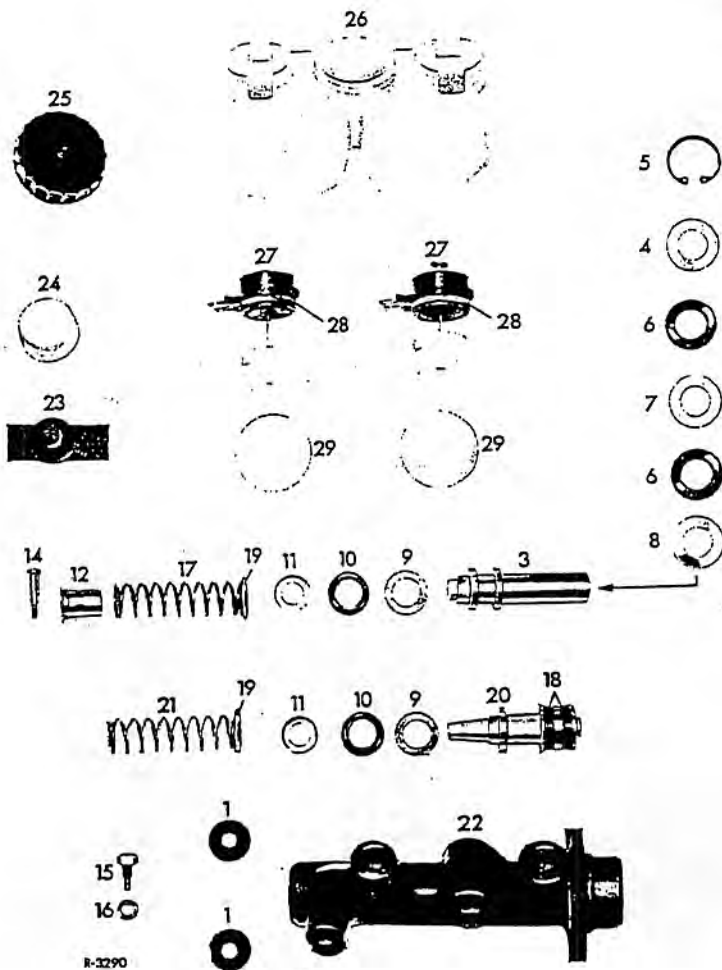


Fig. 42-3 a/36 c

- 1 Plug
- 3 Piston (push rod circuit)
- 4 Piston stop washer
- 5 Piston stop ring
- 6 Vacuum sealing ring
- 7 Spacer ring
- 8 Support ring
- 9 Piston cup washer
- 10 Primary cup
- 11 Thrust ring
- 12 Spring retainer
- 14 Connecting screw
- 15 Stop screw for intermediate piston
- 16 Sealing ring (copper)
- 17 Pressure spring
- 18 Ring cup
- 19 Spring retainer
- 20 Intermediate piston (floating circuit)
- 21 Pressure spring
- 22 Housing
- 23 Splash guard
- 24 Strainer
- 25 Screw cap
- 26 Reservoir
- 27 Contact insert
- 28 O-ring
- 29 Cover cap
- 30 Float
- 31 Sealing ring

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**Reassembly:**

5. Insert reservoir (26) in the plugs (1) of the housing (22) (Fig. 42-3 a/36 a).
6. Replace O-rings (28) on the contact inserts (27) (Fig. 42-3 a/36 b).
7. Install the contact inserts (27) in the reservoir (26) and screw on the cover caps (29).

8. Insert splash guard (23) and strainer (24) in the reservoir (Fig. 42-3 a/36 a).

**Note:** After the installation of the tandem master cylinder check the contact inserts. With the ignition switched on and the parking brake released (on Model 250 SL with the doors closed) the pilot light on the instrument cluster must light up. Then repeat the test with reservoir filled up; the pilot light must now be inactive.

**F. Check Valve and Special Check Valve**

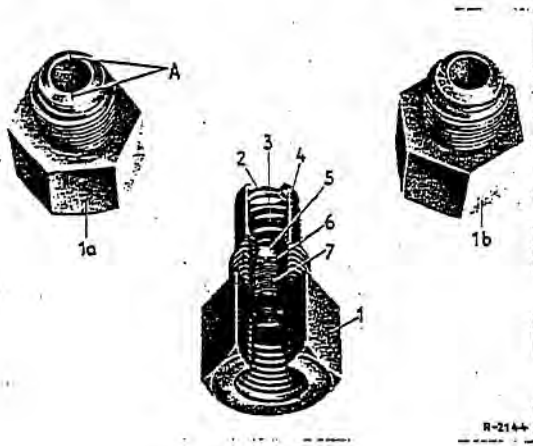


Fig. 42-3 a/37

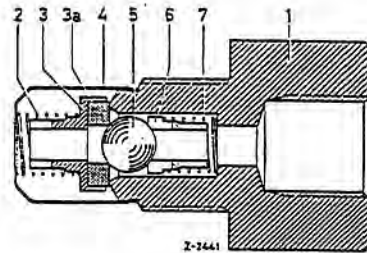


Fig. 42-3 a/38

Check valve and special check valve in the 1<sup>st</sup> version tandem master cylinder

- |                                      |  |                   |                   |
|--------------------------------------|--|-------------------|-------------------|
| 1 Connector with check valve         | 4 Metal sleeve   | 5 Connector       | 4 Metal sleeve    |
| 1a Connector for special check valve | 5 Ball   | 2 Pressure spring | 5 Ball            |
| 1b Connector for check valve         | 6 Spring sleeve  | 3 Spring retainer | 6 Spring sleeve   |
| 2 Pressure spring                    | 7 Pressure spring                                      | 3a Rubber ring    | 7 Pressure spring |
| 3 Spring retainer                    | A Notches in the connector for the special check valve |                   |                   |

**Section X-Y**

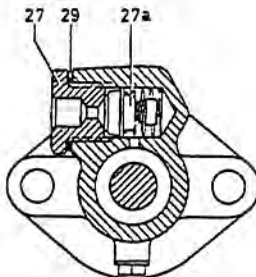


Fig. 42-3 a/39

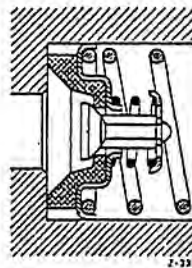


Fig. 42-3 a/40

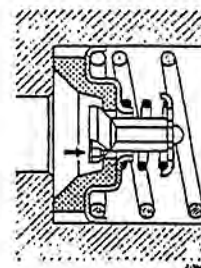


Fig. 42-3 a/41

Check valve and special check valve in the 2<sup>nd</sup> version tandem master cylinder

- |  |             |                                     |
|--|-------------|-------------------------------------|
| 27 Connector                                       | Check valve | Special check valve in Model 300 SE |
| 27a Check valve or special check valve with spring |             |                                     |
| 28 Sealing ring (copper)                           |             |                                     |

The check valve serves the purpose of keeping the brake fluid in the hydraulic system under a constant definite pressure, the so-called residual pressure (see Job No. 42-0). As a result the brakes respond quickly to even the slightest increase in pressure. In addition, the residual pressure prevents air from entering the hydraulic system.

Since the disk brakes must not have any residual pressure the brake lines for the disk brake are provided with a special check valve which permits the pressure to drop to zero when the brake pedal is released.

On the 1<sup>st</sup> Version tandem master cylinder the check valve operates as follows:

When the brake pedal is depressed the brake fluid forces the ball (5) together with the spring sleeve (6) toward the right against the pressure of the pressure spring (7) so that brake fluid can reach the individual consumer units. As soon as the brake pedal is released the returning brake fluid forces the ball together with the spring retainer (3) and the rubber ring (3a) toward the left and the brake fluid returns to the reservoir via the compensating port. However, the pressure spring (2) has been so dimensioned that the spring retainer together with the rubber ring is pushed onto the sealing seat of the connector as soon as the predetermined residual pressure is reached. This prevents a further decrease in the pressure (Fig. 42-3a/38). When the special check valve is installed the pressure in the brake lines falls to zero via the notches "A" (Fig. 42-3 a/37).

On the 2<sup>nd</sup> Version tandem master cylinder the check valve operates as follows:

When the brake pedal is depressed the brake fluid pushes the valve toward the left and flows to the consumer units. When the brake pedal is released the valve assembly is pushed toward the right against the pressure exerted by the pressure spring. As soon as the pressure corresponding to that of the pressure spring is reached the valve closes and thus maintains the necessary residual pressure (Figs. 42-3 a/39 to 42-3 a/41).

When a special check valve is installed the brake fluid escapes via the calibrated bore in the valve cone until there is no longer any residual pressure in the brake-line system.

# Primary Pressure Valve

Job No.
42-4

## A. General

The primary pressure valve has been installed in vehicles which are equipped with disk brakes on the front axle. In order to ensure that the friction pads are released quickly and safely from the brake disk there must be no residual pressure in the line system leading toward the calipers and in the calipers themselves. Since, however, on the other hand a residual pressure of approx. 0.5-0.8 atm. is still required for the proper functioning of the drum brakes on the rear axle a primary pressure valve is required between the distributor fitting on the master cylinder and the brake lines to the rear axle.

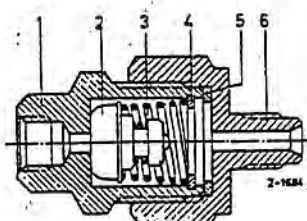


Fig. 42-4/1

- 1 Housing
- 2 Check valve
- 3 Pressure spring
- 4 Piston stop ring
- 5 Sealing ring
- 6 Threaded union

## B. Removal and Installation of Primary Pressure Valve

### Removal:

1. Detach the brake line (8) at the primary pressure valve (13) and unscrew the valve from the master cylinder (Fig. 42-4/2).

### Installation:

2. Screw the primary pressure valve into the master cylinder.
3. Connect the brake line.
4. Bleed the brake system and check for leaks.

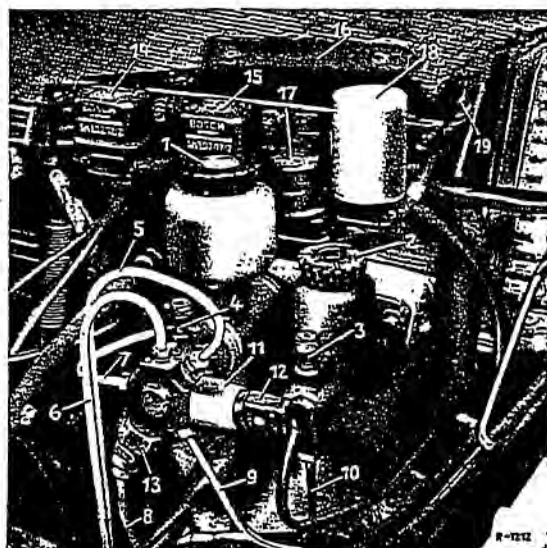


Fig. 42-4/2

Arrangement of master cylinder in cars with disk brakes on the front axle

- |                                 |   |
|---------------------------------|---|
| 1 Screw cap (master cylinder)   | 10 Line from supply cylinder to extraction cylinder |
| 2 Screw cap (supply cylinder)   | 11 Stop light switch                                |
| 3 Bleed screw (master cylinder) | 12 Plug connection                                  |
| 4 Bleed screw (supply cylinder) | 13 Primary pressure valve                           |
| 5 Brake line                    | 14 Relay  |
| 6 Brake line                    | 15 Relay  |
| 7 Brake line                    | 16 Assembly plate                                   |
| 8 Brake line                    | 17 Relay  |
| 9 Brake line                    | 18 Relay  |
|                                 | 19 Inspection lamp socket                           |



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Page 1 of 1

Abstract or introductory paragraph of text, describing the project or document.



Section header or sub-heading for the main body of text.

Main body of text, likely containing the primary findings or details of the project.

Table with multiple rows and columns, containing data or a list of items.

Table with multiple rows and columns, containing data or a list of items.

# Front Wheel Brake Cylinder

Job. No.

42-5

Modification: Attachment of 2nd version Wheel Cylinder and Section B added

## A. Removal and Installation of Wheel Brake Cylinder

### Removal:

1. Remove the brake shoes (see Job No. 42-8, Sections A and B).
2. Unscrew the hollow screws from the brake wheel cylinders and remove the brake line (4) from the brake wheel cylinders, paying attention to the rubber pad (5) between the line and the brake anchor plate (Fig. 42-5/1).

**Note:** When the brake hose has to be connected or disconnected at the brake line, the brake line should be held steady at the square socket (1) of the connector.

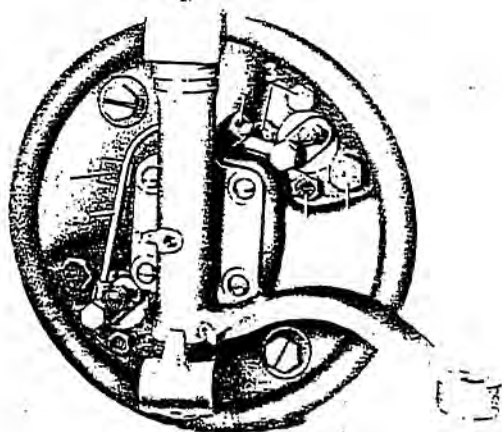


Fig. 42-5/1

- |                                      |                 |
|--------------------------------------|-----------------|
| 1 Square socket at the<br>brake line | 3 Hexagon screw |
| 2 Stop screw or<br>hexagon screw     | 4 Brake line    |
|                                      | 5 Rubber pad    |

3. Unscrew the three hexagon screws (3) and remove the brake wheel cylinder (4) (Figs. 42-5/1 and 42-5/2).

### Installation:

4. Place the brake wheel cylinder (4) in the brake anchor plate (1) and fasten with the three fixing screws (3). Fit new lock washers and make sure that the fixing screws are tightened evenly.
5. Attach the brake line (4) between the two brake wheel cylinders by means of the two hollow screws, using new copper gaskets. Then lay the rubber pad (5) between the brake line and the brake anchor plate.

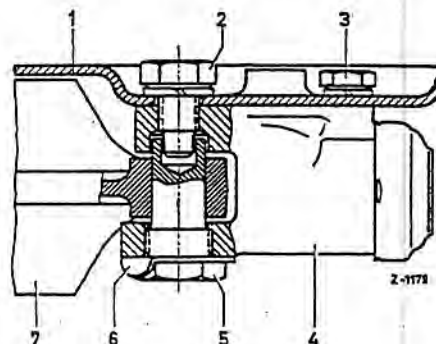


Fig. 42-5/2

1st version

- |                      |                        |
|----------------------|------------------------|
| 1 Brake anchor plate | 4 Brake wheel cylinder |
| 2 Stop screw         | 5 Anchor pin           |
| 3 Hexagon screw      | 6 Locking plate        |
|                      | 7 Brake shoe           |

**Note:** Care should be used in tightening the hollow screws in order to avoid distorting the brake line.

6. Screw in stop screw or hexagon screw (2) (Figs. 45-5/2 and 42-5/3).

42-5/1

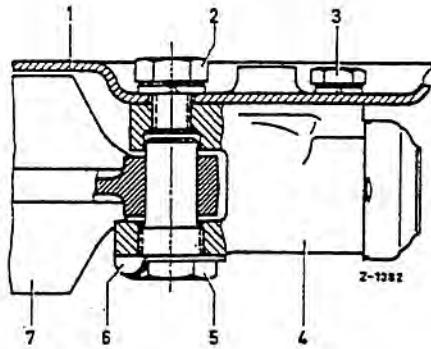


Fig. 42-5/3

2nd version

- |                      |                 |
|----------------------|-----------------|
| 1 Brake anchor plate | 5 Anchor pin    |
| 2 Hexagon screw      | 6 Locking plate |
| 3 Hexagon screw      | 7 Brake shoes   |
| 4 Wheel cylinder     |                 |

**Note:** In the 1st version of the brake shoe suspension the screw (2) is a stop screw which engages in the bore of the anchor pin and thus represents a limit stop. On the 2nd version the stop screw was replaced by a hexagon screw and in this case the stop is situated in the wheel cylinder eye.

7. Install the brake shoes (see Job No. 42-8, Sections A and B).
8. Bleed the brake system.

## B. Disassembly, Checking, and Reassembly of Wheel Brake Cylinder

1. Unscrew the bleed screw from the brake wheel cylinder.
2. Remove the actuating pin (8), the metal boot (6), and the rubber boot (7). Then remove the piston (5), the cup (4), the cup expander (3), and the stop spring (2) from the brake wheel cylinder housing (Fig. 42-5/4).
3. Thoroughly clean all parts with brake fluid or alcohol.

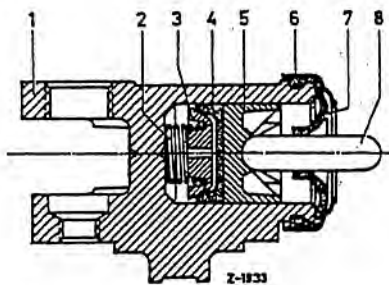


Fig. 42-5/4

- 1 Brake wheel cylinder housing
- 2 Spring
- 3 Piston cup expander
- 4 Cup
- 5 Piston
- 6 Metal boot
- 7 Rubber boot
- 8 Actuating pin

### Checking:

4. Check the brake wheel cylinder bore for wear, scoring, and rust. Scored or rusty brake wheel cylinders must be replaced (for measurements see Job No. 42-0).
5. Check the piston for scoring and wear.

### Reassembly:

6. The bore in the brake wheel cylinder, the piston, and a new cup should be lightly coated with brake fluid or ATE blue brake paste.

**Note:** When reassembling the brake wheel cylinder, always use new cups and new rubber boots.

7. Slide the stop spring (2), the cup expander (3), a new cup (4), and the piston (5) into the bore of the brake wheel cylinder (Fig. 42-5/4).
8. Press on the rubber boot (7) and the metal boot (6); then install the actuating pin (8) (see Fig. 42-5/4).

# Rear Wheel Brake Cylinder

Job No.

42-6

Modification: Note before para 9 in Section B modified

## A. Removal and Installation of Wheel Brake Cylinder

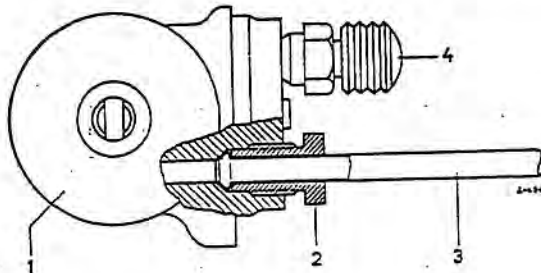


Fig. 42-6/1

- |                        |                             |
|------------------------|-----------------------------|
| 1 Wheel brake cylinder | 3 Brake line                |
| 2 Cap screw            | 4 Rubber cap of bleed screw |

### Removal:

1. Use a sturdy screw driver to force the brake shoes with automatic adjustment outward as far as they will go. Move the brake shoes with mechanical adjustment forward as far as they will go by turning the adjustment bolt.
2. Unscrew the cap screw (2) which fastens the brake line (3) to the brake wheel cylinder (1) (Fig. 42-6/1).
3. Screw out the hexagon screws from the brake wheel cylinder and pull out the brake wheel cylinder from the brake anchor plate.

### Installation:

**Note:** For some time cars with two-circuit brakes were equipped with new wheel cylinders Part No. 002 429 09 18. These wheel cylinders are provided with cups with 7 blind holes.

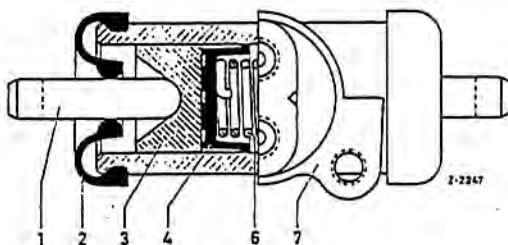


Fig. 42-6/2

- |                 |                        |
|-----------------|------------------------|
| 1 Pressure bolt | 4 Blind hole cup       |
| 2 Rubber cap    | 6 Pressure spring      |
| 3 Piston        | 7 Wheel brake cylinder |

4. Fasten the brake wheel cylinder to the brake anchor plate. Use new lock washers. Make sure that the fixing screws are tightened evenly.
5. Screw the brake line to the brake wheel cylinder.

**Note:** Make sure that the brake line is properly laid along the rear axle tubes. The rubber rings on the brake line are a protection against rubbing wear and should rest against the axle tube.

On recent cars the brake lines are attached to the rear axle tubes by means of hose straps.

6. Force the brake shoes with automatic adjustment inward with a sturdy screw driver. Move the brake shoes with mechanical adjustment inward by turning the adjustment bolt, making sure that the retaining pins are properly seated in the brake shoes.
7. In the case of mechanically adjusted brake shoes adjust the brakes (see Job No 42-20, Section A).
8. On models with automatic brake adjustment depress the brake pedal several times before starting the car, so that the brake shoes can adjust themselves and make contact with the brake drums.

**Note:** Never omit this procedure; there can be no brake action until the brake shoes have adjusted themselves.

9. Bleed the brake system.

42-6/1

## B. Disassembly, Checking, and Reassembly of Brake Wheel Cylinder

### Disassembly:

1. Unscrew the bleed screw from the brake wheel cylinder.
2. Remove the actuating pins (1) and the two rubber boots (2) (Fig. 42-6/4).

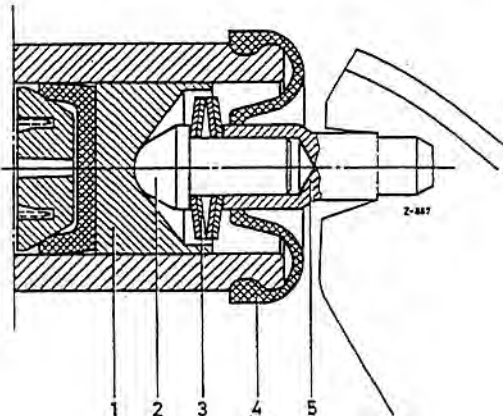


Fig. 42-6/3

Cylinder with spring-loaded actuating pin

- |              |               |
|--------------|---------------|
| 1 Piston     | 4 Rubber boot |
| 2 Bolt       | 5 Guide pin   |
| 3 Cup spring |               |

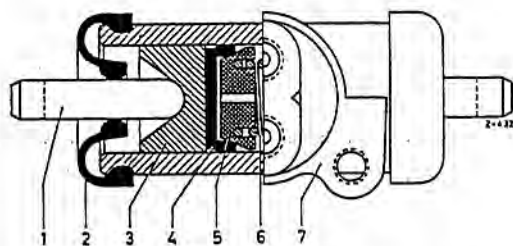


Fig. 42-6/4

Cylinder with rigid actuating pin

- |                 |                       |
|-----------------|-----------------------|
| 1 Actuating pin | 5 Piston cup expander |
| 2 Rubber boot   | 6 Spring              |
| 3 Piston        | 7 Wheel cylinder      |
| 4 Cup           |                       |

3. Remove the two pistons (3), the two cups (4), the two cup expanders (5), and the spring (6) from the brake wheel cylinder bore (Fig. 42-6/4).
4. Thoroughly clean all parts with brake fluid or alcohol.

### Checking:

5. Check the brake wheel cylinder bore for wear, scoring, and rust. Scored or rusty brake wheel cylinders must be replaced (for measurements see Job No. 42-0).

6. Check the two pistons for scoring and wear.
7. Check the spring-loaded actuating pins for ease of movement; the guide pin (5) must move easily in the bolt (2). Coat the sliding surfaces with Molycote paste type "G" before reassembly. If new cup springs (3) are installed, make sure that they have a diameter of 15 mm. These cup springs should be installed in such a way that the two pairs are opposed to one another (Fig. 42-6/3).

### Reassembly:

8. The bore in the brake wheel cylinder, the two pistons, and the two new cups should be lightly coated with brake fluid or ATE blue brake paste.

**Note:** When reassembling the brake wheel cylinder, always use new cups and new rubber boots.

For some time cars with two-circuit brake systems were equipped with  $\frac{3}{4}$ " wheel brake cylinders with blind hole cups (see Fig. 42-6/2). When repairs are carried out these blind hole cups should be replaced by the previous version cups which are contained in the Repair Set 000 586 12 42.

9. Insert a new cup (4) and piston (3) in the bore of the brake wheel cylinder. Press on a rubber boot (2) at this side (Fig. 42-6/4).
  10. Now install a cup expander (5) and the spring (6) from the other side into the brake wheel cylinder in such a way that the cup expander rests snugly against the cup (Fig. 42-6/4).
- Note:** The spring must be properly seated in the cup expander.
11. Install the second cup expander (5), the second cup (4), and the second piston (3). Then press the second rubber boot onto the brake wheel cylinder (Fig. 42-6/4).
  12. Insert the actuating pin.



# Removal and Installation of Brake Caliper

Job. No.

42-7

Modification: Various modifications (marked \*) added in Section A.  
Teves Disk Brake new in Section B.

## A. Front Brake Caliper

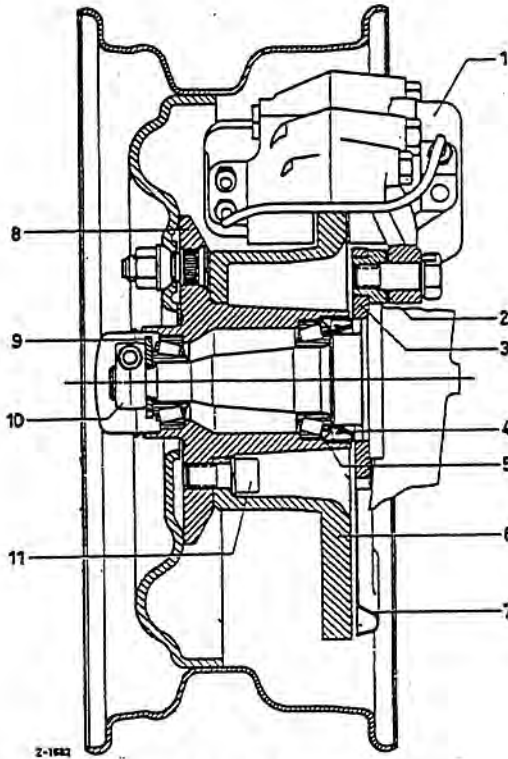


Fig. 42-7/1

3<sup>rd</sup> version

- |                            |                   |
|----------------------------|-------------------|
| 1 Brake caliper            | 5 Disk            |
| 2 Shim                     | 6 Brake disk      |
| 3 Steering knuckle bracket | 7 Cover plate     |
| 4 Rubber seal              | 8 Front wheel hub |

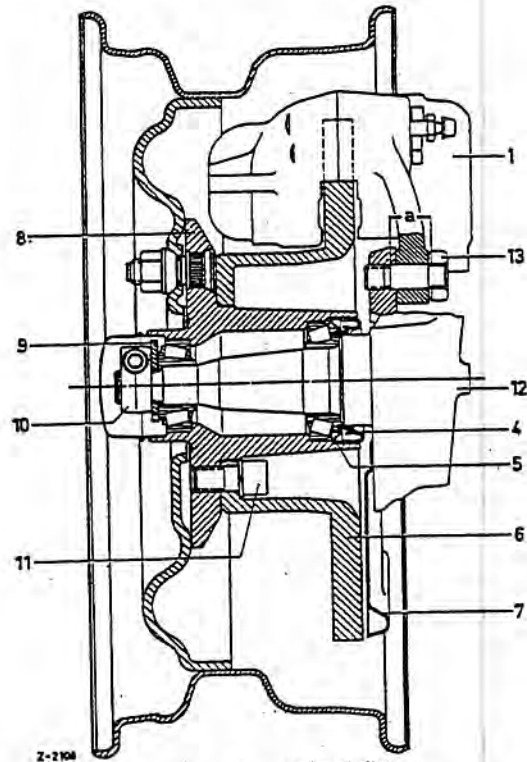


Fig. 42-7/2

1<sup>st</sup> and 2<sup>nd</sup> versions

- |                         |   |
|-------------------------|---|
| 9 Washer                | 13 Hexagon fitting screw                  |
| 10 Clamping nut         | □ = Shank length of hexagon fitting screw |
| 11 Hexagon socket screw |   |
| 12 Steering knuckle     |   |

Disk brake Make Girling

### Removal:

**Note:** In the case of Dunlop the brake caliper, as a rule, need only be removed if the brake disk or the front wheel hub has to be removed. In the case of pressure cylinder leaks it is quite sufficient to remove the cylinder from the brake caliper and to replace either the piston seal or the pressure cylinder.

1. Detach the brake line (11) from the brake caliper (9) (Figs. 42-7/5, 42-7/6, and 42-7/7).

**Note:** Various brake caliper makes have been \* installed which in the course of time have

been modified; the brake lines are connected as follows:

**Note:** On the 1<sup>st</sup> version of the Girling brake caliper the brake line is attached to the inner pressure cylinder by a hollow screw. The connector for the brake hose points upward. The bleed screw is arranged in the outer brake caliper half (Fig. 42-7/5).

In the case of the 2<sup>nd</sup> version the brake line is attached to the outer pressure cylinder. The connector for the brake hose is attached behind the steering knuckle and the bleed screw is on the inner pressure cylinder (Fig. 42-7/6).

42-7/1

In addition, heat screening plates have been arranged between the pistons and friction pads to protect the dust caps.

\* In the case of the 3<sup>rd</sup> version of the Girling brake caliper the brake line is connected to the inner pressure cylinder and the connecting line has been dispensed with (Fig. 42-7/7).

\* On the Teves brake caliper the connection is the same as on the 3<sup>rd</sup> version Girling brake caliper.

On the Dunlop disk brake the line is attached to the outer pressure cylinder (Fig. 42-7/8).

2. Tap up the locking plate (14). Unscrew the hexagon fitting screws (13) and remove the brake caliper (Fig. 42-7/5 to 42-7/8). Pay attention to the shims arranged between the bracket and the fixing eyes of the brake caliper (Figs. 42-7/1, 42-7/2, and 42-7/3).

**Note:** The brake caliper must have cooled down to normal temperature before the hexagon fitting screws are loosened.

\* In the case of 1<sup>st</sup> version steering knuckles where the brake caliper bracket is riveted to the steering knuckles, shims have been installed between the fixing eyes of the caliper and the bracket. Pay attention to the shims when removing the brake caliper.

#### Installation:

3. Attach the brake caliper to the bracket making sure that a new locking plate is used and in the case of a 1<sup>st</sup> version steering knuckle that the shims are reinstalled between bracket and fixing eyes of the brake caliper in the same way as before (Figs. 42-7/2 and 7/3).

\* Because of the larger brake disk diameter on Models 250 S, 250 SE, 300 SEb and 300 SEL only brake calipers marked '14' on the internal pressure cylinder should be installed. These brake calipers have a machined brake disk passage.

**Note:** When installing the brake caliper make sure that the bleed screw is on top.

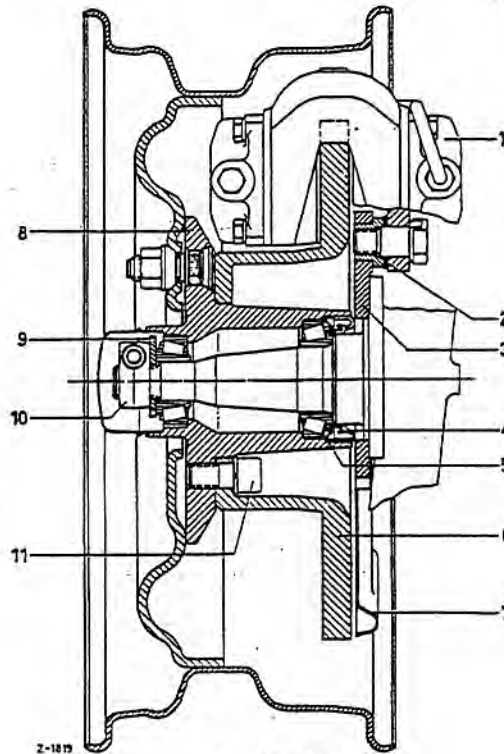


Fig. 42-7/3

#### Dunlop Disk Brake

1 Brake caliper	7 Cover plate
2 Shim	8 Front wheel hub
3 Steering knuckle bracket	9 Washer
4 Rubber seal	10 Clamping nut
5 Disk	11 Hexagon socket screw
6 Brake disk	

On 3<sup>rd</sup> version Girling brake calipers the shank of the hexagon fitting screw (13) has a length of  $a = 20$  mm. The hexagon fitting screw with a shank length of  $a = 21$  mm used on the 1<sup>st</sup> and 2<sup>nd</sup> version Girling brake calipers must on no account be used on the 3<sup>rd</sup> version caliper (Fig. 42-7/2).

\* The locking plates have been modified several times. Use locking plate Part No. 111 994 04 32 for Teves and Girling brake calipers and locking plate Part No. 112 994 03 32 for Dunlop brake calipers. The sheet-metal extension of this locking plate should be bent over the rubber ring (19) of the brake line in order to secure the line in position (Fig. 42-7/8).

Also for the Dunlop brake caliper has the locking plate been changed. The extended locking plate has to be bent over the rubber ring (19) of the brake line in order to ensure that the brake line has been properly laid. The locking plate has the Part. No. 112 994 03 32 (Fig. 42-7/8).

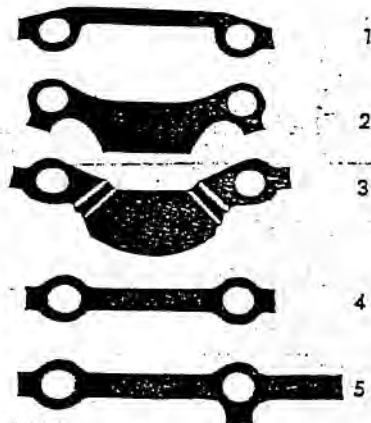


Fig. 42-7/4

R-1223

- 1 Locking plate Part No. 111 994 01 32 for Girling brake caliper 1st and 2nd version
- 2 Locking plate Part No. 111 994 01 32 for Girling brake caliper 3rd version
- 3 Locking plate 2nd version Part No. 111 994 04 32 for Girling brake caliper 3rd version and Teves brake caliper
- 4 Locking plate 1st version Part No. 112 994 01 32 for Dunlop brake caliper
- 5 Locking plate 2nd version Part No. 112 994 03 32 for Dunlop brake caliper

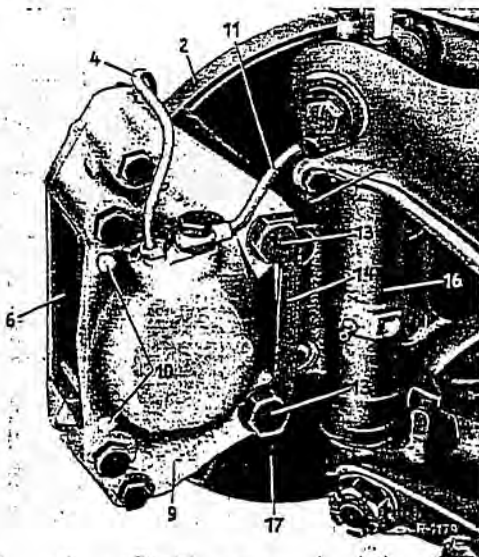


Fig. 42-7/5

Arrangement of Girling disk brake 1st version

- |                              |                             |
|------------------------------|-----------------------------|
| 2 Brake disk                 | 13 Hexagon fitting screw    |
| 4 Connecting line            | 14 Locking plate            |
| 6 Friction pad               | 15 Steering knuckle bracket |
| 9 Brake caliper              | 16 Steering knuckle         |
| 10 Locking pin               | 17 Cover plate              |
| 11 Brake line with connector |                             |

4. Use a feeler gage to check the position of the brake caliper in relation to the brake disk at the machined points "M" of the brake calipers as follows (Figs. 42-7/11 and 42-7/12).

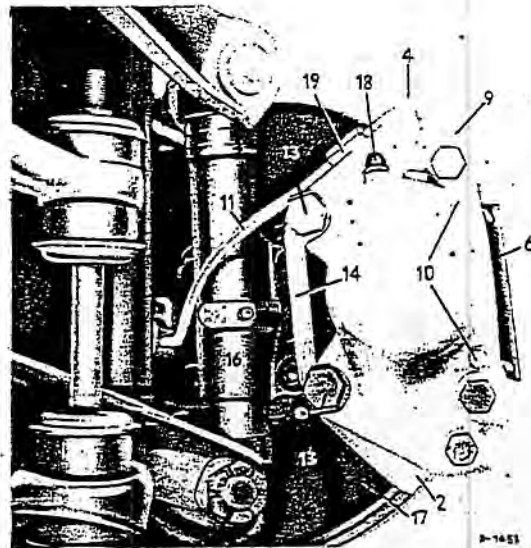


Fig. 42-7/6

Arrangement of Girling disk brake 2nd version

- |                              |                          |
|------------------------------|--------------------------|
| 2 Brake disk                 | 13 Hexagon fitting screw |
| 4 Connecting line            | 14 Locking plate         |
| 6 Friction pad               | 16 Steering knuckle      |
| 9 Brake caliper              | 17 Cover plate           |
| 10 Locking pin               | 18 Bleed screw           |
| 11 Brake line with connector | 19 Rubber lug            |

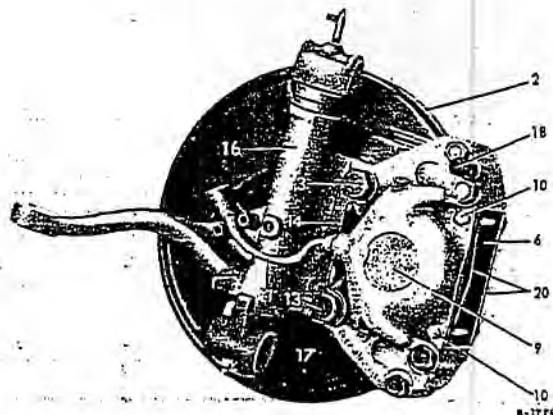


Fig. 42-7/7

Arrangement of Girling disk brake 3rd version

- |                              |                                |
|------------------------------|--------------------------------|
| 2 Brake disk                 | 14 Locking plate               |
| 6 Friction pad               | 16 Steering knuckle            |
| 9 Brake caliper              | 17 Cover plate                 |
| 10 Locking pin               | 18 Bleed screw with rubber cap |
| 11 Brake line with connector | 20 Heat screening plate        |
| 13 Hexagon fitting screw     |                                |

- a) The brake caliper must be installed parallel to the brake disk. The distance between caliper and brake disk (aperture a) measured on the inner side of the brake disk must not differ between top and bottom measurements by more than the amount given in Job No. 42-0 (Figs. 42-7/11 to 42-7/14).

b) The brake caliper must be installed in such a way that the aperture (a) is as nearly the same as possible on the inside and the outside of the caliper (see Job. No. 42-0 and Figs. 42-7/11 to 42-7/14).

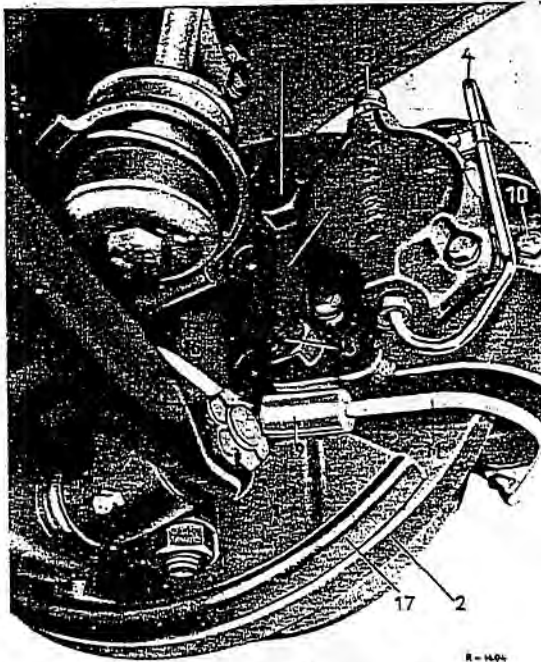


Fig. 42-7/8

Arrangement of Dunlop disk brake

- |                                  |                          |
|----------------------------------|--------------------------|
| 2 Brake disk                     | 13 Hexagon fitting screw |
| 4 Connecting line with hose clip | 14 Locking plate         |
| 9 Brake caliper                  | 16 Steering knuckle      |
| 10 Hexagon screw                 | 17 Cover plate           |
| 11 Brake line with connector     | 18 Bleed screw           |
|                                  | 19 Rubber ring           |

c) Shims are available in various thicknesses in order to facilitate proper positioning of the brake caliper in the case of 1<sup>st</sup> version steering knuckles (riveted bracket) (see Job No. 42-0).

d) If on 2<sup>nd</sup> version steering knuckles (steering knuckle and bracket forged integral) the deviations exceed the amount stated under a) and b) above, first check the steering knuckle for distortion on the fixing eyes.

Then check the caliper by measuring the distance from the aperture of the caliper to the fixing eyes. If the difference exceeds 0.2 mm the caliper must be replaced.

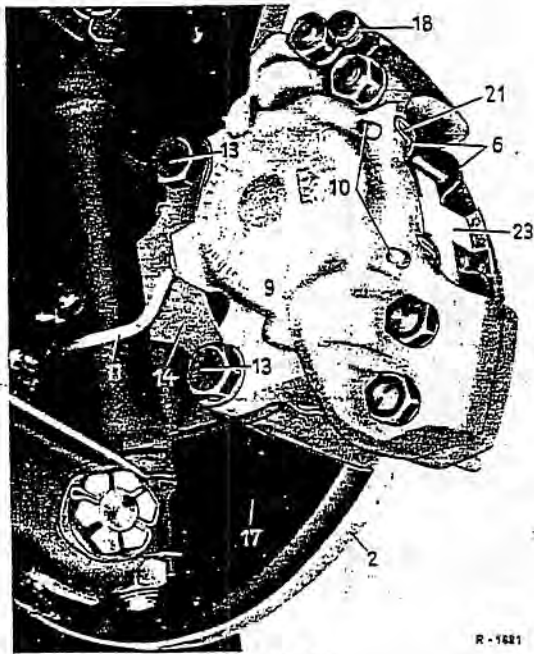


Fig. 42-7/9

Arrangement of Teves disk brake

- |                              |                                |
|------------------------------|--------------------------------|
| 2 Brake disk                 | 14 Locking plate               |
| 6 Friction pad               | 17 Cover plate                 |
| 9 Brake caliper              | 18 Bleed screw with rubber cap |
| 10 Retaining pin             | 21 Locking clip                |
| 11 Brake line with connector | 23 Cross leaf spring           |
| 13 Hexagon fitting screw     |                                |

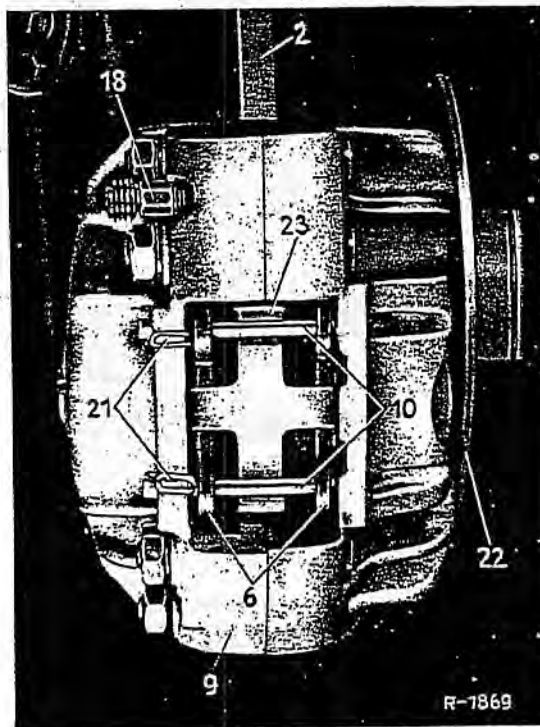


Fig. 42-7/10

Arrangement of Teves disk brake

- |                  |                                |
|------------------|--------------------------------|
| 2 Brake disk     | 18 Bleed screw with rubber cap |
| 6 Friction pad   | 21 Locking clip                |
| 9 Brake caliper  | 22 Front wheel hub             |
| 10 Retaining pin | 23 Cross leaf spring           |

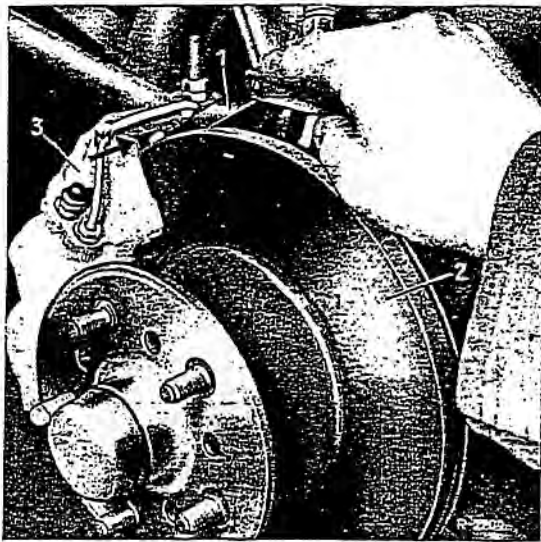


Fig. 42-7/11

Girling brake caliper

- 1 Feeler gage
- 2 Brake disk
- 3 Brake caliper
- M = Measuring point

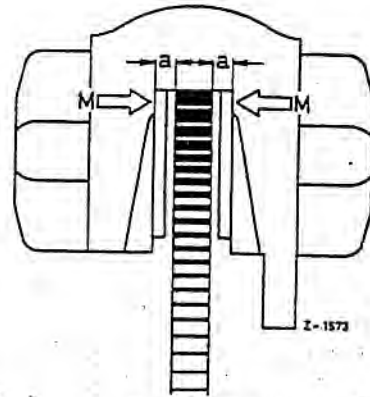


Fig. 42-7/14

M = Measuring point

5. Tighten the hexagon fitting screws with the prescribed torque. (see Job. No. 42-0) and secure by means of the locking plate.
6. Connect the brake line (11) (see Figs. 42-7/5 to 42-7/6, and 42-7/7).

Note: a) When connecting the brake line to the 1<sup>st</sup> version Girling brake caliper install new copper sealing rings (see Fig. 42-7/5).

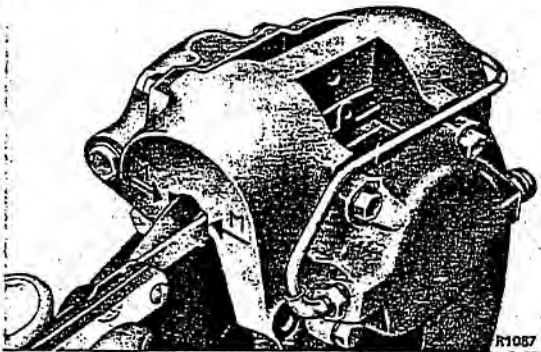


Fig. 42-7/12

Dunlop brake caliper

M = Measuring point

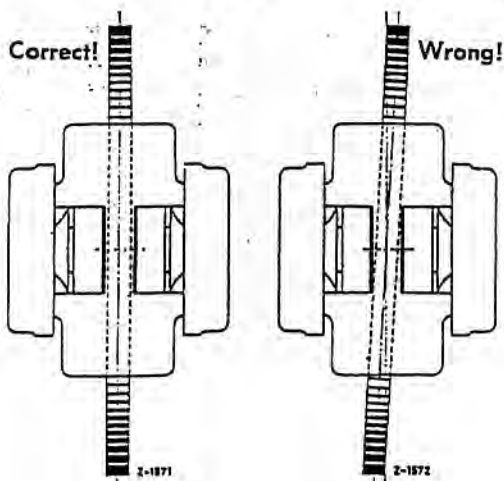


Fig. 42-7/13



Fig. 42-7/15

Arrangement of Girling brake caliper 2<sup>nd</sup> version

- 1 Front wheel hub
- 2 Brake disk
- 4 Connecting line
- 9 Brake caliper
- 11 Brake line

b) Make sure that on the 1<sup>st</sup> and 2<sup>nd</sup> version Girling brake caliper the connecting line (4) is properly laid. If a 1<sup>st</sup> or 2<sup>nd</sup> version Girling brake caliper is replaced by a 3<sup>rd</sup> version caliper, the brake line (11) must also be replaced since on the 3<sup>rd</sup> version caliper the brake line is connected to the inner pressure cylinder (Fig. 42-7/15).

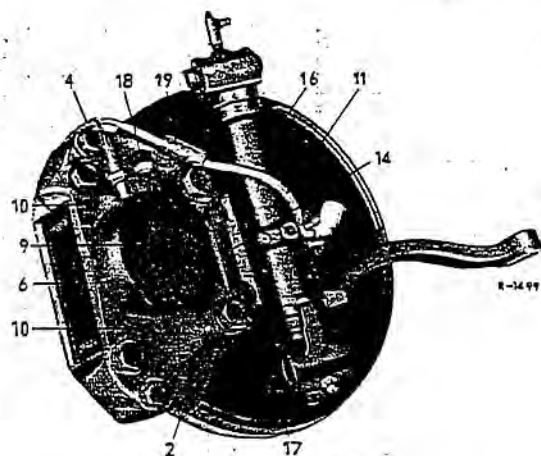


Fig. 42-7/16

Arrangement of Girling brake caliper 2<sup>nd</sup> version

- |                              |                          |
|------------------------------|--------------------------|
| 2 Brake disk                 | 13 Hexagon fitting screw |
| 4 Connecting line            | 14 Locking plate         |
| 6 Friction pad               | 16 Steering knuckle      |
| 9 Brake caliper              | 17 Cover plate           |
| 10 Locking pin               | 18 Bleed screw           |
| 11 Brake line with connector | 19 Rubber ring           |

7. Bleed the brake system and check for leaks.

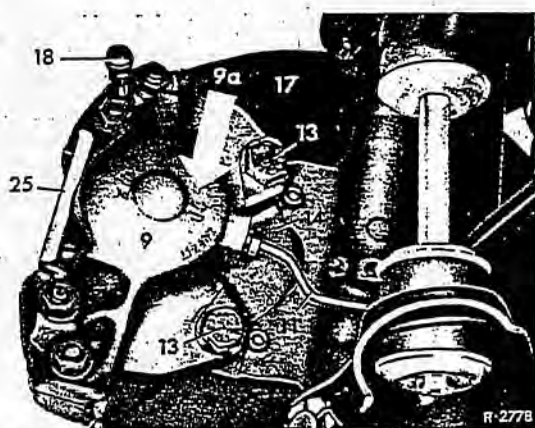


Fig. 42-7/17

- |                          |                                |
|--------------------------|--------------------------------|
| 9 Brake caliper          | 14 Locking plate               |
| 9a Code number           | 17 Cover plate                 |
| 11 Brake line            | 18 Bleed screw with rubber cap |
| 13 Hexagon fitting screw | 25 Cover plate                 |

8. Before starting the car, depress the brake pedal hard several times to make sure that on Girling and Teves disk brakes the friction pads

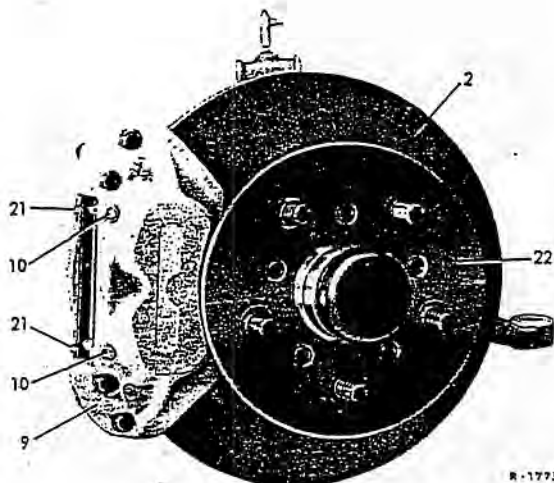


Fig. 42-7/18

Arrangement of Girling brake caliper 3<sup>rd</sup> version

- |                  |                    |
|------------------|--------------------|
| 2 Brake disk     | 21 Lock            |
| 9 Brake caliper  | 22 Front wheel hub |
| 10 Retaining pin |                    |

make contact with the brake disk and on Dunlop brake calipers the clearance between friction pads and brake disks is adjusted. Then check and if necessary top up the brake fluid reserve in the reservoir.

**Note: Do not fail to depress the brake pedal several times before driving the car away because the brakes will not operate unless the friction pads make contact with the brake disk or the correct clearance is obtained.**

9. Turn the steering mechanism to full left and right lock several times in order to make sure that the brake hoses do not rub against any part.

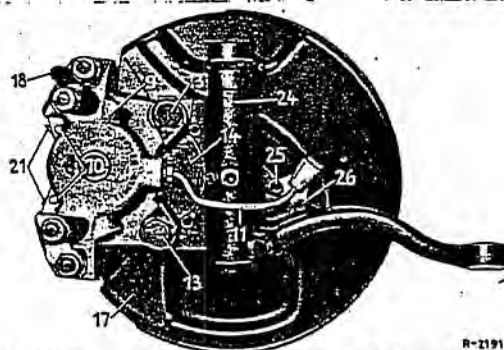


Fig. 42-7/19

- |                          |                                |
|--------------------------|--------------------------------|
| 9 Brake caliper          | 18 Bleed screw with rubber cap |
| 10 Locking pin           | 21 Locking clip                |
| 11 Brake line            | 24 Steering knuckle            |
| 13 Hexagon fitting screw | 25 Hexagon socket screw        |
| 14 Locking plate         | 26 Hexagon socket screw        |
| 17 Cover plate           |                                |

## B. Rear Brake Caliper

### a) Make Dunlop and Teves on Model 300 SE

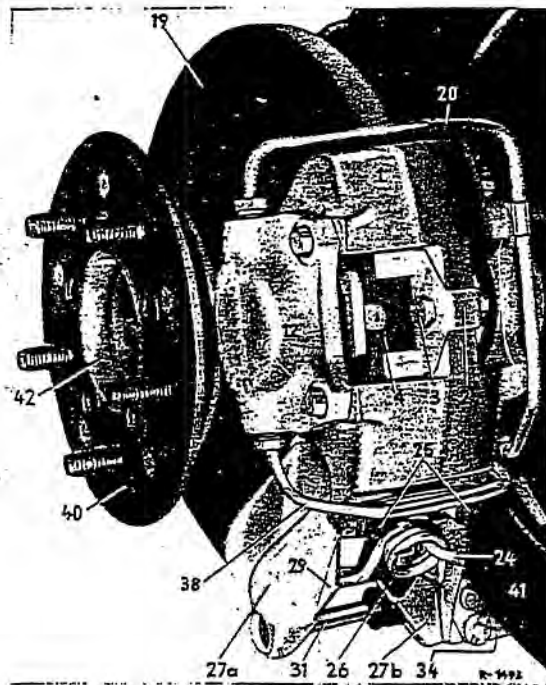


Fig. 42-7/20

#### Arrangement of Dunlop brake caliper

- |  |  |
|--|--|
| 1 Brake caliper                                      | 26 Leg spring                                    |
| 2 Stirrup  | 27a Outer lining carrier                         |
| 3 Hexagon screw with hexagon nut and serrated washer | 27b Inner lining carrier                         |
| 4 Friction pad with mounting plate (service brake)   | 29 Friction pad with mounting plate (hand brake) |
| 12 Pressure cylinder                                 | 31 Adjustment screw                              |
| 19 Brake disk  | 34 Tension lever                                 |
| 20 Connecting line with pipe clip                    | 38 Brake line                                    |
| 24 Locking plate                                     | 40 Wheel fixing disk                             |
| 25 Swing bolt  | 41 Brake support lever                           |
|  | 42 Rear axle shaft                               |

#### Removal:

**Note:** As a rule, the Dunlop brake caliper need only be removed if the brake disk, the bearing housing of the brake support or the rear axle shaft has to be removed. In the case of pressure cylinder leaks it is quite sufficient to remove the cylinder from the brake caliper and to replace either the piston seal or the pressure cylinder.

1. Disconnect the brake line (38) from the outer pressure cylinder (12) (Fig. 42-7/20).
2. Remove the hand brake caliper (see Job No. 42-25).

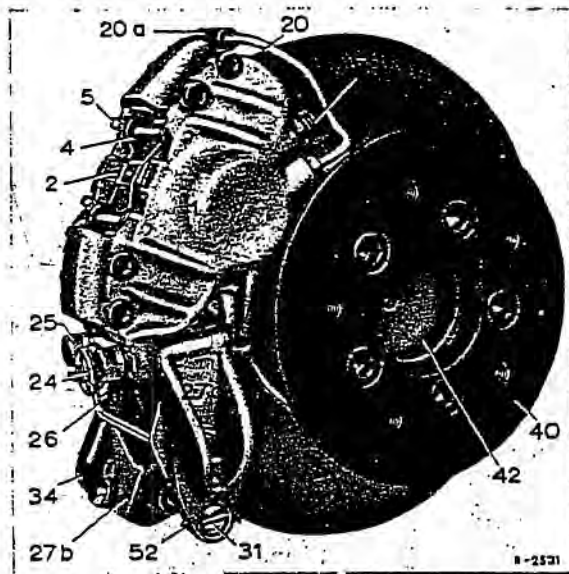


Fig. 42-7/21

#### Arrangement of Teves Brake Caliper

- |                                   |                          |
|-----------------------------------|--------------------------|
| 1 Brake caliper                   | 26 Leg spring            |
| 2 Cross leaf spring               | 27a Outer lining carrier |
| 4 Friction pad (service brake)    | 27b Inner lining carrier |
| 5 Locking clip                    | 31 Adjustment screw      |
| 20 Connecting line                | 34 Tension lever         |
| 20a Rubber ring                   | 40 Wheel fixing disk     |
| 24 Retaining plate for leg spring | 42 Rear axle shaft       |
| 25 Swing bolt                     | 52 Cotter pin            |

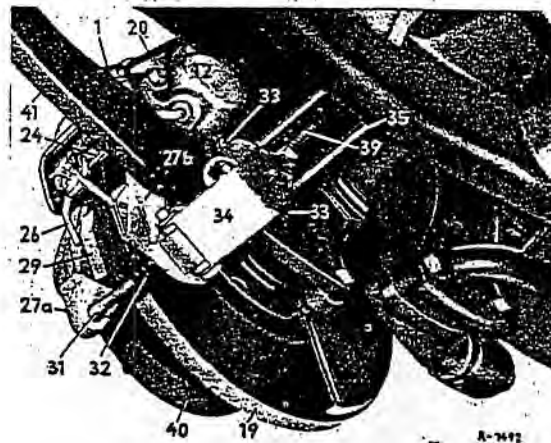


Fig. 42-7/22

#### Arrangement of Dunlop brake caliper

- |                              |                              |
|------------------------------|------------------------------|
| 1 Brake caliper              | 31 Adjustment screw          |
| 12 Pressure cylinder         | 32 Rubber sleeve             |
| 19 Brake disk                | 33 Hexagon screw with washer |
| 20 Connecting line           | 34 Tension lever             |
| 24 Locking plate             | 35 Rear brake cable bracket  |
| 26 Leg spring                | 39 Rear brake cable          |
| 27a Outer lining carrier     | 40 Wheel fixing disk         |
| 27b Inner lining carrier     | 41 Brake support lever       |
| 29 Friction pad (hand brake) |                              |

3. Tap up the locking plates (47), unscrew the hexagon fitting screws (46), and remove the brackets (48) with the welded-on nuts (Figs. 42-7/23 and 42-7/24).

4. Remove the brake caliper (1) paying attention to the shims (2) arranged between the bearing housing (41) and the caliper (Fig. 42-7/25).

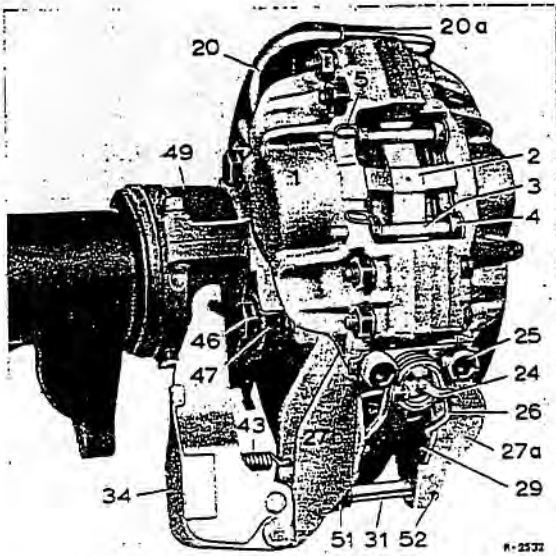


Fig. 42-7/23

Arrangement of Teves Brake Caliper

- |                                   |                              |
|-----------------------------------|------------------------------|
| 1 Brake caliper                   | 27a Outer lining carrier     |
| 2 Cross leaf spring               | 27b Inner lining carrier     |
| 3 Locking pin                     | 29 Friction pad (hand brake) |
| 4 Friction pad (service brake)    | 31 Adjustment screw          |
| 5 Locking clip                    | 34 Tension lever             |
| 20 Connecting line                | 43 Return spring             |
| 20a Rubber ring                   | 46 Hexagon fitting bolt      |
| 24 Retaining plate for leg spring | 47 Locking plate             |
| 25 Swing bolt                     | 49 Bearing housing           |
| 26 Leg spring                     | 51 Rubber sleeve             |
|                                   | 52 Cotter pin                |

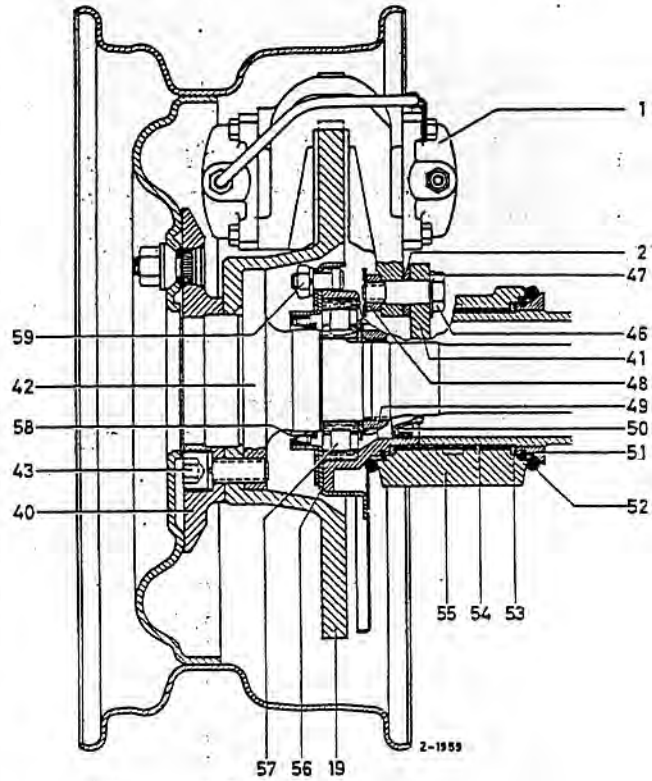


Fig. 42-7/25

- |                                      |  |
|--------------------------------------|--|
| 1 Brake caliper                      | 50 Seal  |
| 2 Shim                               | 51 Sealing ring                                  |
| 19 Brake disk                        | 52 Rubber ring                                   |
| 40 Wheel fixing disk                 | 53 Split shim                                    |
| 41 Fixing eye on the bearing housing | 54 Bearing shell                                 |
| 42 Rear axle shaft                   | 55 Bearing housing                               |
| 43 Hexagon socket screw              | 56 Sealing ring retainer                         |
| 46 Hexagon fitting bolt              | 57 Barrel roller bearing                         |
| 47 Locking plate                     | 58 Seal  |
| 48 Bracket                           | 59 Fitting bolt with hexagon nut and lock washer |
| 49 Grooved nut with lock             |  |

Installation:

5. Fit the brake caliper (1) to the bearing housing (41) and install the shims (2) between bearing housing and the fixing eyes of the caliper in the same way as before (Fig. 42-7/25).

6. Put new locking plates (47) on the hexagon fitting screws (46) and start by screwing in the top fitting screw. At the same time press in the bracket (48) with the welded-on nuts against the fitting screw (Figs. 42-7/23 and 42-7/24).

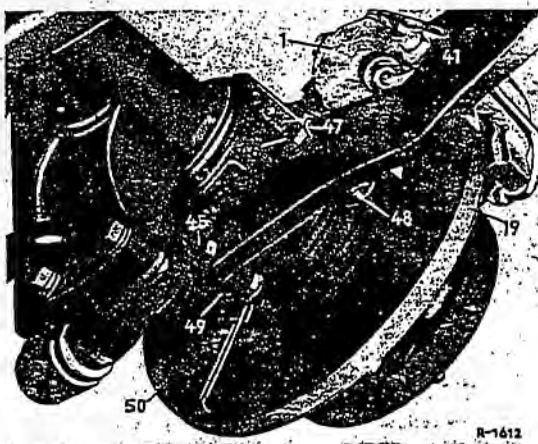


Fig. 42-7/24

- |                          |                    |
|--------------------------|--------------------|
| 1 Brake caliper          | 47 Locking plate   |
| 19 Brake disk            | 48 Bracket         |
| 41 Brake support lever   | 49 Bearing housing |
| 45 Hexagon screw         | 50 Cover plate     |
| 46 Hexagon fitting screw |                    |



**Note:** On cars equipped with Teves Brake calipers, a modified cover plate (5) (Fig. 42-7/24) has been installed. In this version the bracket with weld-on nuts is no longer required since the hexagon fitting bolts are screwed into the weld-on nuts of the cover plate.

7. Screw in the lower fitting screw.
8. Tighten the two hexagon fitting screws with the prescribed torque (see Job No. 42-0).
9. Measure the position of the brake caliper in relation to the brake disk (see Section A).

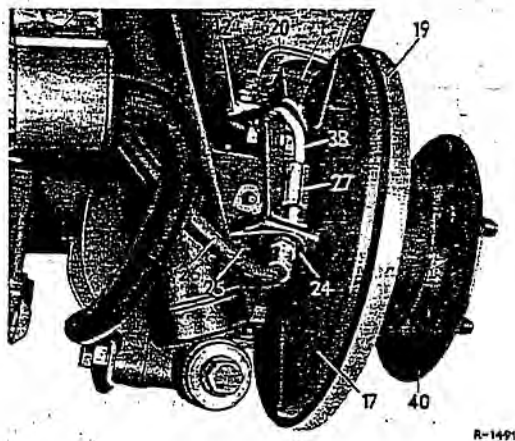


Fig. 42-7/26

1 Brake caliper	25 Hexagon screw
12 Pressure cylinder	26 Brake hose
17 Cover plate	27 Rubber ring
19 Brake disk	38 Brake line
20 Connecting line	40 Wheel fixing disk
24 Locking plate	

**Note:** a) Since the fulcrum of the right rear axle shaft and the rear axle tube are on different levels, the brake disk which is fastened to

the rear axle shaft is not always parallel to the bearing housing carrying the brake caliper when the car settles on its suspension. Before aligning the right brake caliper it is necessary therefore to lift the right axle tube until it is on the same horizontal plane as the left axle tube which is attached to the rear axle housing.

b) The shims are available in various thicknesses (see Job No. 42-0).

10. Secure the hexagon fitting screws by means of the locking plates.
11. Install the hand brake caliper (see Job No. 42-25).
12. Connect the brake line (38) making sure that the rubber ring (27) is properly positioned (Fig. 42-7/26).

**Note:** The minimum distance of the brake line (38) from the cover plate (17) is 10 mm.

13. Bleed the brake system and check for leaks.
14. Before starting the car, vigorously depress the brake pedal several times so that the clearance between friction pads and brake disk can adjust itself. Then check the amount of brake fluid in the reservoir of the main cylinder and if necessary top up.

**Note:** Do not fail to depress the brake pedal several times before driving the car away because the brakes will not operate unless the correct clearance is obtained.

b) Make Teves on Models 250 S, 250 SE, 300 SEb and 300 SEL

**Removal:**

1. Jack up the car and remove the wheels. On cars with air suspension pay attention to the lifting and jacking up instructions.

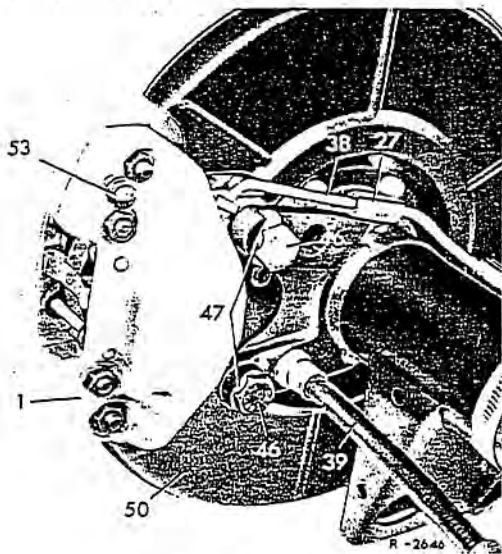


Fig. 42-7/27

Arrangement on Models 250 S, 250 SE, and 300 SEb

- |                 |                                |
|-----------------|--------------------------------|
| 1 Brake caliper | 46 Hexagon fitting screw       |
| 27 Rubber ring  | 47 Locking plate               |
| 38 Brake line   | 50 Cover plate                 |
| 39 Brake cable  | 53 Bleed screw with rubber cap |

2. Detach the brake line (38) from the brake caliper (1). Close the brake line and the connection in the brake caliper with dummy plugs.

**Installation:**

3. Fit the bracket (48) to the brake caliper fixing eyes and fit the brake caliper to the bracket on the rear axle. Screw the hexagon fitting screws (46) into the bracket using new locking plates (47), tighten the screws with the prescribed torque and lock them (see Job No. 42-0).

4. Attach the brake line to the brake caliper. Bleed the brakes and check for leaks (see Job No. 42-23).

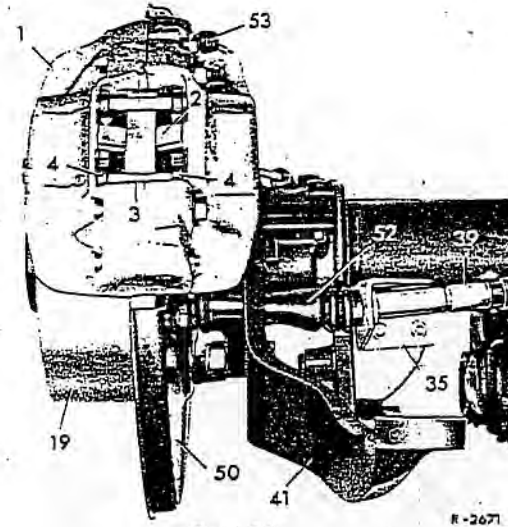


Fig. 42-7/28

Arrangement on Model 300 SEL

- |                     |                                |
|---------------------|--------------------------------|
| 1 Brake caliper     | 39 Brake cable                 |
| 2 Cross leaf spring | 41 Brake support lever         |
| 3 Locking pin       | 50 Cover plate                 |
| 4 Friction pad      | 52 Rubber sleeve               |
| 19 Brake disk       | 53 Bleed screw with rubber cap |
| 35 Cable bracket    |                                |

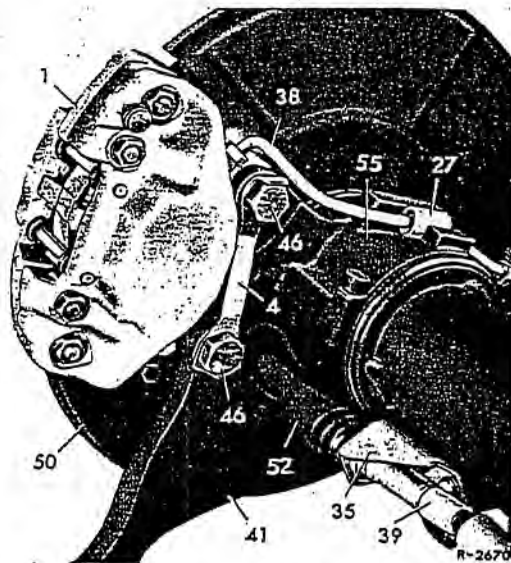


Fig. 42-7/29

Arrangement on Model 300 SEL

- |                        |                          |
|------------------------|--------------------------|
| 1 Brake caliper        | 41 Brake support lever   |
| 4 Locking plate        | 46 Hexagon fitting screw |
| 27 Rubber ring         | 50 Cover plate           |
| 35 Brake cable bracket | 52 Rubber sleeve         |
| 38 Brake line          | 55 Bearing assembly      |
| 39 Brake cable         |                          |

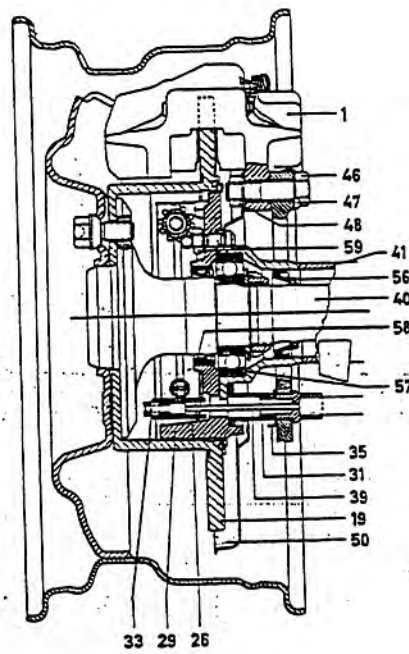


Fig. 42-7/30

- 1 Brake caliper
- 19 Brake disk
- 26 Expansion lock
- 29 Back plate
- 31 Rubber sleeve
- 33 Brake cable pin
- 35 KL Lock for brake cable
- 39 Brake cable
- 40 Rear axle shaft
- 41 Bearer tube
- 46 Hexagon fitting screw
- 47 Locking plate
- 48 Bracket with weld-on nut
- 50 Cover plate
- 56 Sealing ring
- 57 Annular grooved bearing
- 58 Sealing ring
- 59 Fitting screw with lock washer and hexagon nut

Job No.

42-8

## Removal and Installation of Front Brake Shoes

Modification: Anchor Pin Stop in Wheel Brake Cylinder

### A. Brake Shoes with Mechanical Adjustment

#### Removal:

1. After jacking up the car, remove the brake drum, if necessary by means of the three puller screws 191 589 00 35.
2. Detach the two return springs by means of Brake Spring Pliers 000 589 01 37.

**Note:** Put a suitable pad under the brake spring pliers to prevent damage to the brake lining.

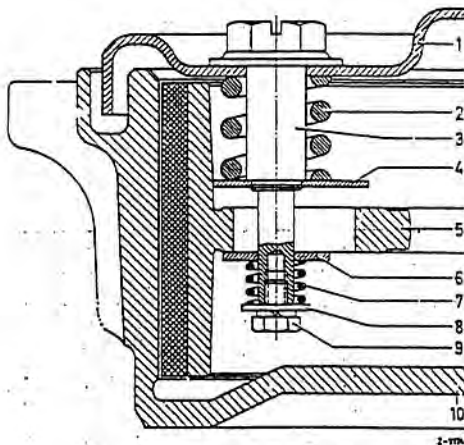


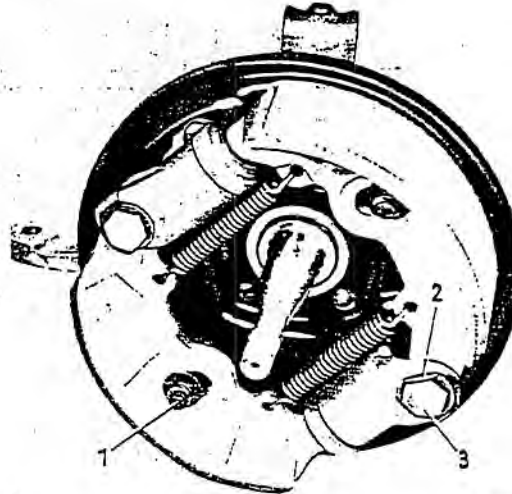
Fig. 42-8/1

- |                      |                   |
|----------------------|-------------------|
| 1 Brake anchor plate | 6 Washer          |
| 2 Pressure spring    | 7 Pressure spring |
| 3 Adjustment bolt    | 8 Washer          |
| 4 Eccentric plate    | 9 Hexagon screw   |
| 5 Brake shoe         | 10 Brake drum     |

3. Screw out the hexagon screw (9), and remove the washer (8), the spring (7), and the washer (6) (Fig. 42-8/1).

4. Screw out the stop screw (2) (Fig. 42-8/3).

**Note:** Since in the 2<sup>nd</sup> version of the brake shoe suspension the anchor pin stop (5) is located in the wheel brake cylinder, it is not necessary to screw out the hexagon screw (2) (Fig. 42-8/4).



R-857

Fig. 42-8/2

- |                 |
|-----------------|
| 1 Hexagon screw |
| 2 Locking plate |
| 3 Anchor pin    |

5. Bend the locking plate (6) upward and screw out the anchor pin (5) from the eye of the brake wheel cylinder (4) (Fig. 42-8/3 and 42-8/4).

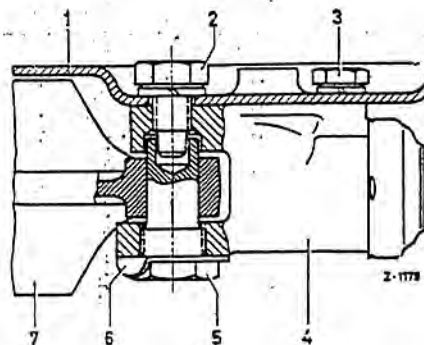


Fig. 42-8/3

#### 1<sup>st</sup> Version

- |                        |                 |
|------------------------|-----------------|
| 1 Brake anchor plate   | 5 Anchor pin    |
| 2 Stop screw           | 6 Locking plate |
| 3 Hexagon screw        | 7 Brake shoe    |
| 4 Brake wheel cylinder |                 |

6. Remove the brake shoe.
7. Follow the same procedure in removing the second brake shoe.
8. Remove the retaining pins from the brake wheel cylinders.
9. Clean brake shoes and brake anchor plate thoroughly with compressed air.

#### Installation:

10. Press the retaining pin into the brake wheel cylinder and install the brake shoe in the brake anchor plate.
11. Place the locking plate (6) over the anchor pin (5) and screw in the anchor pin (Fig. 42-8/3).
12. Secure the anchor pin with the locking plate.
13. Screw in and tighten the stop screw (2) (Fig. 42-8/3).
14. First place in position the large washer (6), the pressure spring (7), and then the small washer (8) and screw in the hexagon screw (9) until it is positioned against the adjustment bolt (3) (see Fig. 42-8/1).

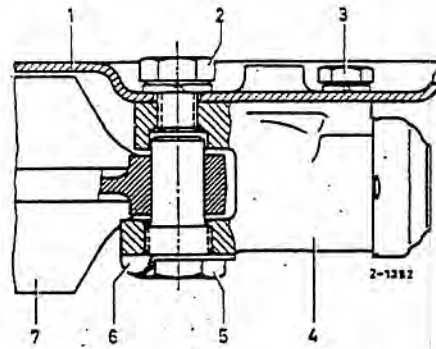


Fig. 42-8/4

#### 2nd Version

- |                        |                 |
|------------------------|-----------------|
| 1 Brake anchor plate   | 5 Anchor pin    |
| 2 Hexagon screw        | 6 Locking plate |
| 3 Hexagon screw        | 7 Brake shoes   |
| 4 Wheel brake cylinder |                 |

**Note:** The purpose of the pressure spring (8) is to press the brake shoe against the contact plate of the brake anchor plate.

15. Attach the return springs.
16. Install the brake drum and the wheel.
17. Adjust the brakes (see Job No. 42-20, Section A).
18. Jack down the car.

### B. Brake Shoes with Automatic Adjustment

#### Removal:

1. After jacking up the car, remove the brake drum, if necessary by means of the three puller screws 191 589 00 35.
2. Detach the two return springs by means of Brake Spring Pliers 000 589 01 37.

**Note:** Put a suitable pad under the brake spring pliers to prevent damage to the brake lining.

3. Remove the cotter pin (3) of the guide pin (14) at the back of the brake anchor plate and take off the washer (2). Then pull out the guide pin (14) together with the pressure spring (13) (Fig. 42-8/4).

4. Unscrew the bolt (4) of the automatic adjustment at the back of the brake anchor plate and remove together with the lock washer (1).

5. Screw out the stop screw (2) and remove it together with the lock washer (see Fig. 42-8/3).

**Note:** Since in the 2nd version of the brake shoe suspension the anchor pin stop (5) is located in the wheel brake cylinder, it is not necessary to screw out the hexagon screw (2) (Fig. 42-8/4).

- Bend the locking plate (6) upward and screw out the anchor pin (5) from the eye of the brake wheel cylinder (see Fig. 42-8/3).

**Note:** The anchoring of the brake shoe on the brake wheel cylinder is the same for both eccentric and automatic adjustment.

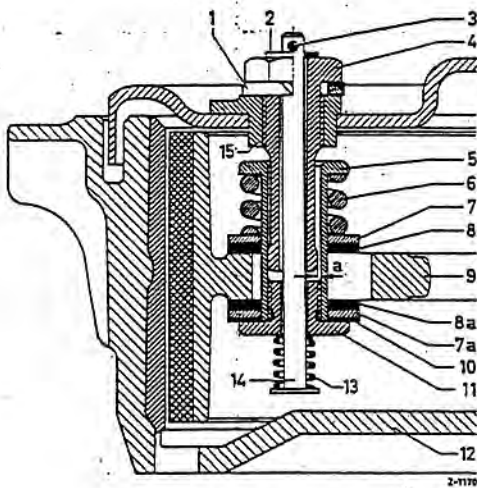


Fig. 42-8/5

- |                           |                     |
|---------------------------|---------------------|
| 1 Lock washer             | 9 Brake shoe        |
| 2 Washer                  | 10 Washer           |
| 3 Cotter pin              | 11 Tensioning screw |
| 4 Bolt                    | 12 Brake drum       |
| 5 Adjusting sleeve        | 13 Pressure spring  |
| 6 Pressure spring         | 14 Guide pin        |
| 7 and 7a Thrust washers   | a — clearance       |
| 8 and 8a Friction washers |                     |

- Remove the brake shoe.
- Follow the same procedure in removing the second brake shoe.
- Remove the retaining pins from the brake wheel cylinders.
- Clean brake shoes and brake anchor plate thoroughly with compressed air.

**Installation:**

- When reinstalling the brake shoes, the automatic adjustment and the clearance must be carefully checked. Use a sturdy screw driver to press the brake shoes outward and inward several times against the resistance of the automatic adjust-

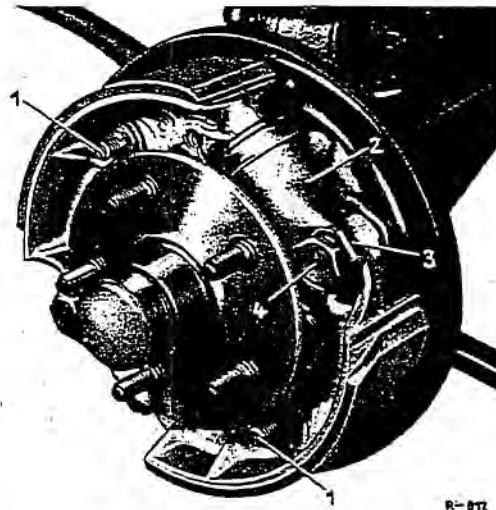


Fig. 42-8/6

- |                        |                 |
|------------------------|-----------------|
| 1 Guide pin            | 3 Locking plate |
| 2 Brake wheel cylinder | 4 Anchor pin    |

ment. The brake shoes must remain stationary in any position, even when they are forced outward as far as they will go. To check, lightly tap the sides of the brake shoes. **On no account must the return spring overcome the frictional resistance of the automatic adjustment and pull the brake shoes inward.**

- Check the clearance too with a large screw driver. When the brake shoe is released from its outward position, you should be able to hear the click produced by the adjusting sleeve striking against the bolt. Watch for bent bolts. Complete clearance is indispensable, since otherwise the brake may not release if it is subjected to much stress.
- Before installing the brake drums, push the brake shoes as far in as they will go.
- Before starting the car, and during the test run, depress the brake hard several times, so that the brake shoes can adjust themselves completely.

**Note:** Do not on any account fail to depress the brake pedal several times before starting the car because the brakes will not operate until the brake shoes have adjusted themselves.

# Removal and Installation of Rear Brake Shoes

Job. No.

42-9

*Modification: Installation instructions supplemented and extended*

## A. Brake Shoes with Mechanical Adjustment, 1st and 3rd Versions

Malleable cast iron brake shoes 50 and 65 mm wide

### Removal:

1. After jacking up the car, remove the brake drum, if necessary by means of the three puller screws 191 589 00 35.
  2. Detach the return spring for the brake shoes and the return spring for the brake lever.
- Note:** Put a suitable pad under Brake Spring Pliers 000 589 01 37 to prevent damage to the brake lining.
3. Pull out the cotter pin (10) from the adjustment bolt (1). Then remove the washer (9) together with the pressure spring (8) and the washer (7) (Fig. 42-9/1).

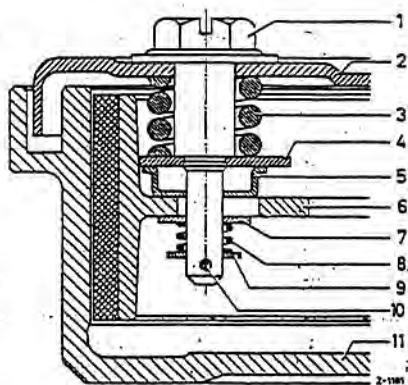


Fig. 42-9/1

Arrangement of the 50 mm brake

- |                      |                   |
|----------------------|-------------------|
| 1 Adjustment bolt    | 7 Washer          |
| 2 Brake anchor plate | 8 Pressure spring |
| 3 Pressure spring    | 9 Washer          |
| 4 Eccentric plate    | 10 Cotter pin     |
| 5 Cup washer         | 11 Brake drum     |
| 6 Brake shoe         |                   |

4. Screw out the hexagon screw for the brake shoe attachment from the anchor pin and remove it together with the lock washer, the steel washers, and the brass washer.

5. Detach the two brake shoes from the anchor pin and the rear brake cable from the brake lever.
6. Detach the pressure spring from the anchor pin.

**Note:** In order to prevent the pistons and cups from dropping out of the brake wheel cylinder, it is advisable to fit a Piston Clamp 000 589 02 37.

7. Clean brake shoes and brake anchor plate thoroughly with compressed air.

### Installation:

8. Put the cup washer (5) on the adjustment bolt (1) (Fig. 42-9/1).

**Note:** On the 65 mm rear wheel brake an additional washer (7a) has been installed between the cup washer (5) and the brake shoe (6) (Fig. 42-9/2).

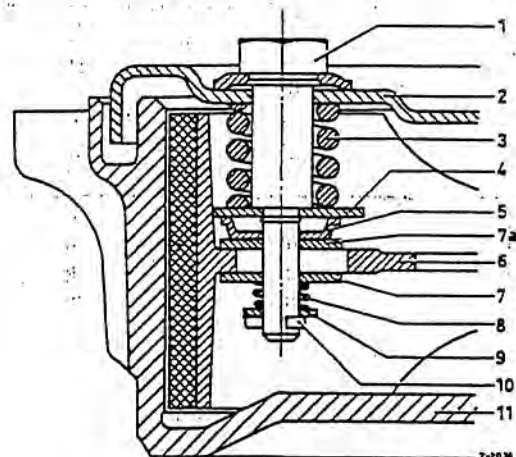


Fig. 42-9/2

Arrangement of the 65 mm brake

- |                      |                   |
|----------------------|-------------------|
| 1 Adjustment bolt    | 7 Washer          |
| 2 Brake anchor plate | 7a Washer         |
| 3 Pressure spring    | 8 Pressure spring |
| 4 Eccentric plate    | 9 Washer          |
| 5 Cup washer         | 10 Cotter pin     |
| 6 Brake shoe         | 11 Brake drum     |

42-9/1

9. Lightly grease the anchor pin (9) and slide the pressure spring (7) onto the anchor pin. Tension the pressure spring by means of Spring Clamp 180 589 01 37 (Fig. 42-9/3).

10. Install the brake shoes making sure that the brake lever strut for the hand brake properly engages the pin of the front brake shoe and that the washers are installed in their proper sequence.

**Note: Arrangement of washers on 50 mm brake shoes:** Washer (6) must be installed between the outer brake shoe (4) and the brass washer (3). The pressure spring (7) rests directly against the inner brake shoe (5) (Fig. 42-9/3).

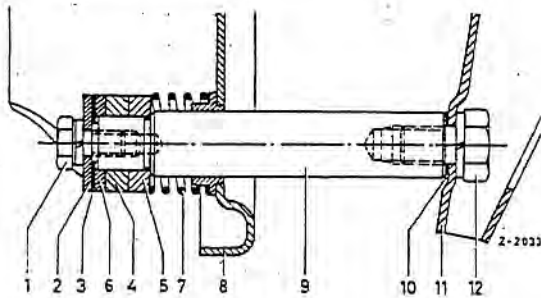


Fig. 42-9/3

- |                    |                      |
|--------------------|----------------------|
| 1 Hexagon screw    | 7 Pressure spring    |
| 2 Washer           | 8 Brake anchor plate |
| 3 Brass washer     | 9 Anchor pin         |
| 4 Outer brake shoe | 10 Shim              |
| 5 Inner brake shoe | 11 Bracket           |
| 6 Washer           | 12 Hexagon screw     |

**Arrangements of washer on 65 mm brake shoes:** Washer (6) must be installed between the inner brake shoe (5) and the

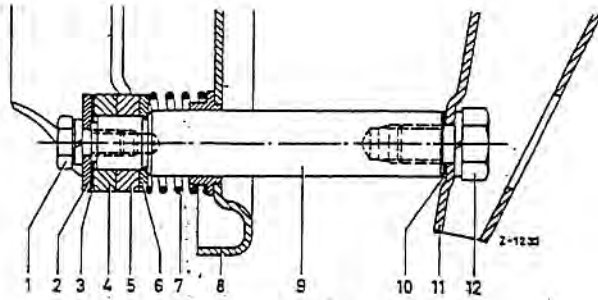


Fig. 42-9/4

- |                    |                      |
|--------------------|----------------------|
| 1 Hexagon screw    | 7 Pressure spring    |
| 2 Washer           | 8 Brake anchor plate |
| 3 Brass washer     | 9 Anchor pin         |
| 4 Outer brake shoe | 10 Shim              |
| 5 Inner brake shoe | 11 Bracket           |
| 6 Washer           | 12 Hexagon screw     |

pressure spring (7). The brass washer (3) rests directly against the outer brake shoe (Fig. 42-9/4).

11. Put on the brass washer (3) and screw in the hexagon screw (1) together with lock washer and washer (2). Remove the spring clamp (Fig. 42-9/4).

12. Install washer (7), pressure spring (8), and washer (9) on the adjustment bolt and cotter (Fig. 42-9/1).

**Note:** Make sure that the actuating pins of the wheel cylinders properly engage the brake shoes.

13. Attach the return spring for the brake shoes and the return spring for the brake lever.

14. Adjust the brakes (see Job No. 42-20, Sections A to C).

### B. Brake Shoes with Mechanical Adjustment, 2nd Version

Light-metal brake shoes 65 mm wide

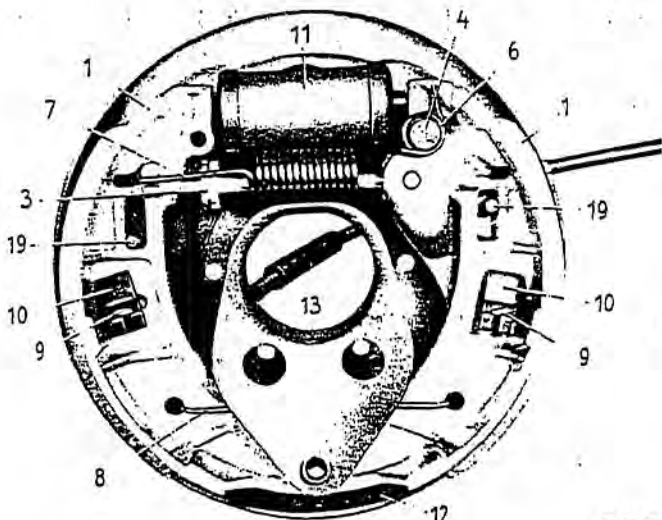


Fig. 42-9/5

- |                       |                       |
|-----------------------|-----------------------|
| 1 Brake shoes         | 9 Retaining pin       |
| 3 Push rod            | 10 Flat shaped spring |
| 4 Collar bolt         | 11 Wheel cylinder     |
| 6 Brake lever spring  | 12 Brake anchor plate |
| 7 Upper return spring | 13 Brake cable        |
| 8 Lower return spring | 14 Eccentric plate    |

#### Removal:

1. Detach the upper and lower return springs (7) and (8) (Figs. 42-9/5 and 42-9/6).



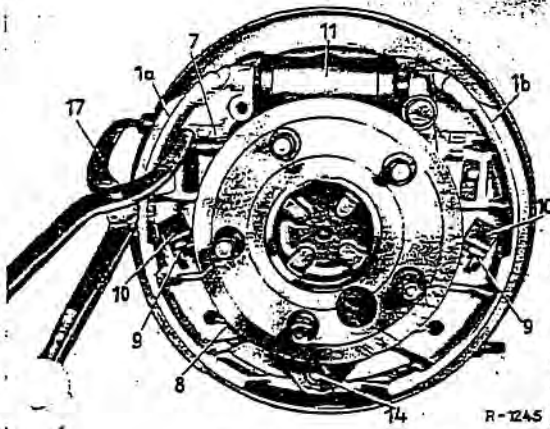


Fig. 42-9/6

- |                       |                            |
|-----------------------|----------------------------|
| 1a Front brake shoe   | 10 Flat shaped spring      |
| 1b Rear brake shoe    | 11 Wheel cylinder          |
| 7 Upper return spring | 14 Brake shoe anchor plate |
| 8 Lower return spring | 17 Brake spring pliers     |
| 9 Retaining pin       |                            |

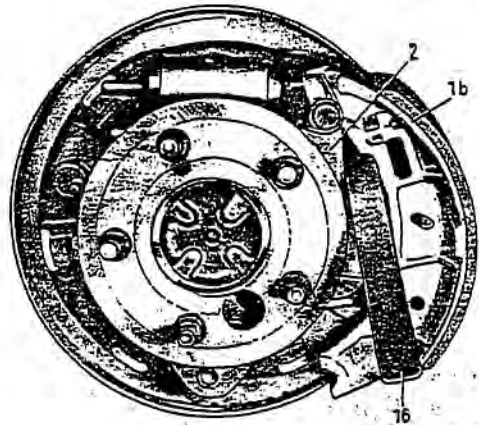


Fig. 42-9/8

- |                    |
|--------------------|
| 1b Rear brake shoe |
| 2 Brake lever      |
| 16 Spreader        |

- Remove the two flat shaped springs (10) using a pair of pliers to turn the retaining pin (9) until the flat shaped spring can be taken out. Then take the retaining pins out of the brake anchor plate (Fig. 42-9/7).

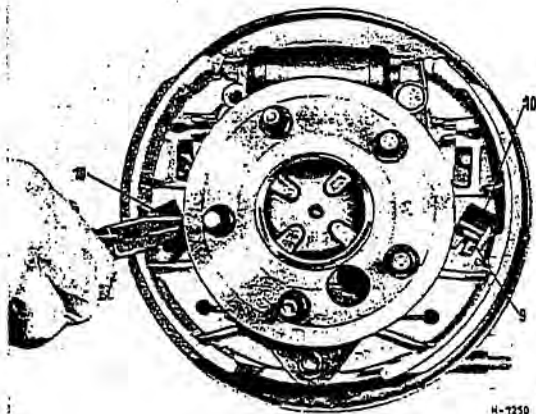


Fig. 42-9/7

- |                 |                       |
|-----------------|-----------------------|
| 9 Retaining pin | 10 Flat shaped spring |
|-----------------|-----------------------|

- Turn the two eccentrics (19) on the brake anchor plate until the brake shoes are in their extreme outward position (Fig. 42-9/2).
- Insert the spreader (16) between the brake shoes (1b) and the brake lever (2) (Fig. 42-9/8).

**Note:** It is advisable to use a piece of flat iron about 15 mm wide as a spreader.

- First remove the rear brake shoe and then the front brake shoe.
- Remove the cotter pin from the collar bolt (4). Take the collar bolt out of the brake shoe paying attention to the sleeve (5) and the return spring (6). Remove the brake lever with push rod and return spring (Fig. 42-9/9).
- Screw the push rod (3) out of the brake lever (2). Remove the upper return spring (7) from the push rod (Fig. 42-9/9).

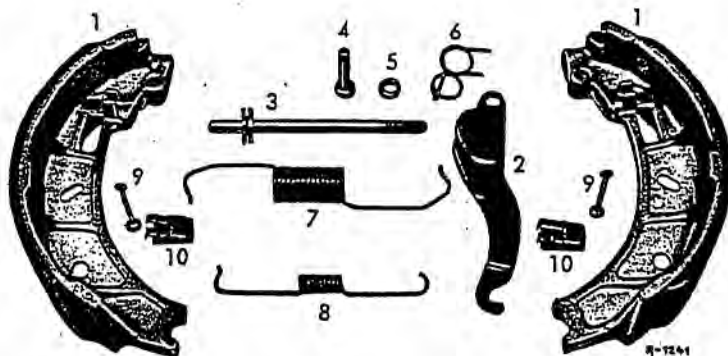


Fig. 42-9/9

- |                       |
|-----------------------|
| 1 Brake shoes         |
| 2 Brake lever         |
| 3 Push rod            |
| 4 Collar bolt         |
| 5 Sleeve              |
| 6 Return spring       |
| 7 Upper return spring |
| 8 Lower return spring |
| 9 Retaining pin       |
| 10 Flat shaped spring |

**Installation:**

8. Lightly coat the threads of the push rod (3) with Molycote Paste Type 'G'. Put the upper return spring (7) on the push rod in such a way that the long coil end points towards the push rod thread. Screw the push rod completely into the brake lever (2) (Fig. 42-9/9).
9. Attach the brake lever (2) with the push rod (3) and the return springs (6) and (7) to the rear brake shoe. Make sure that the return spring (6) is correctly positioned (see Figs. 42-9/9 and 42-9/10).
10. Attach the return spring (7) to the brake shoe (1) and lock by means of the retaining pin (15) (Fig. 42-9/10).

**Note:** Instead of the retaining pin (15) also a drift can be used for locking the return spring.

If the spring is not locked in position it may become detached when the brake shoes are installed. As the spring engages the brake shoe at the rear, reattachment of the spring is very difficult when the brake shoes are installed.

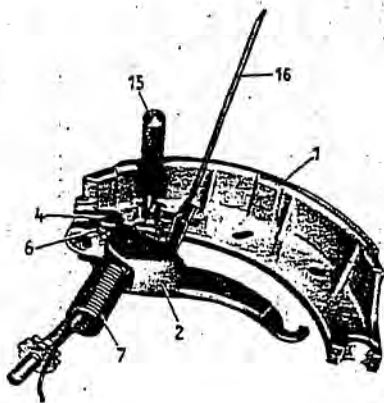


Fig. 42-9/10

- |                      |                       |
|----------------------|-----------------------|
| 1 Brake shoes        | 7 Upper return spring |
| 2 Brake lever        | 15 Retaining pin      |
| 4 Collar bolt        | 16 Spreader           |
| 6 Brake lever spring |                       |

11. Insert the spreader (16) between the brake shoe and the brake lever (2), attach the brake cable and install the brake shoes in the brake anchor plate. Then remove the spreader (Fig. 42-9/10).

**Note:** When inserting the spreader excessive tensioning of the return spring (6) should be avoided.

12. Lightly rub the anchor pin (14) and the contact surfaces (18) for the brake shoes with Molycote Paste Type 'G' (Figs. 42-9/6 and 42-9/11).
13. Insert the front brake shoe (1a) in the brake anchor plate (Fig. 42-9/6).
14. Turn the two eccentrics (19) until the brake shoes (1) are in their extreme inward position. In doing this make sure that the pressure pins of the wheel cylinder (11) engage the brake shoes properly (see Fig. 42-9/5).
15. Install retaining pins (9) into the brake anchor plate, place the flat shaped spring (10) on the retaining pin, compress it and turn the retaining pin by 90° (Fig. 42-9/12).

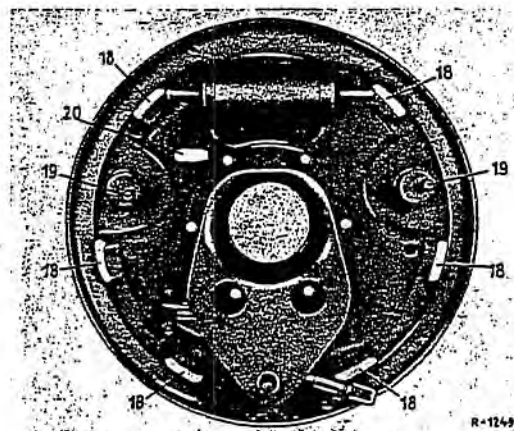


Fig. 42-9/11

- |   |
|---|
| 18 Contact surfaces for brake shoes       |
| 19 Eccentric                              |
| 20 Slotted hole in the brake anchor plate |

16. Attach the upper return spring (7) (Fig. 42-9/5).

**Note:** The return spring must be positioned between the spring guides of the brake shoe.

17. Remove the retaining pin for the return spring from the rear brake shoe.
18. Attach the lower return spring (8) (Fig. 42-9/12).

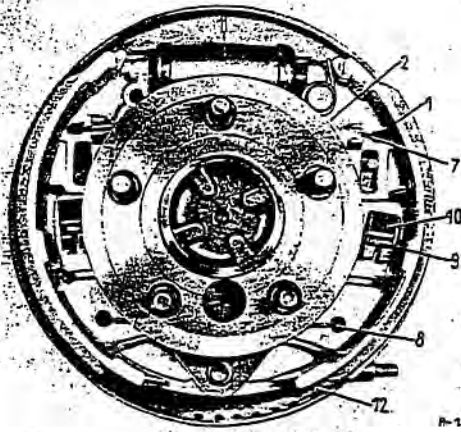


Fig. 42-9/12

- |                       |                       |
|-----------------------|-----------------------|
| 1 Brake shoes         | 9 Retaining pin       |
| 2 Brake lever         | 10 Flat shaped spring |
| 7 Upper return spring | 11 Wheel cylinder     |
| 8 Lower return spring | 12 Brake anchor plate |

**Note:** The curved end of the return spring must be attached to the front brake shoe. If the spring is installed in the wrong position the curved end may rub against the brake lever (Fig. 42-9/13).

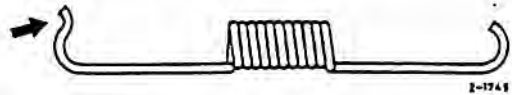


Fig. 42-9/13

19. Check whether the pins of the wheel cylinder and the push rod engage the brake shoes properly. Make sure that the return springs are properly seated.
20. Install the brake drums and the road wheels.
21. Adjust the brakes (see Job No. 42-20).

### C. Brake Shoes with Automatic Adjustment

#### Removal:

1. After jacking up the car, remove the brake drums, if necessary by means of the three puller screws 191 589 C0 35.
2. Detach the return spring for the brake shoes and the return spring for the brake lever.

**Note:** Put a suitable pad under Brake Spring Pliers 000 589 01 37 to prevent damage to the brake lining.

3. Pull out the cotter pin (4) from the guide pin (3) of the automatic adjustment. Remove the washer (2), then the guide pin (3) together with the spring (5) on both brake shoes (11) (Fig. 42-9/14).

**Note:** Since the cotter pin (4) is difficult to get at, the guide pin can be installed the opposite way. The guide pin is now installed from behind and the cotter pin with the washer is put on from the front (Fig. 42-9/14).

4. Unscrew the hexagon screw (1) for the brake shoe attachment from the anchor pin (9), and remove together with the lock washer, the washer (2) and brass washer (3) (Fig. 42-9/15).

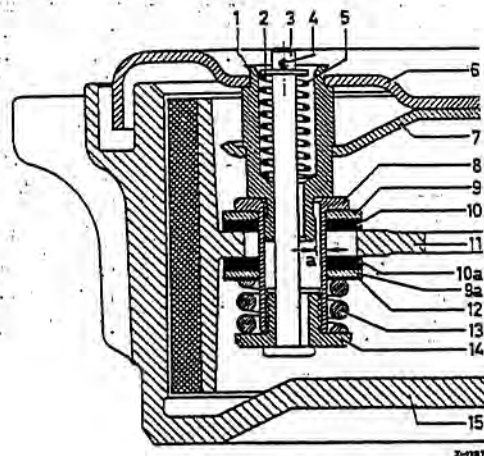


Fig. 42-9/14

- |                      |                            |
|----------------------|----------------------------|
| 1 Bolt               | 9 and 9a Thrust washer     |
| 2 Washer             | 10 and 10a Friction washer |
| 3 Guide pin          | 11 Brake shoe              |
| 4 Cotter pin         | 12 Washer                  |
| 5 Pressure spring    | 13 Pressure spring         |
| 6 Brake anchor plate | 14 Tensioning screw        |
| 7 Bow                | 15 Brake drum              |
| 8 Adjusting sleeve   | a = Clearance              |

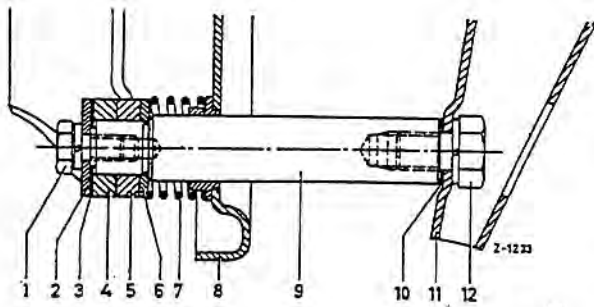


Fig. 42-9/15

- |                    |                      |
|--------------------|----------------------|
| 1 Hexagon screw    | 7 Pressure spring    |
| 2 Washer           | 8 Brake anchor plate |
| 3 Brass washer     | 9 Anchor pin         |
| 4 Outer brake shoe | 10 Shim              |
| 5 Inner brake shoe | 11 Bracket           |
| 6 Washer           | 12 Hexagon screw     |

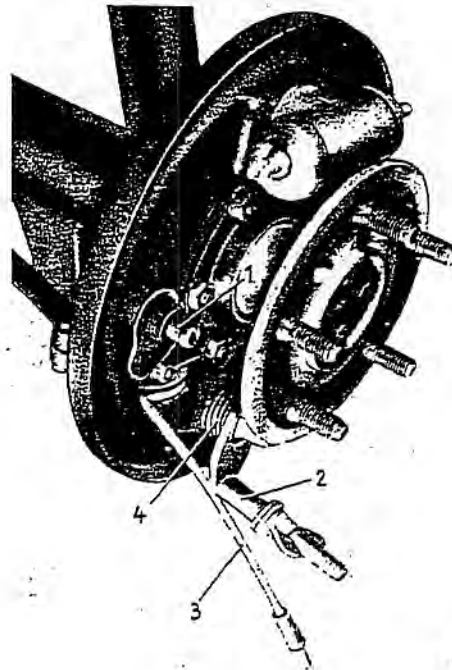


Fig. 42-9/17

- |                |                   |
|----------------|-------------------|
| 1 Bolt         | 3 Brake cable     |
| 2 Spring clamp | 4 Pressure spring |

5. Remove both brake shoes from the anchor pin and detach the rear brake cable from the brake lever.

Then remove the washer (6) and the pressure spring (7) from the anchor pin (see Fig. 42-9/15).

6. Remove the two spring-loaded pins from the brake wheel cylinder (Fig. 42-9/16).

**Note:** In order to prevent the pistons and cups from dropping out of the brake wheel cylinder it is advisable to fit a Piston Clamp 000 589 02 37.

7. Remove the pin (2) from the guide pin (5) and check the cup springs (3) for initial tension. When reassembling, coat the contact surface of the pin lightly with Molykote Paste Type "G" (Fig. 42-9/16).

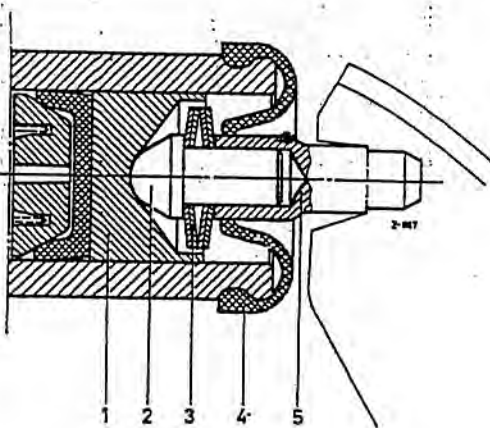
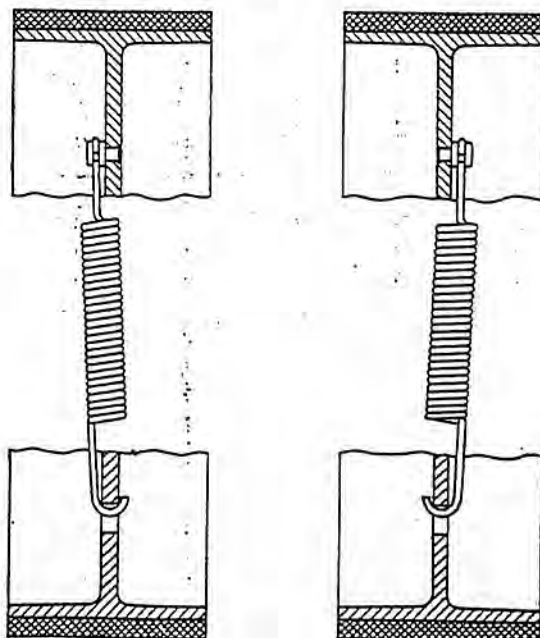


Fig. 42-9/16

- |              |             |
|--------------|-------------|
| 1 Piston     | 4 Boot      |
| 2 Pin        | 5 Guide pin |
| 3 Cup spring |             |



left

right

Fig. 42-9/18

**Note:** In order to shorten the brake pedal travel, the cup springs in the spring-loaded pressure pin have been changed. The new cup springs have an external diameter of 15 mm instead of the 20 mm diameter of the 1st version springs.

8. Clean brake shoes and brake anchor plate thoroughly with compressed air.

**Installation:**

9. When reinstalling the brake shoes, compress the pressure spring (4) with Spring clamp (2) 180 589 01 37 (Fig. 42-9/17).

10. Make sure that the proper return spring is used. The right and left return spring are shaped differently (Fig. 42-9/18).

11. Check the automatic adjustment and the clearance (see Job No. 42-8, Section B, paras 11-14).

12. Adjust the hand brake (see Job No. 42-20, Section C).

**Note:** Do not fail to depress the brake pedal several times before Driving the car away because the brakes will not operate unless the correct clearance is obtained.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. This is essential for ensuring the integrity of the financial statements and for providing a clear audit trail.

2. The second part of the document outlines the various methods used to collect and analyze data. These methods include interviews, surveys, and focus groups, each of which has its own strengths and limitations.

3. The third part of the document describes the process of identifying and defining the research objectives. This involves a thorough review of the literature and a clear statement of the research questions.

4. The fourth part of the document discusses the importance of selecting a representative sample of the population. This is crucial for ensuring that the results of the study are generalizable to the entire population.

5. The fifth part of the document outlines the various methods used to collect and analyze data. These methods include interviews, surveys, and focus groups, each of which has its own strengths and limitations.

6. The sixth part of the document describes the process of identifying and defining the research objectives. This involves a thorough review of the literature and a clear statement of the research questions.

7. The seventh part of the document discusses the importance of selecting a representative sample of the population. This is crucial for ensuring that the results of the study are generalizable to the entire population.

8. The eighth part of the document outlines the various methods used to collect and analyze data. These methods include interviews, surveys, and focus groups, each of which has its own strengths and limitations.

9. The ninth part of the document describes the process of identifying and defining the research objectives. This involves a thorough review of the literature and a clear statement of the research questions.

10. The tenth part of the document discusses the importance of selecting a representative sample of the population. This is crucial for ensuring that the results of the study are generalizable to the entire population.

# Replacement of Friction Pads

Modification: Section A supplemented, Disk Brake Make Girling 4th version added.

Job No.

42-10

## A. Make Girling

The friction pads have to be replaced when the lining thickness is 2 mm or less or when the friction pads are oily or greasy. Use only complete sets of approved friction pads.

**Note:** The Girling brake caliper Type 17/3 (1st, 2nd, and 3rd version) has two small pistons on the outer side and one large piston on the inner side.

As from spring 1967 the Girling brake caliper Type 17/2 (4th version) has been installed which has pistons with identical diameter on both sides. For this brake caliper the same friction pad repair set should be used as for the Teves brake caliper.

### Removal:

1. On the 4th version (two piston caliper) remove the shaft cover plate.

**Note:** If friction pad wear is found to be excessive check the pistons for ease of movement. If pistons do not move easily, repair the brake caliper.

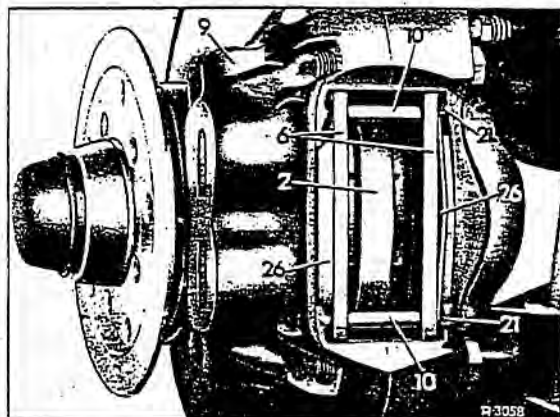


Fig. 42-10/1

- |                 |                         |
|-----------------|-------------------------|
| 2 Brake disk    | 10 Lock pin             |
| 6 Friction pad  | 21 Spring clip          |
| 9 Brake caliper | 26 Heat screening plate |

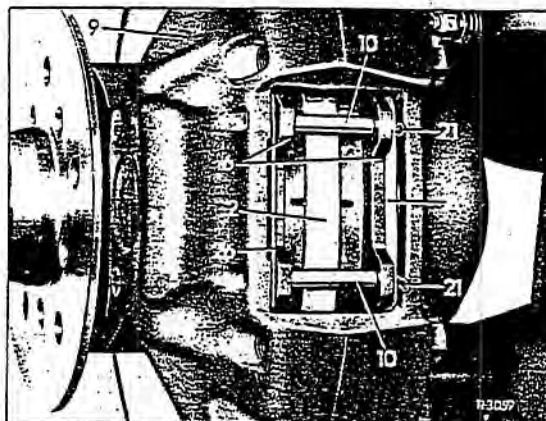


Fig. 42-10/2

- |                 |                         |
|-----------------|-------------------------|
| 2 Brake disk    | 10 Lock pin             |
| 6 Friction pad  | 21 Spring clip          |
| 9 Brake caliper | 26 Heat screening plate |

2. Remove the spring clips (21) from the lock pins (10). Take the lock pins out of the brake caliper (9) (Figs. 42-10/1 and 42-10/2).
3. Use the removal tool (30) to pull one friction pad (4) out of the brake caliper gap (Figs. 42-10/3 and 4) and clean the friction pad guide with a cylindrical brush.

**Note:** The removal tool should be made in the shop in accordance with the dimensions given in Fig. 42-10/10. As from the 2nd version, heat screening plates have been installed between the pistons and the friction pads in order to protect the dust caps.

4. Check the dust cap for cracks. If the dust cap is damaged the brake caliper must be removed and disassembled since the accumulated dirt may easily produce leaks in the brake caliper.

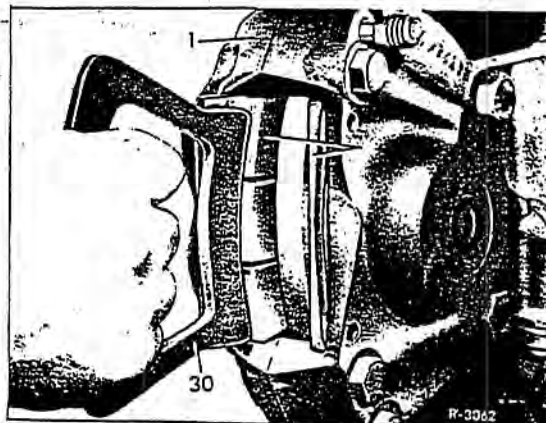


Fig. 42-10/3

- |                           |
|---------------------------|
| 1 Brake caliper           |
| 4 Friction pad            |
| 30 Piston resetting tongs |

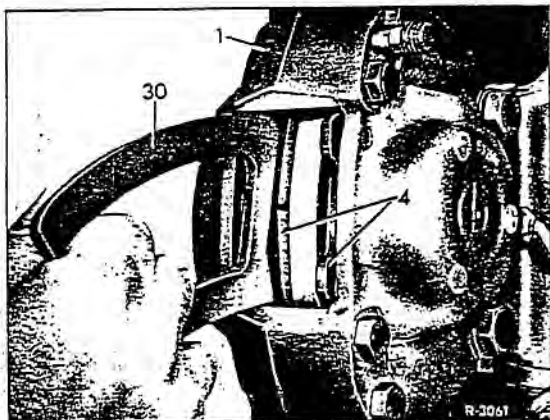


Fig. 42-10/4

1 Brake caliper 4 Friction pad 30 Removal tool

- Use the piston resetting tongs (30) to push the piston back. Make sure that one friction pad (4) always remains in the brake caliper (1) since otherwise pushing back one piston would move the opposite piston forward (Figs. 42-10/5 and 5 a).

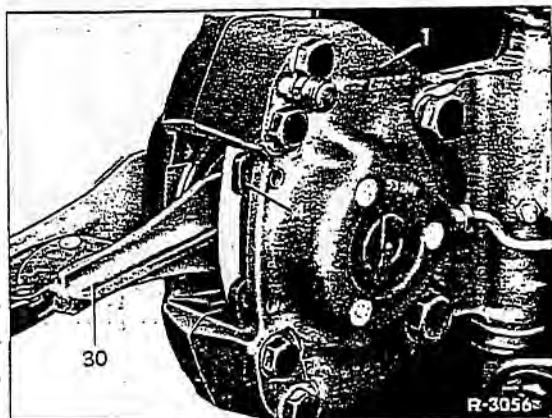


Fig. 42-10/5

1 Brake caliper 4 Friction pad 30 Piston resetting tongs

**Note:** In order to prevent overflowing of the reservoir when one piston is pushed back, a certain amount of brake fluid should always be drained from the reservoir of the brake master cylinder before the friction pads are replaced.

On the 2nd and 3rd versions of the brake caliper, care should be taken to ensure that the heat screening plates are not damaged or dented when the pistons are being forced back.

#### Installation:

- Lightly coat the areas of the friction pad marked by arrows in Fig. 42-10/5 with Molykote-Paste "U" or Liqui-Moly-Paste 36.
- Replace the second friction pad as described in para 3.

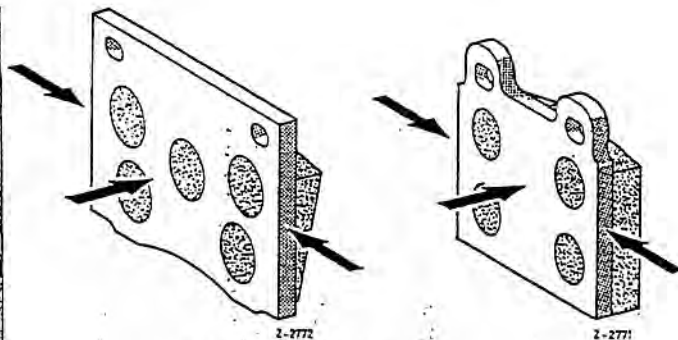


Fig. 42-10/5

1st to 3rd versions

4th version

- Install the retaining pins and spring clips, and on the 4th version caliper install also the shaft cover plate.

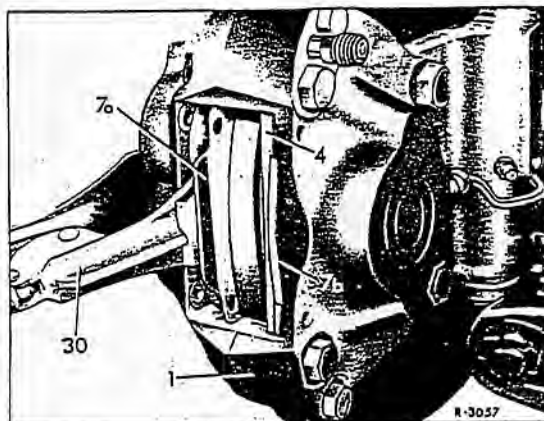


Fig. 42-10/5 a

1 Brake caliper 7b Inner heat screening plate  
4 Friction pad 30 Piston resetting tongs  
7a Outer heat screening plate

- Depress the brake pedal hard several times until a solid resistance is felt. Then check and if necessary top up the level of the brake fluid in the fluid reservoir.

**Note:** Do not on any account omit to actuate the brake pedal, since the brakes will not operate unless the friction pads make contact with the brake disk!

- When the friction pads have been replaced they should be carefully run in by braking the car several times from 80 to 40 km/h and the car should be braked to a complete stop only after the brake system has cooled down and even then deceleration should be gradual.

**Note:** If breaking in of new brake pads according to the above-specified procedure is omitted the brakes may have a tendency to act with uneven efficiency if applied hard right after installation of new pads.



## B. Make Dunlop (Service Brake)

Modification: Fig. 42-10/8 modified, dismantling tool and Section C added

**Note:** Friction pads should be replaced when they are worn down to approx. 6 mm or when they are greasy.

### Removal:

1. Unscrew the hexagon screw for fastening the stirrup (10) and remove together with the stirrup (Fig. 42-10/7).

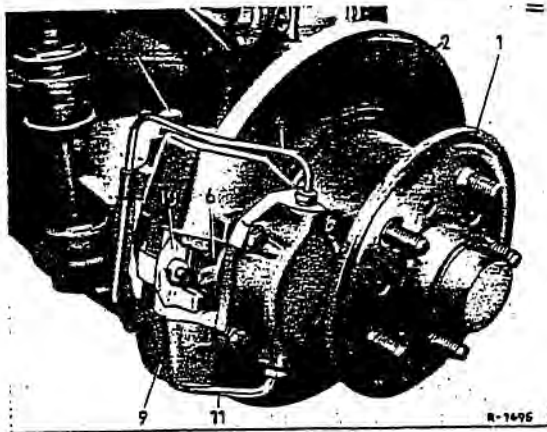


Fig. 42-10/6

- |                   |                 |
|-------------------|-----------------|
| 1 Front wheel hub | 9 Brake caliper |
| 2 Brake disk      | 10 Stirrup      |
| 4 Connecting line | 11 Brake line   |
| 6 Friction pad    | 18 Bleed screw  |

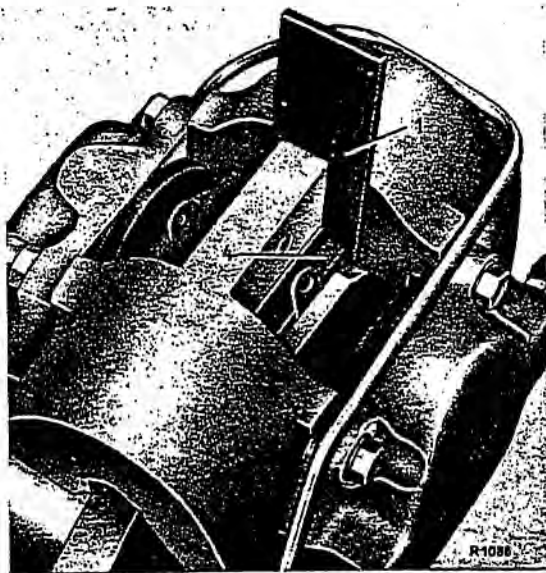


Fig. 42-10/7

- |   |
|---|
| 1 Friction pad control gage 001 589 0221 00 |
| 4 Friction pad                              |

**Note:** The friction pad control gage can be bought from our works or it can be made in accordance with measurements given in Fig. 42-10/8.

The friction pad control gage has been changed in order to make measuring of the friction pad thickness possible without removal of the stirrup (10).

2. Insert the friction pad control gage (1) in the brake caliper. If the gage tongue can be pushed to the back of the friction pad (4) the friction pad should be replaced (Fig. 42-10/7).

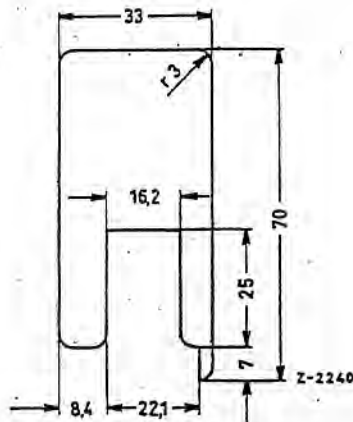


Fig. 42-10/8

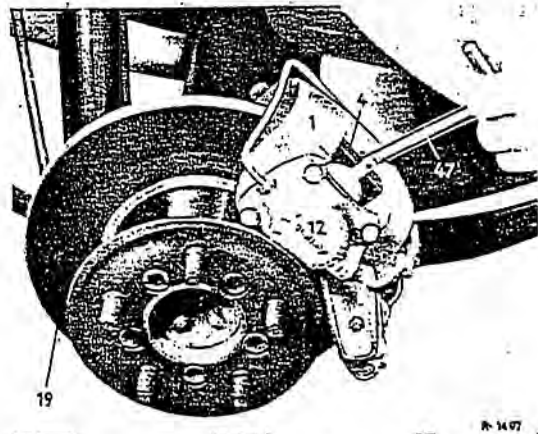


Fig. 42-10/9

- |                      |               |
|----------------------|---------------|
| 1 Brake caliper      | 19 Brake disk |
| 4 Friction pad       | 47 Hook       |
| 12 Pressure cylinder |               |

42-10/3

3. Insert a hook (47) in the fitting plate of the friction pad (4) and pull the friction pad out of the aperture of the caliper (1) (Fig. 42-10/9).

**Note:** The dismantling tool can be made in the shop according to the dimensions given in Fig. 42-10/10. This tool can be used for Girling, Dunlop, and Teves brake calipers.

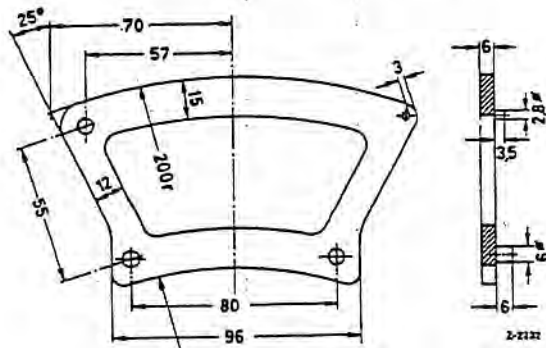


Fig. 42-10/10

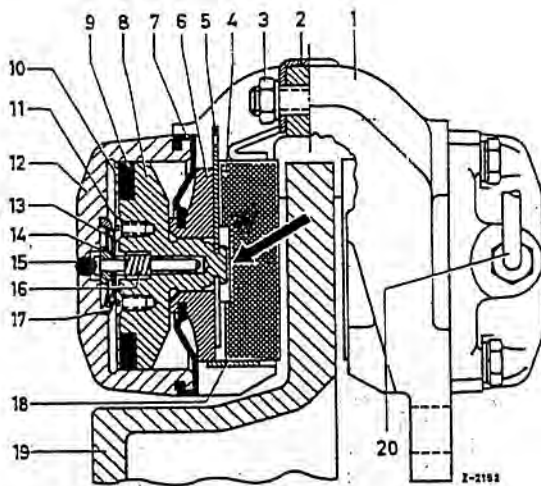


Fig. 42-10/11

- |   |                      |
|---|----------------------|
| 1 Brake caliper                                   | 10 Piston plate      |
| 2 Stirrup   | 11 Countersunk screw |
| 3 Hexagon screw with nut and serrated lock washer | 12 Pressure cylinder |
| 4 Friction pad                                    | 13 Paw spring        |
| 5 Fitting plate                                   | 14 Limiting bush     |
| 6 Lining pressure plate                           | 15 Retaining pin     |
| 7 Dust cap  | 16 Friction spring   |
| 8 Piston with guide ball                          | 17 Spring disk       |
| 9 Piston seal                                     | 18 Retaining plate   |
|   | 19 Brake disk        |
|   | 20 Connecting line   |

4. Carefully clean the friction pad guide in the caliper and thoroughly blow out with compressed air.

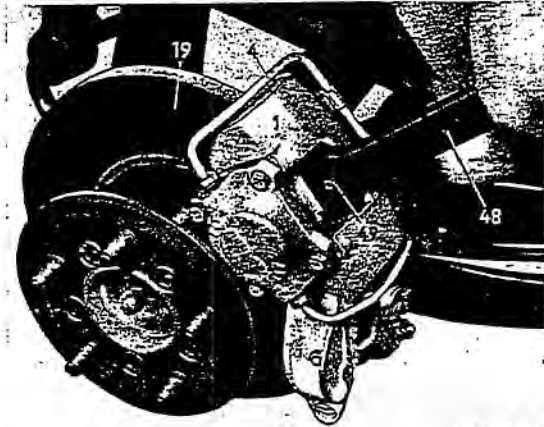


Fig. 42-10/12

- |                   |                        |
|-------------------|------------------------|
| 1 Brake caliper   | 48 Piston return lever |
| 4 Connecting line | 000 589 28 63 00       |
| 19 Brake disk     | 49 Fixing pin          |

5. Use piston return lever (48) or piston resetting tongs (48a) to push the piston in the pressure cylinder into its end position, making sure that the fixing pin (49) engages the bore for the hexagon screw (Figs. 42-10/11, 2 and 3).

Check the guide for the lining pressure plate in the caliper for binding and pressure marks. If any marks are found remove them with a scraper. Remove pressure marks on the guide quadrant of the lining pressure plate by means of fine-grain emery paper.

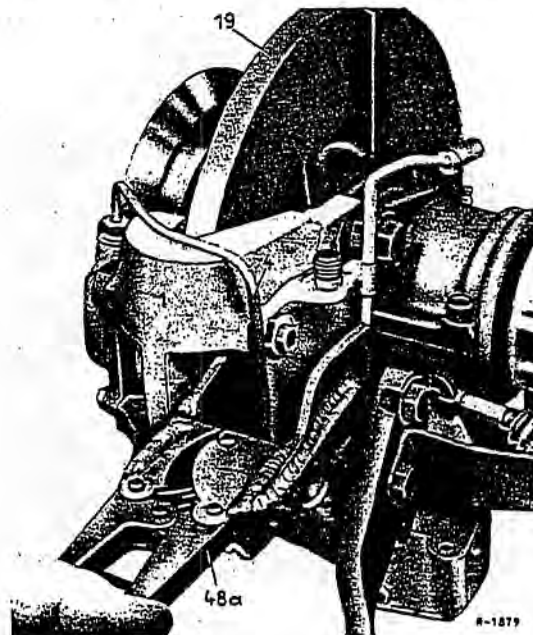


Fig. 42-10/13

- |                   |                            |
|-------------------|----------------------------|
| 1 Brake caliper   | 19 Brake disk              |
| 2 Connecting line | 48a Piston resetting tongs |

Modification: Installation procedures marked \* added or modified. Section D revised.

Check the dust cap for cracks. If cracks or other damage are found, remove the pressure cylinder and repair.

**Note:** In order to prevent overflowing of the fluid reservoir when the pistons are being pushed back, a certain amount of brake fluid should be drained beforehand.

**Installation:**

6. Install a new friction pad (4) in the guide bolt of the piston (8) taking care to ensure that the friction pad together with its fitting plate (5) properly engages the guide bolt of the piston (see arrow in Fig. 42-10/11).

**Note:** Before installing the friction pad, rub Molykote Paste "U" or graphite grease into the pad faces marked with arrows in Fig. 42-10/13a. Take care to ensure that the braking area of the friction pad is kept free from grease.

7. Attach the stirrup (10) to the caliper (9) and actuate the service brake several times so that the clearance between the friction pads and the brake disk can adjust itself (Fig. 42-10/6).

**Note:** Do not fail to depress the brake pedal \* several times before driving the car away because the brakes will not operate unless the pistons have adjusted themselves with the friction pads.

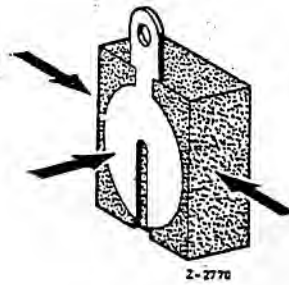
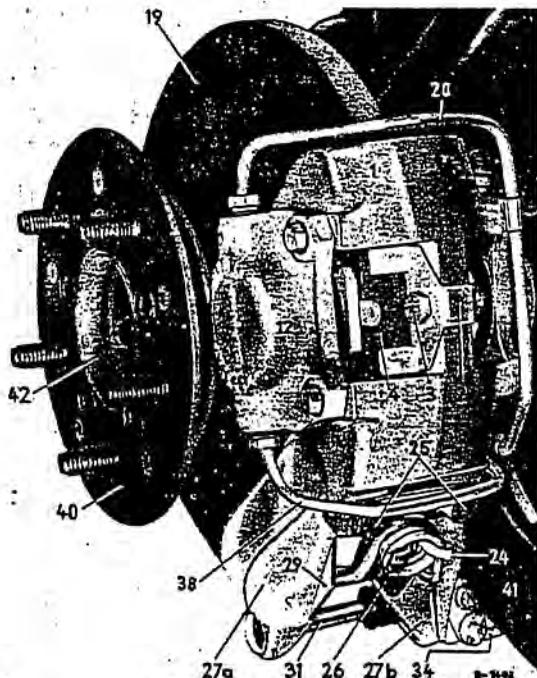


Fig. 42-10/13a

**C. Make Dunlop (Hand Brake)**

**Note:** The hand-brake friction pads have to be replaced when the lining thickness is worn down to approx. 4.5 mm (measured at the thinnest spot) or when the pads are greasy.



**Removal:**

1. Pull out the cotter pin on the outer lining carrier (27a) and back out the adjustment screw (31) several turns (Fig. 42-10/14).
2. Detach the leg spring (26) from the fitting plates of the friction pads (29) (Fig. 42-10/14).
3. Loosen the hexagon nut on the cheese head screw fastening the friction pads to the lining carriers.

Fig. 42-10/14

- |   |   |
|---|---|
| 1 Brake caliper   | 26 Leg spring                                   |
| 2 Stirrup   | 27a Outer lining carrier                        |
| 3 Hexagon nut with hexagon nut and serrated lock washer | 27b Inner lining carrier                        |
| 4 Friction pad with fitting plate (service brake)       | 29 Friction pad with fitting plate (hand brake) |
| 12 Pressure cylinder                                    | 31 Adjustment screw                             |
| 19 Brake disk   | 34 Tension lever                                |
| 20 Connecting line with pipe clip                       | 38 Brake line                                   |
| 24 Locking plate  | 40 Wheel fixing disk                            |
| 25 Swing bolt   | 41 Brake support lever                          |
|   | 42 Rear axle shaft                              |

**Note:** The hexagon nut on the inner lining carrier can only be loosened by means of an offset box wrench.

4. Use a hook (47) to lift the friction pad (29) out of the lining carrier (27). Thoroughly clean the guide for the friction pad in the lining carrier (Fig. 42-10/15).
5. Back out the wing nut (8) on the relay lever (5) as far as it will go. (Fig. 42-10/16).

**Installation:**

6. Install new friction pads (29) in the lining carriers (27a) and (27b) and tighten the hexagon nuts of the cheese head screws (Fig. 42-10/14).

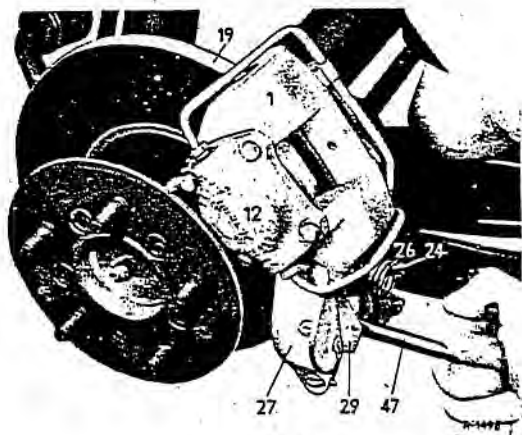


Fig. 42-10/15

- |                      |                                    |
|----------------------|------------------------------------|
| 1 Brake caliper      | 27 Lining carrier                  |
| 12 Pressure cylinder | 29 Friction pad with fitting plate |
| 19 Brake disk        | 47 Hook                            |
| 24 Locking plate     |                                    |
| 26 Leg spring        |                                    |

7. Attach the leg spring (26) to the fitting plates of the friction pads (28) (Fig. 42-10/15).
8. Screw in the adjustment screw (31) until there is a clearance of approx. 0.5 mm between the friction pads (29) and the brake disk (19). Then cotter the adjustment screw (Fig. 42-10/14).

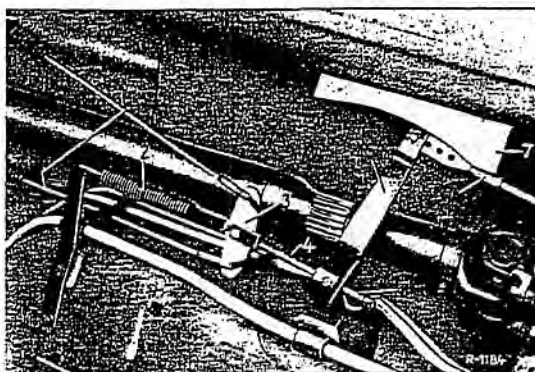


Fig. 42-10/16

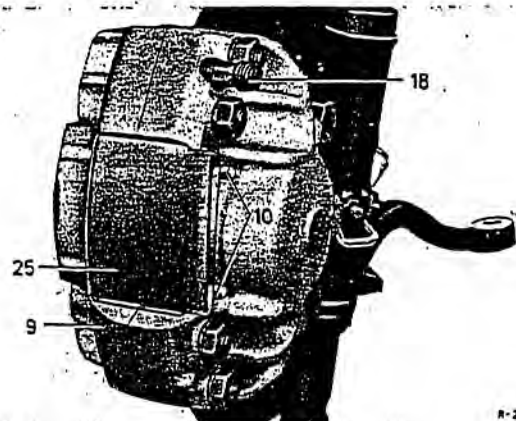
- |                     |                                      |
|---------------------|--------------------------------------|
| 1 Rear brake cables | 6 Center brake cable                 |
| 2 Return spring     | 7 Relay lever guide                  |
| 3 Equalizer         | 8 Wing nut for hand brake adjustment |
| 4 Tensioning screw  |                                      |
| 5 Relay lever       |                                      |

**Note:** The cotter pin prevents turning of the adjustment screw during the adjustment process.

10. Actuate the hand brake several times in order to adjust the distance between the friction pads and the brake disk properly.

**D. Make Teves (Service Brake)**

**Note:** The friction pads have to be replaced when the lining thickness is worn down to 2 mm, or when the pads are greasy. Install only linings that are on the approved list.



**Removal:**

1. Remove the cover plate (25), if installed, from the brake caliper (9) of the front wheel brake (Fig. 42-10/17).

Fig. 42-10/17

- |                                |
|--------------------------------|
| 9 Brake caliper                |
| 10 Locking pin                 |
| 18 Bleed screw with rubber cap |
| 25 Cover plate                 |

- Remove the locking clips on 1<sup>st</sup> version brake calipers where the lock pins (10) are secured with locking clips (21). Then drive the lock pins out of the brake caliper (9) and remove the crossleaf spring (23) (Fig. 42-10/23).

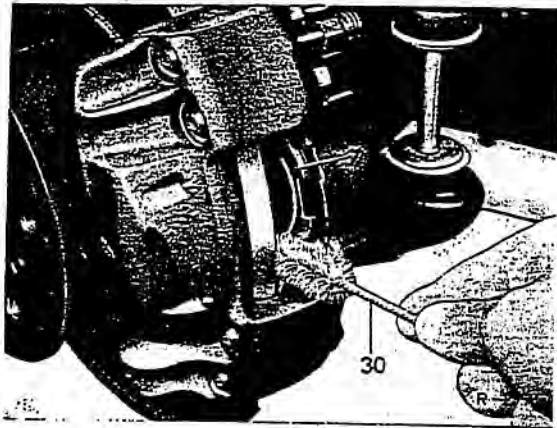


Fig. 42-10/18

- 1 Brake caliper
- 7 Heat screening plate
- 30 Cylindrical brush

- On recent brake calipers, the lock pin (3) is secured in the brake caliper (1) by means of a clamping sleeve (3a). To remove the lock pin, drive it out outward with a 4–6 mm drift (Fig. 42-10/19).
- Use the dismantling tool (30) to pull one friction pad (12) out of the gap of the brake caliper. Clean the guide for the friction pad in the brake caliper with a cylindrical brush (30) (Fig. 42-10/18).

**Note:** The dismantling tool should be made in the shop according to the dimensions given in Fig. 42-10/10.

- Check the dust cap for cracks. If the dust cap is damaged the brake caliper must be removed and disassembled since dirt intrusions are liable to produce leaks in the brake caliper very quickly.

**Note:** If excessive friction pad wear is found in the front wheel brake, make the following checks:

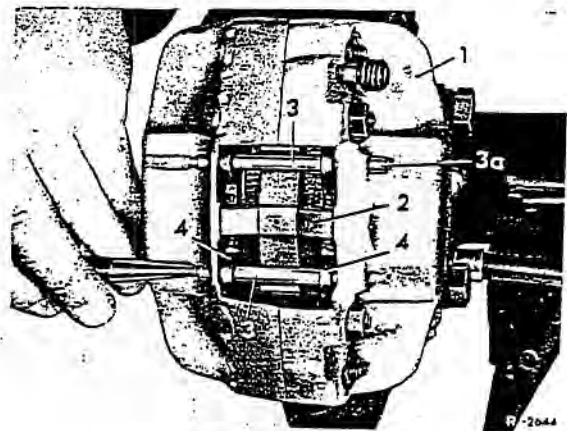


Fig. 42-10/19

- 1 Brake caliper
- 2 Crossleaf spring
- 3 Lock pin
- 3a Clamping sleeve
- 4 Friction pad

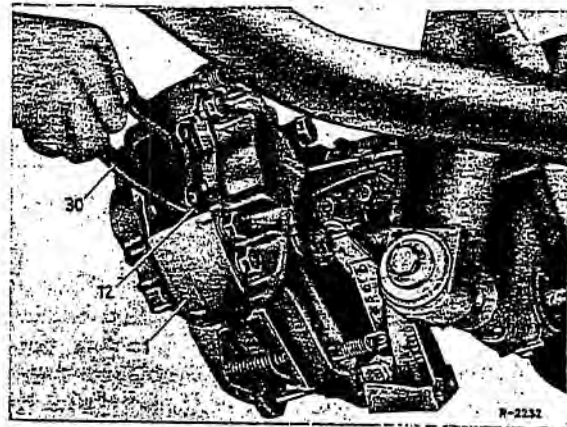


Fig. 42-10/20

- 1 Brake caliper
- 12 Friction pad
- 30 Dismantling tool

- Check the pistons in the brake caliper for free movement. When pistons do not move freely or are seized, repair the brake caliper.
- Install cover plates of the latest version. These cover plates (Part No. 111 420 04 44 left and Part No. 111 420 05 44 right) give the brake disk and the brake caliper a large measure of protection against water and dust.
- Install the cover plate Part No. 000 421 02 20 (see para 12).
- Use the piston resetting tongs (30) to push the piston back. Make sure that one friction pad always remains in the brake caliper since otherwise pushing back one piston would move the opposite piston forward (Fig. 42-10/21).

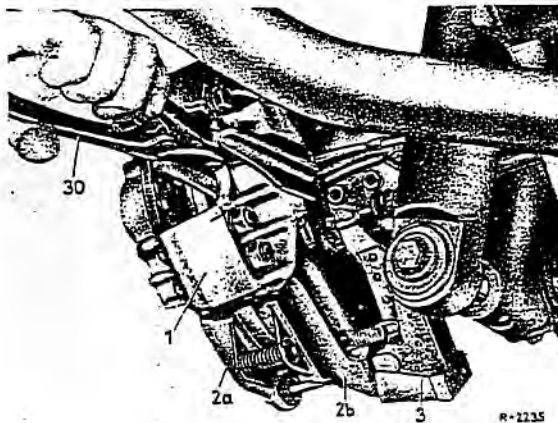


Fig. 42-10/21

- |                         |                           |
|-------------------------|---------------------------|
| 1 Brake caliper         | 3 Tension lever           |
| 2a Outer lining carrier | 30 Piston resetting tongs |
| 2b Inner lining carrier |                           |

**Note:** In order to prevent overflowing of the reservoir when one piston is pushed back, a certain amount of brake fluid should always be drained from the reservoir of the brake master cylinder before the friction pads are replaced.

The brake calipers of the rear wheel brakes have been equipped with an automatic adjusting device and a disk-wobble compensator. As a result relatively more force is required to push the piston back.

7. Check the position of the screening plate (7) in the brake caliper (1). If necessary, slightly turn the piston (2) with piston turning tool 000 589 36 37 00 (Figs. 42-12/22 to 42-12/25).

**Note:** Dented heat screening plates should be replaced. To do this remove the brake caliper (see Job Nos. 42-7 and 42-12).

On Model 300 SE the brake caliper for the rear wheel brake is provided with a heat screening plate only on the outer piston.

#### Installation:

8. Install the friction pad and replace the second friction pad as described in para 4.



Fig. 42-10/22

- |                        |
|------------------------|
| 1 Brake caliper        |
| 2 Piston               |
| 7 Heat screening plate |
| 31 Piston turning tool |

9. Rub Molykote Paste "U" on the points of the friction pad that are marked in Fig. 42-10/22a.

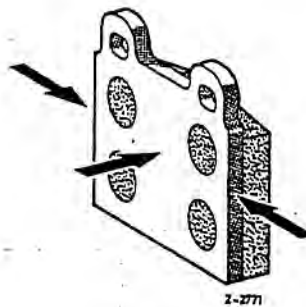


Fig. 42-10/22a

**Note:** The friction pads 1 for the front wheel brake have been provided with a rain groove. Friction pads without this groove can be remachined by means of a two-lipped 3 mm end mill. For groove width and depth see Fig. 42-10/26.

**Cars with disk brakes on both front and rear axles must always be provided with the same quality pads.**

10. On the 1<sup>st</sup> version brake calipers fit the crossleaf spring (23) and install the lock pin (10). Secure the lock pins by means of the locking clips (21) in such a way that the bent leg of the locking clip points outward (Fig. 42-10/23).

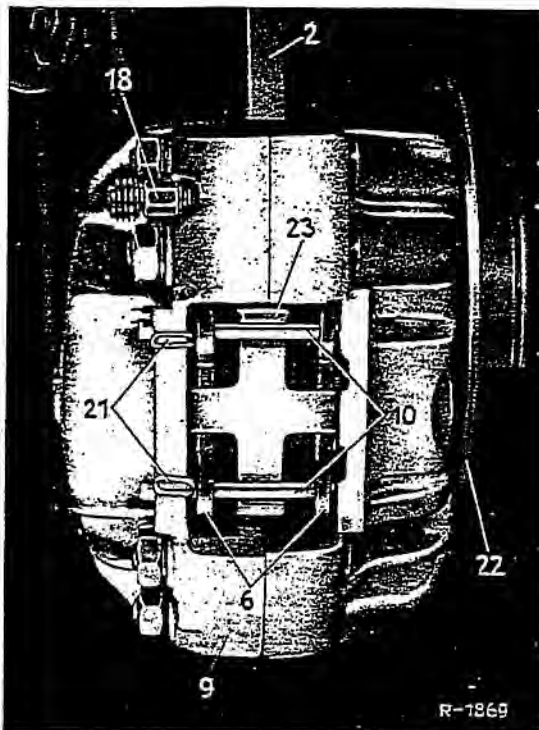


Fig. 42-10/23

- |                 |                      |
|-----------------|----------------------|
| 2 Brake disk    | 18 Bleed screw       |
| 6 Friction pad  | 21 Locking clip      |
| 9 Brake caliper | 22 Front wheel hub   |
| 10 Lock pin     | 23 Cross leaf spring |

11. On recent brake calipers drive the lock pins (3) into the brake caliper (1) from the inside toward the outside (Fig. 42-10/24).

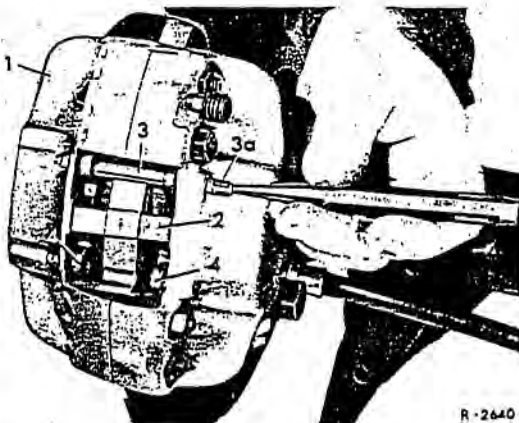


Fig. 42-10/24

- |                    |
|--------------------|
| 1 Brake caliper    |
| 2 Crossleaf spring |
| 3 Retaining pin    |
| 3a Clamping sleeve |
| 4 Friction pad     |

12. Put the well cover plate on the brake caliper, making sure that it is firmly seated in the brake caliper.

**Note:** The well cover plate Part No. 000-421 02 20 can be installed subsequently; it prevents dirt from entering the brake caliper.

13. Vigorously depress the brake pedal several times until firm resistance becomes noticeable. Then check the level of the brake fluid in the reservoir and, if necessary, top up.

**Note:** Do not fail to depress the brake pedal, since the brakes will not operate until the friction pads rest against the brake disk.

14. After the replacement of the friction pads carefully wear in the pads in order to produce a complete wear pattern by braking the car several times from 80 to 40 km/h and

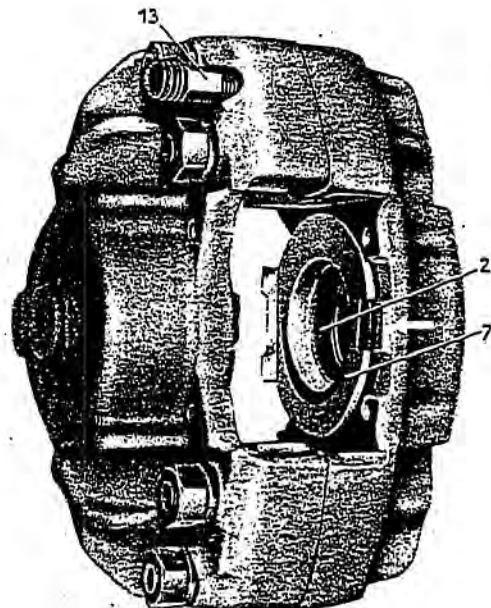


Fig. 42-10/25

- |                        |
|------------------------|
| 2 Piston               |
| 3 Heat screening plate |
| 13 Bleed screw         |

braking to a standstill with major deceleration only after the braking system has cooled down.

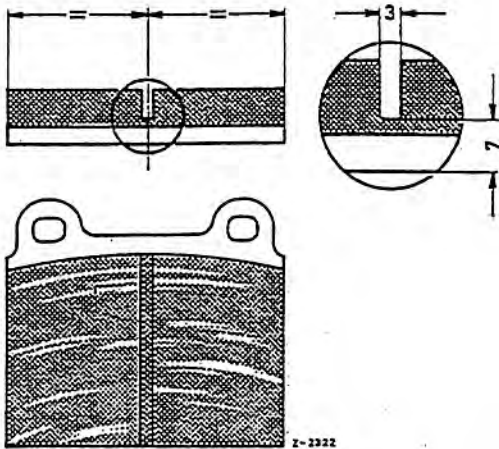


Fig. 42-10/26

**Note:** If initial braking with new pads is too fierce, the lining surface is liable to be charred, with the result that the car will show uneven braking action.

When new friction pads have been installed and uneven braking action results even when they have been worn in very carefully, the friction pads must be removed and re-installed according to their surface pattern.

Linings with a higher friction value have a rough streaky surface. Linings with a lower friction value have a bright smooth surface. Always install a friction pad with a smooth surface lining and a friction pad with a rough lining in each brake caliper.



# Removal and Installation of Brake Disk

Job No.

42-11

Modification: Para 5 and Note in Sections A and B extended (see\*) and Section C added

## A. Brake Disks on the Front Axle

### Removal:

1. Remove the brake caliper (see Job No. 42-7).
2. Remove the front wheel hub (see Job No. 33-5).
3. Fix the front wheel hub in Fixture 136 589 05 31 and unscrew the hexagon socket screws (11) fixing the brake disk (6) to the front wheel hub (8) (Fig. 42-11/1).

4. Check the brake disk for scores and replace if scoring is excessive (Figs. 42-11/2 and 3).

**Note:** Since the brake disk is not protected against the influence of dust and dirt, scores are liable to occur after short runs of a car. Such concentric scores have no negative influence on braking action. The brake disk need only be replaced if the scoring is excessive i. e. if the scores have a depth of approx. 0.5 mm (Fig. 42-11/2).

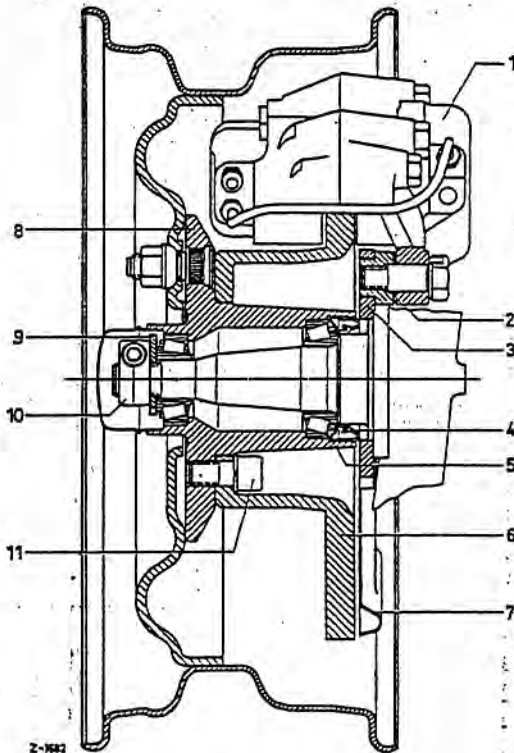


Fig. 42-11/1

- |                            |                         |
|----------------------------|-------------------------|
| 1 Brake caliper            | 7 Cover plate           |
| 2 Shim                     | 8 Front wheel hub       |
| 3 Steering knuckle bracket | 9 Washer                |
| 4 Rubber seal              | 10 Clamping nut         |
| 5 Disk                     | 11 Hexagon socket screw |
| 6 Brake disk               |                         |

**Note:** If the brake disk is to be used again mark the alignment between brake disk and front wheel hub before removing the brake disk.

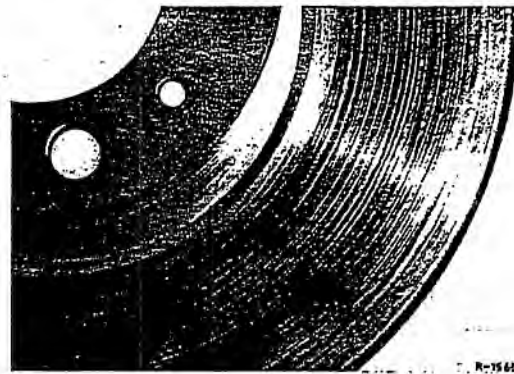


Fig. 42-11/2

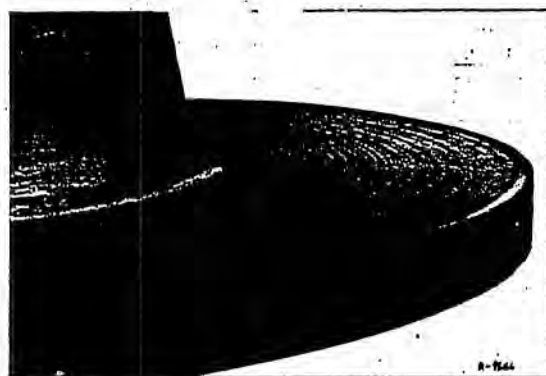


Fig. 42-11/3

On cars with mid-centering, the brake disk (2) has five milled points because of the spherical collar screw (5a). In addition it is heavily chamfered at the recess for the front wheel hub (Fig. 42-11/4).

42-11/1

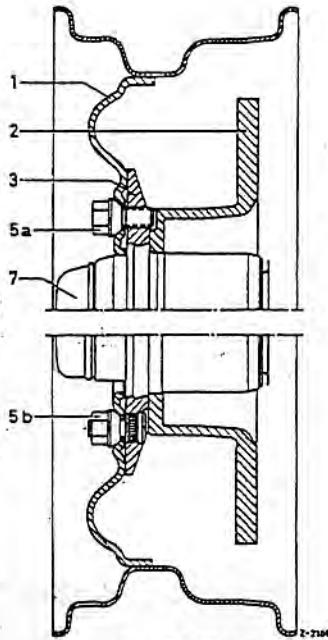


Fig. 42-11/4

- |                           |  |
|---------------------------|--|
| 1 Disk wheel              | 5b Wheel fixing bolt with spherical collar nut |
| 2 Brake disk              | 7 Hub cap                                      |
| 3 Front wheel hub         |  |
| 5a Spherical collar screw |  |

**Installation:**

5. Attach the brake disk (6) to the front wheel hub (8) paying attention to any previous markings (Fig. 42-11/1). Install the hexagon socket screws (11) with new lock washers and tighten with the prescribed torque (see Job No. 42-0).

**Note:** Before attaching the brake disk, thoroughly remove any rust that may have accumulated on the brake disk flange or the front wheel hub. Make sure that there is no burr on the recess of the brake disk.

On recent cars hexagon socket screws with integral lock washer, Part No. 000 990 37 12, are used.

When a new brake disk must be used, remove the anti-corrosion paint before installing it.

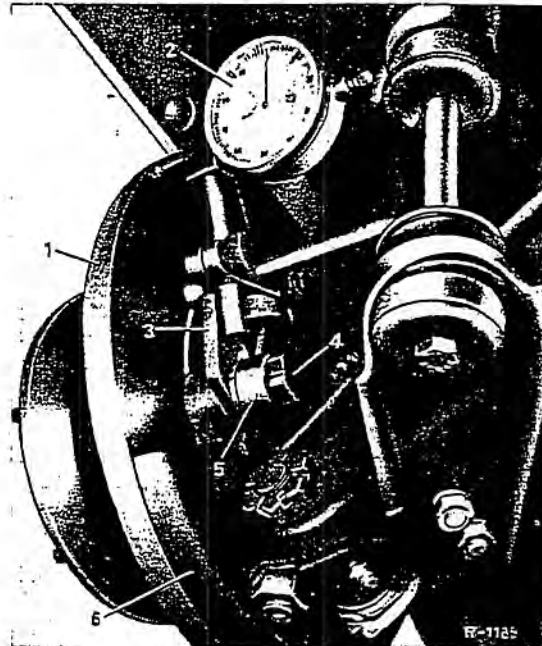


Fig. 42-11/5

- |                    |                         |
|--------------------|-------------------------|
| 1 Brake disk       | 4 Hexagon filling screw |
| 2 Dial gage        | 5 Distance sleeve       |
| 3 Dial gage holder | 6 Cover plate           |

6. Install the front wheel hub (see Job No. 33-5).

7. Measure the run-out of the brake disk on the outer diameter (Fig. 42-11/5).

**Note:** If the run-out is excessive, reseal the brake disk on the front wheel hub.

8. Install the brake caliper (see Job No. 42-7).

9. Bleed the brake system and check for leaks.

## B. Brake Disk on Rear Axle of Model 300 SE

### Removal:

1. Remove the brake caliper (see Job No. 42-7).
2. Unscrew the hexagon socket screws with which the wheel fixing disk (40) and the brake disk (19) are attached to the rear axle shaft (42) (Fig. 42-11/6).

**Note:** Before removing the wheel fixing disk and the brake disk, mark their relative position to the rear axle shaft.

3. Remove the wheel fixing disk and the brake disk.
4. Check the brake disk for scores and replace if scoring is excessive (see section A).

### Installation:

5. Attach the brake disk and the wheel fixing disk to the rear axle shaft paying attention to previous markings.

When a new brake disk must be used, remove the anti-corrosion paint before installing it.

**Note:** Before attaching the brake disk and the wheel fixing disk remove any rust that may have accumulated on the flange of the rear axle shaft, the wheel fixing disk, and the brake disk. Thoroughly clean the seat of the rear axle shaft making sure that the recess of the brake disk and the wheel fixing disk is free from burrs.

\* Hexagon socket screws M 12 × 1.5 × 30 DIN 912-8 G have been replaced by grade 10 K screws. Always install 10 K screws in place of 8 G screws.

Always use new lock washers when installing the hexagon socket screws and tighten them with the prescribed torque (see Job No. 42-0).

6. Measure the run-out of the brake disk on the outer diameter (Fig. 42-11/5 and Job No. 42-0).

**Note:** If the run-out is excessive reseal the brake disk on the rear axle shaft. It is often advisable to check the flange of the rear axle shaft for run-out since very often a distorted rear axle shaft is responsible for excessive run-out of the brake disk on the rear axle. The run-out of the rear axle shaft can only be measured when the shaft has been removed from the vehicle (see Job Nos. 35-0 and 35-3).

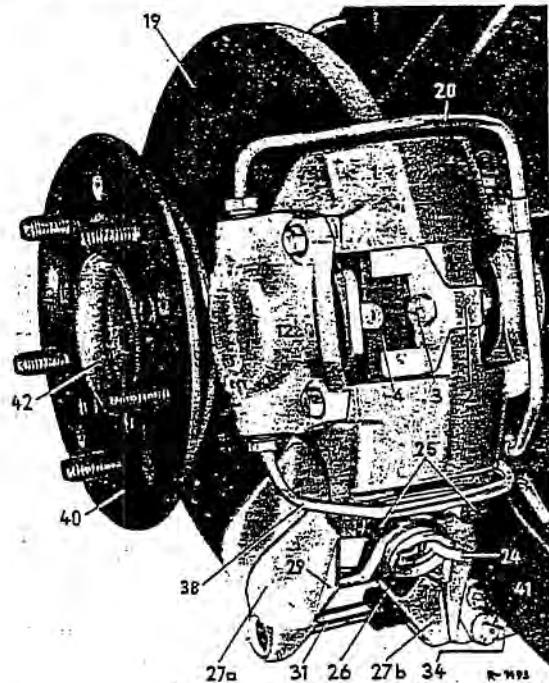


Fig. 42-11/6

- |   |   |
|---|---|
| 1 Brake caliper   | 25 Swing bolt                                   |
| 2 Stirrup   | 26 Leg spring                                   |
| 3 Hexagon screw with hexagon nut and serrated lock washer | 27a Outer lining carrier                        |
| 4 Friction pad with fitting plate (service brake)         | 27b Inner lining carrier                        |
| 12 Pressure cylinder                                      | 29 Friction pad with fitting plate (hand brake) |
| 19 Brake disk   | 31 Adjustment screw                             |
| 20 Connecting line with pipe clip                         | 34 Tension lever                                |
| 24 Locking plate  | 38 Brake line                                   |
|   | 40 Wheel fixing disk                            |
|   | 41 Brake support lever                          |
|   | 42 Rear axle shaft                              |

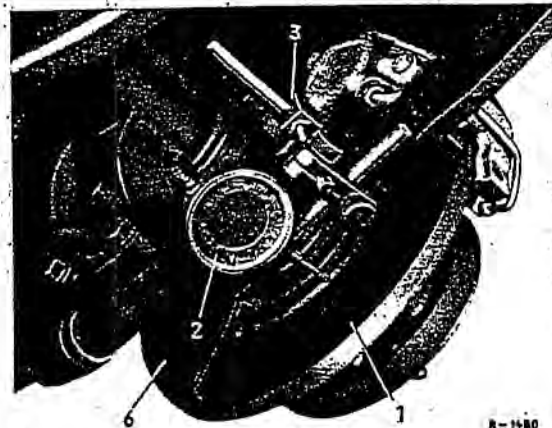


Fig. 42-11/7

- |              |                    |
|--------------|--------------------|
| 1 Brake disk | 3 Dial gage holder |
| 2 Dial gage  | 6 Cover plate      |

7. Install the brake caliper (see Job No. 42-7).
8. Bleed the brake system and check for leaks.

42-11/3

### **C. Brake Disks on Rear Axle of Models 250 S, 250 SE, 300 SEb and 300 SEL**

The brake disk is attached to the rear axle together with the disk wheel by means of spherical collar screws.

To remove the brake disk gently tap it off its seat on the rear axle shaft with a plastic hammer; the parking brake must be in the released position. Before reinstalling the brake disk, lightly coat the seat on the rear axle shaft with Molycote Paste "U" or Liqui-Moly Paste 36 in order to facilitate removal.

# Cleaning of Brake Disk

Job No.
42-11a

Brake disks which have been in use for a considerable period of time acquire a coating in the braking areas which consists mostly of abrasive particles of the friction pads. Before friction pads are replaced, and when complaints are received about uneven braking action of the disk brake, these abrasive particles which accumulate in the pores of the brake disk should be removed. The special cleaning pads shown in Fig. 42-11a/1 will clean the brake disk effectively in a very short time. The cleaning pads are installed in the brake caliper in place of the friction pads. The front wheel is driven by the finish balancer produced by Messrs. Hoffmann, and the brake pedal is depressed with moderate pressure; the abrasive particles on the brake disk are removed by the abrasive cloth (grain 80) with which the cleaning pads are covered. Cleaning should only be discontinued when the dark coating has been completely removed.

The brake disks on the rear axle on Model 300 SE must not be cleaned in this way, since the one side drive would damage the differential.

The cleaning pads, two each for the three brake caliper Makes Teves, Girling, and Dunlop, must be made in the shop according to the instructions given below in Fig. 42-11a/1.

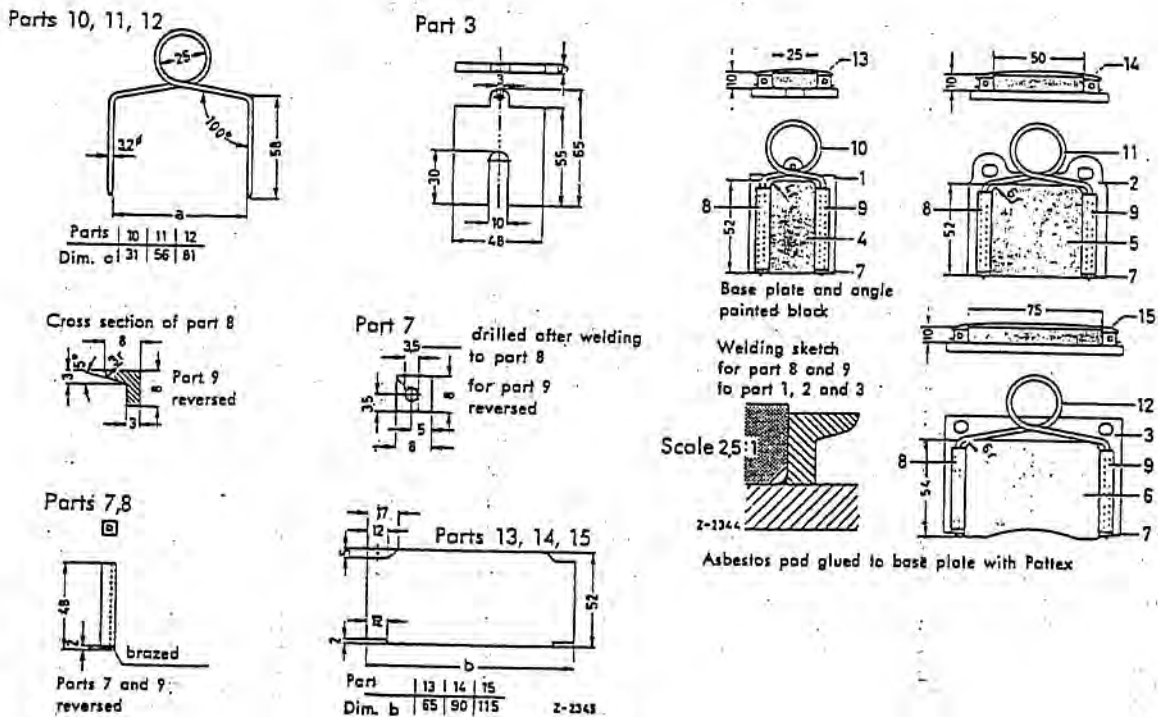


Fig. 42-11a/1

- |            |                              |                                   |
|------------|------------------------------|-----------------------------------|
| 1          | Base plate                   | SI 37.2                           |
| 2          | Base plate                   | made from an old Make Teves pad   |
| 3          | Base plate                   | made from an old Make Girling pad |
| 4, 5, 6    | Asbestos pad                 |                                   |
| 7          | Center hole plate            | SI 37.2                           |
| 8          | Angle, left                  | SI 37.2                           |
| 9          | Angle, right                 | SI 37.2                           |
| 10         | Wire stirrup of spring steel | 3.20 DIN 2076, full length 240    |
| 11         | Wire stirrup of spring steel | 3.20 DIN 2076, full length 260    |
| 12         | Wire stirrup of spring steel | 3.20 DIN 2076, full length 285    |
| 13, 14, 15 | Abrasive cloth               | Grain 80                          |



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# Replacement of Piston Seals in Brake Caliper

Job No.

42-12

Modification: Section C added.

## A. Make Girling 1st to 3rd Versions (Type 17/3)

The two halves of the brake calipers must not be disturbed since the hexagon screws have been tightened by the manufacturers with a specific tightening torque.

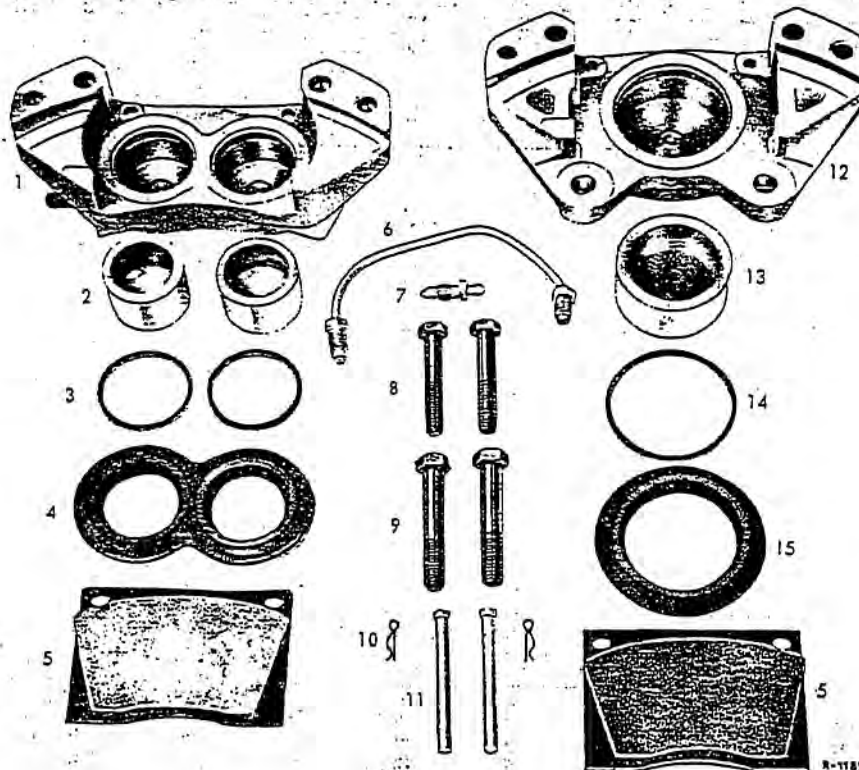


Fig. 42-12/1

1st and 2nd versions

1. Outer caliper half  
2. Piston  
3. Piston seal  
4. Dust cap  
5. Friction pad

6. Connecting line  
7. Bleed screw  
8. Hexagon screw  
9. Hexagon screw  
10. Spring clip

11. Retaining pin  
12. Inner caliper half  
13. Piston  
14. Piston seal  
15. Dust cap

### Removal:

1. Remove the brake caliper (see Job No. 42-7).
2. Remove the friction pads (5). To do this, remove the spring clips (10) from the retaining pins (11) and pull out the retaining pins and friction pads (Fig. 42-12/1). See also Job No. 42-10.

**Note:** On the 2nd and 3rd version of the brake caliper, heat screening plates have been installed between the pistons and the friction pads.

3. On the 1st and 2nd versions disconnect the connecting line. Insert a piece of wood (3) approx. 20 mm thick in the caliper gap (1) and force the piston (5) out of the caliper with compressed air (approx. 0.5 atm.). Then remove the piece of wood and the piston (Fig. 42-12/3).

42-12/1

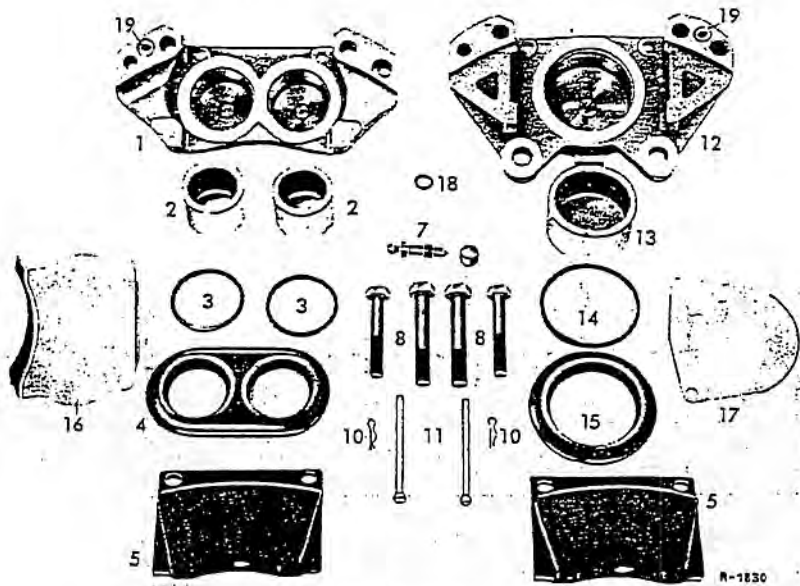


Fig. 42-12/2

3rd version

- |                      |   |
|----------------------|---|
| 1 Outer caliper half | 12 Inner caliper half                   |
| 2 Piston             | 13 Piston                               |
| 3 Piston seal        | 14 Piston seal                          |
| 4 Dust cap           | 15 Dust cap                             |
| 5 Friction pad       | 16 Heat screening plate                 |
| 7 Bleed screw        | 17 Heat screening plate                 |
| 8 Hexagon screw      | 18 Rubber sealing ring                  |
| 10 Spring clip       | 19 Connecting passage in caliper halves |
| 11 Retaining pin     |   |

On the 3rd version without connecting line first hold the inner piston in a clamp and press out the two outer pistons by means of compressed air. Then remove the clamp, shut off the pressure canal in the outer caliper half, and force out the inner piston.

**Note:** The piece of wood is intended to prevent damage to the pistons when they are forced out.

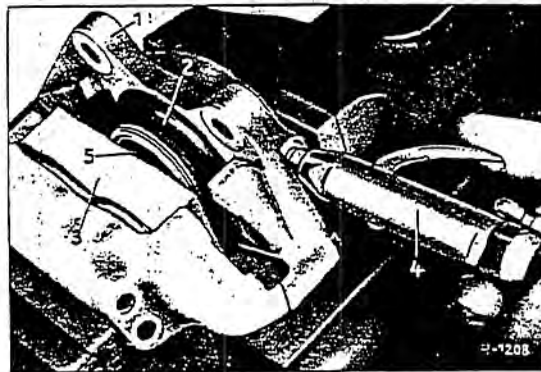


Fig. 42-12/3

- |                  |
|------------------|
| 1 Brake caliper  |
| 2 Dust cap       |
| 3 Piece of wood  |
| 4 Compressed air |
| 5 Piston         |

4. Remove the dust caps.

5. Take the piston seals (3) out of the cylinder bore groove (Fig. 42-12/4).

**Note:** The old piston seal should only be prized out of the annular groove with a sharp tool if the seal is to be replaced.

6. Clean all parts thoroughly with methylated spirits or brake fluid.



Modification: Section B revised and supplemented. Rear wheel brake caliper added.

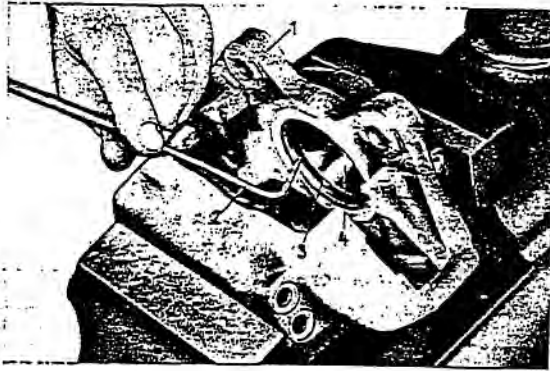


Fig. 42-12/4

- 1 Brake caliper
- 2 Scriber
- 3 Piston seal
- 4 Cylinder bore

7. Check the cylinder bores in the caliper for signs of wear. If the bores are scored or badly rusted or if the pistons are scored or rusted the complete caliper assembly must be replaced.

**Note:** Narrow faint rust rings in the caliper or on the pistons can be removed with abrasive cloth.

**Installation:**

8. Lightly rub new piston seals with ATE Brake Paste and install in the grooves of the cylinder bores.
9. Install new dust caps in the grooves of the cylinder bores and lightly rub the cylinder bores with ATE Brake Paste.

**Note:** Extreme care is necessary when the dust caps are inserted in the groove of the cylinder bore. If the dust cap is not properly seated in the annular groove of the cylinder bore the piston will have to be forced out again since the protecting lip of the dust cap can only be installed in the annular groove of the cylinder bore when the piston is removed.

10. Before installing the pistons, lightly coat the inside of the dust caps with castor oil to prevent corrosion.
11. Install the pistons in the bores of the caliper taking care to ensure that the dust caps are properly seated in the annular groove of the pistons.
12. On the 1<sup>st</sup> and 2<sup>nd</sup> versions connect the connecting line.
13. On the 2<sup>nd</sup> and 3<sup>rd</sup> versions install the heat screening plates. Dented plates must be re-conditioned. Then install the friction pads and secure them in their position.
14. Install the brake caliper (see Job No. 42-7).

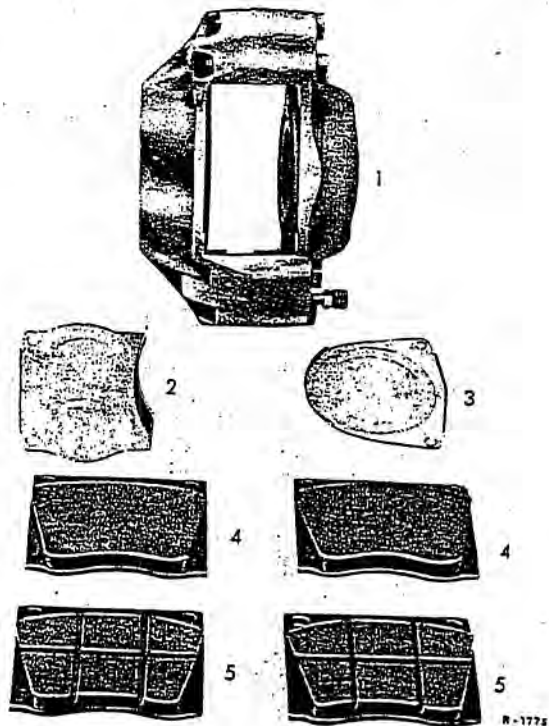


Fig. 42-12/5

- 1 Brake caliper
- 2 Outer heat screening plate
- 3 Inner heat screening plate
- 4 Friction pad Part No. 000 421 01 08
- 5 Grooved friction pad Part No. 000 421 03 08

## B. Make Teves

### Brake Caliper for Front Wheel Brake

The two halves of the brake caliper must not be disturbed, since the fastening screws have been tightened by the manufacturers with a specific tightening torque.

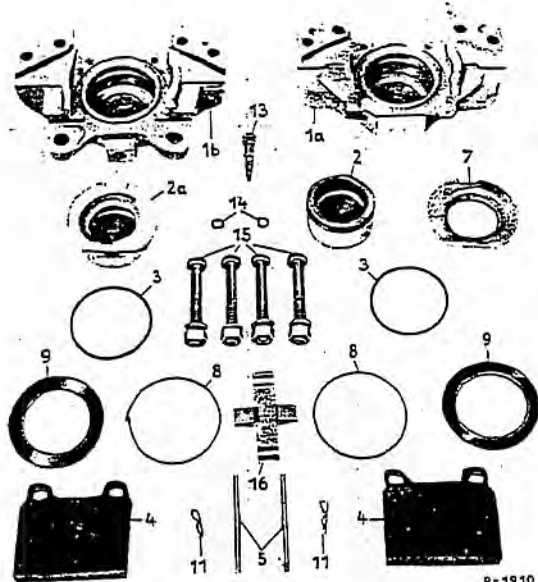


Fig. 42-12/6

- |                                     |                        |
|-------------------------------------|------------------------|
| 1a Outer caliper half               | 7 Heat screening plate |
| 1b Inner caliper half               | 8 Clamp ring           |
| 2 Piston                            | 9 Protective cap       |
| 2a Piston with heat screening plate | 11 Locking clip        |
| 3 Piston seal                       | 13 Bleed screw         |
| 4 Friction pad                      | 14 Rubber seal         |
| 5 Lock pin                          | 15 Cylinder screw      |
|                                     | 16 Cross leaf spring   |

- When a piston is rusted in the brake caliper it cannot be forced out with compressed air since extreme pressure would be required to free a jammed piston. Remove the two heat screening plates from the piston and fix the freely moving piston in its position in the brake caliper (1) by means of the holding fixture (23). Attach the brake caliper to the brake line of the car by means of a brake hose. Bleed the brake caliper and free and force out the jammed piston by depressing the brake pedal (Fig. 42-12/7).

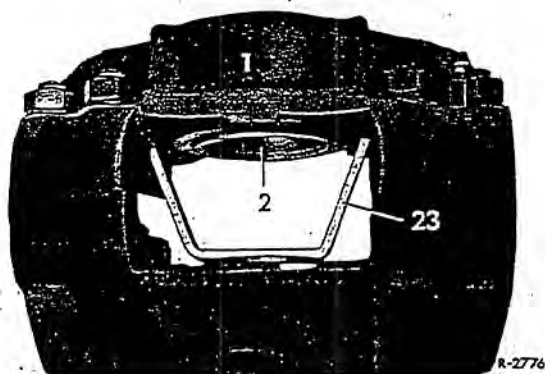


Fig. 42-12/7

- 1 Brake caliper      2 Piston      23 Holding fixture

#### Removal:

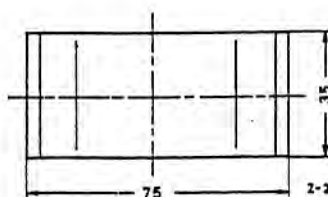
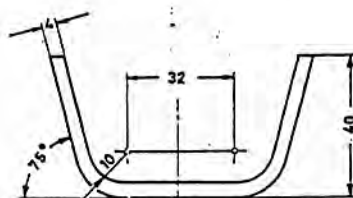
- Remove the brake calipers (see Job No. 42-7).

**Note:** Before removal the brake caliper must have cooled down to normal temperature.

- Remove the friction pads (4). Take the locking clips (11) from the lock pins (5), push the lock pin out of the brake caliper and remove the cross leaf spring (16) and the friction pads (Fig. 42-12/7).

- Hold the piston (2) in the brake caliper with the piston resetting tongs (18). Then press out the opposite piston by means of compressed air (approx. 0.5 atm.) (Fig. 42-12/8).

**Note:** To prevent damage to the piston glue a 5 mm thick piece of rubber to the piston resetting tongs.



2-2816 Fig. 42-12/8

**Note:** The holding fixture should be made in the shop in accordance with the measurements shown in Fig. 42-12/8.

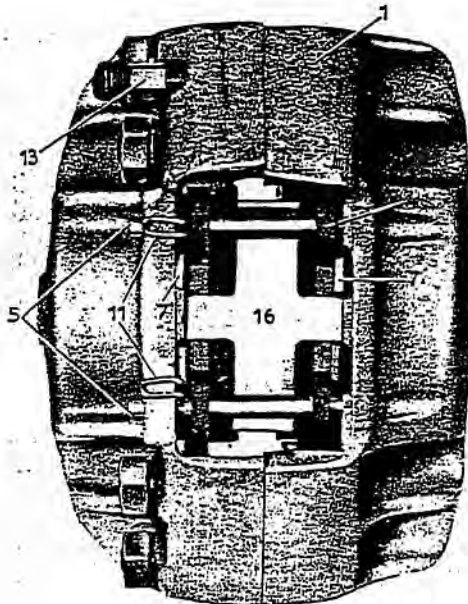


Fig. 42-12/9

- |                        |                      |
|------------------------|----------------------|
| 1 Brake caliper        | 11 Locking clip      |
| 4 Friction pad         | 13 Bleed screw       |
| 5 Lock pin             | 16 Cross leaf spring |
| 7 Heat screening plate |                      |

**Note:** Recent Teves brake calipers have been provided with a modified piston and with an improved seal consisting of a modified dust cap and an incorporated closed clamp ring.

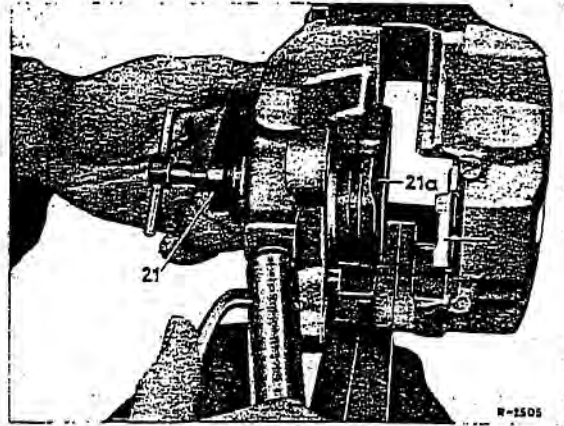


Fig. 42-12/11

- |                                    |
|------------------------------------|
| 1 Brake caliper                    |
| 2 Piston with heat screening plate |
| 21 Tensioning fixture              |
| 21a Rubber plate                   |

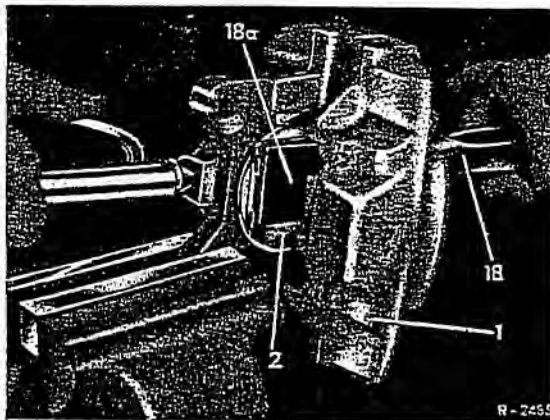


Fig. 42-12/10

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| 1 Brake caliper                    | 18 Piston resetting tongs           |
| 2 Piston with heat screening plate | 18a Rubber plate on resetting tongs |

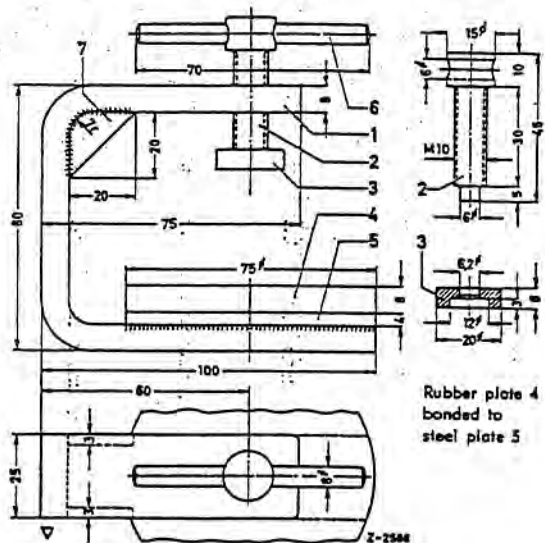


Fig. 42-12/12

5. Install the tensioning fixture (21) in the brake caliper in such a way that the rubber plate seals the bore. Then press out the second piston from the brake caliper (Fig. 42-12/11).

6. Remove the clamp rings (8) for the dust caps (9) and remove the dust caps from the pistons (2) (Fig. 42-12/13).

**Note:** The tensioning fixture should be made in the shop in accordance with the dimensions given in Fig. 42-12/12.

7. Take the piston seals (3) out of the cylinder bore grooves (Fig. 42-12/13).

8. Check the cylinder bores in the caliper for signs of wear. If the bores are scored or rusted, the complete caliper assembly must be replaced.

**Note:** Narrow, faint rust rings in the cylinder can be removed with abrasive cloth.

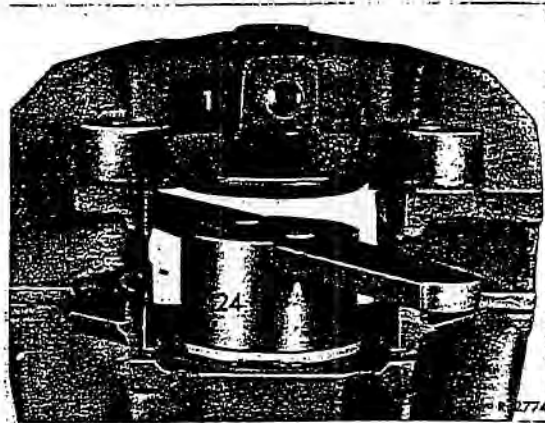


Fig. 42-12/14

1 Brake caliper 24 Tolerance-plug gage

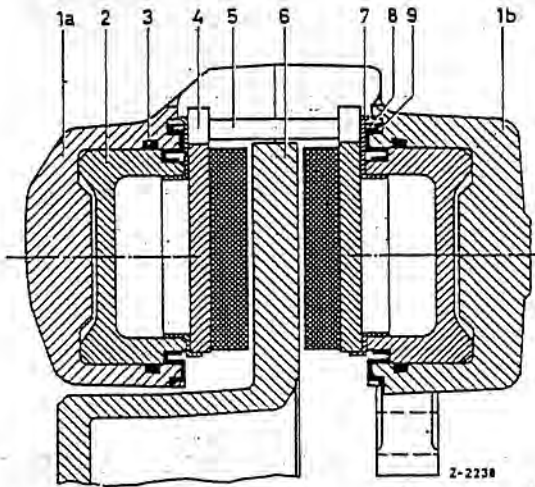


Fig. 42-12/13

- 1a Outer brake caliper half
- 1b Inner brake caliper half
- 2 Piston
- 3 Piston seal
- 4 Friction pod
- 5 Lock pin
- 6 Heat screening plate
- 8 Clamp ring
- 9 Dust cap

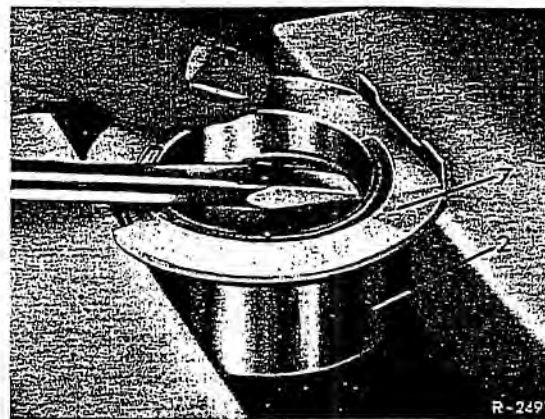


Fig. 42-12/15

2 Piston 7 Heat screening plate

Heavy rust in front of the piston seal can be removed with fine-grain emery paper (grain no. 380 to 500).

The piston must not be cleaned with abrasive or emery cloth since that would damage the chromium-plated surface of the piston. Any accumulations on the piston may be removed with a soft brass wire brush or a rough cleaning rag. If the chrome surface is damaged the piston must be replaced.

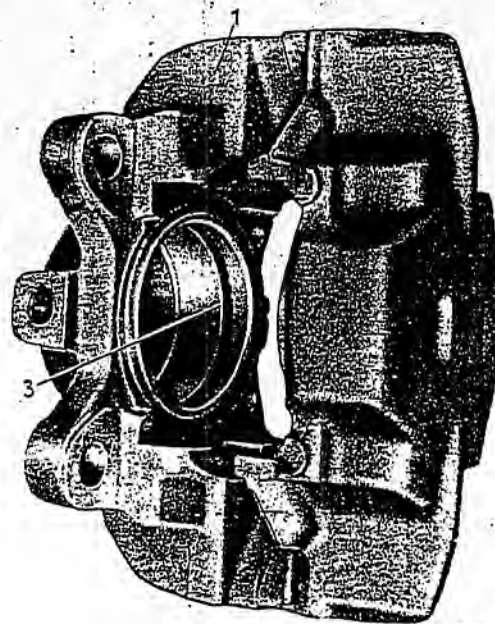


Fig. 42-12/16

1 Brake caliper 3 Piston seal

Modification: Improved dust cap between piston and brake caliper; Forcing Tool (Figs. 42-12/20 and 21) added

9. Prise the heat screening plates (7) off the piston (2) with a screwdriver (Fig. 42-12/15).
10. Check the piston bore in the brake caliper with Tolerance Plug Gage 111 589 15 21 00. If the plug gage can be inserted in the bore, the brake caliper must be replaced (Fig. 42-16/14).

**Installation:**

11. Lightly rub new piston seals with ATE Brake Paste and install in the grooves of the cylinder bores.
12. Insert the piston (2) in the bores of the brake caliper. Then check the position of the piston by means of Piston Gage 001 589 30 21 00 (19) in the brake caliper and, if necessary, turn the piston in the correct position by Piston Turning Tool 000 589 36 37 00 (20) (Figs. 42-12/17 and 18).

**Note:** The piston must be installed in such a way that when the brake caliper is installed the lug on the piston points downward. The lug results in a one-sided contact of the friction pads which reduces the tendency to squeak (Fig. 42-12/19).

13. Lightly wet the inside of new dust caps (2) with ATE Brake Cylinder Paste and put the caps on the pistons (Fig. 42-12/17a).

**Note:** Please note before installation:

The 1<sup>st</sup> version repair set, Part No. 000 586 54 88, must only be used in conjunction with the grooveless piston (4a), Part No. 000 421 32 83. However, the 2<sup>nd</sup> version repair set, Part No. 000 586 13 42, with improved dust cap (2b) can be installed with either the grooveless piston (4a) or the grooved piston (4b), Part No. 000 421 35 83.



Fig. 42-12/17

- 1 Brake caliper
- 2 Piston
- 19 Piston Gage 001 589 30 21 00

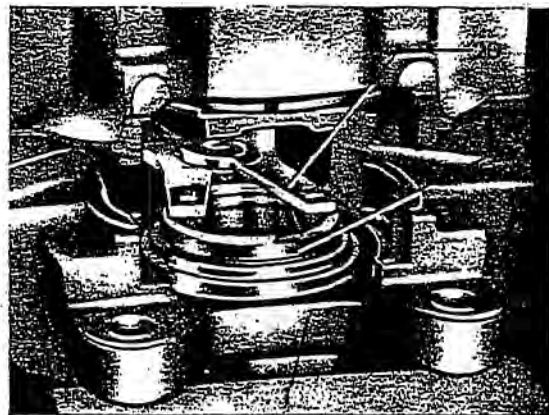
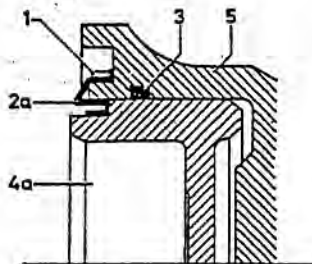
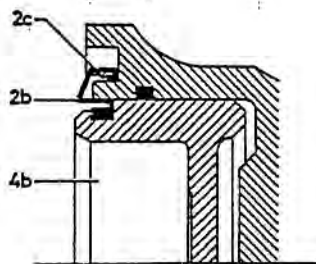


Fig. 42-12/18

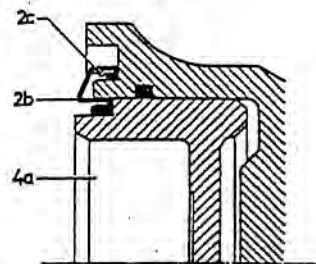
- 1 Brake caliper
- 2 Piston
- 20 Piston Turning Tool 000 589 36 37 00



1<sup>st</sup> version



2<sup>nd</sup> version



repair version

Fig. 42-12/17a

- 1 Split clamp ring
- 2a Dust cap 1st version
- 2b Dust cap 2nd version

- 2c Closed clamp ring
- 3 Piston seal
- 4a Piston 1st version

- 4b Piston 2nd version
- 5 Brake caliper

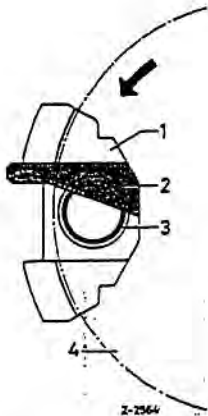


Fig. 42-12/19

- 1 Brake caliper
- 2 Piston Gage 001 589 30 21 00
- 3 Piston
- 4 Brake disk

14. Apply the dust cap (2b) together with the angled clamp ring (2c) to the collar of the brake caliper (5) (Fig. 42-12/17a). Put the mounting plate (25) on the dust cap and with the help of the forcing tool (26) and a hand screw press force the dust cap on the brake caliper collar under a pressure of approx. 30 kp (Fig. 42-12/20).

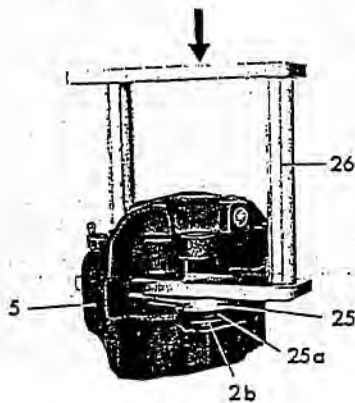


Fig. 42-12/20

- 2b Dust cap second version
- 5 Brake caliper
- 25 Pressure plate
- 25a Rubber plate
- 26 Forcing tool

**Note:** The forcing tool should be made in the shop in accordance with the dimensions given in Fig. 42-12/21.

15. Insert the heat screening plate (7) in the piston in such a way that the recess in the plate fits accurately into the lug of the piston and that the contact surface for the friction pad points toward the fixing eyes (see Fig. 42-10/25). Now insert the fixture (17) in the brake caliper and press the heat screening plate into the piston (Fig. 42-12/22).

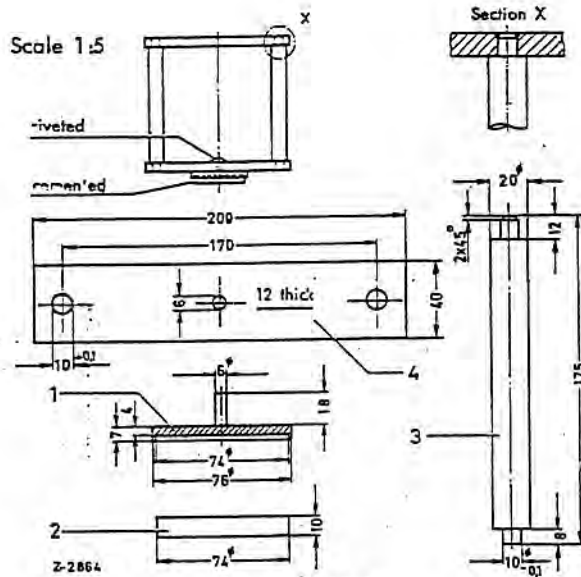


Fig. 42-12/21

- 1 Pressure plate
- 2 Rubber plate
- 3 Connecting pin
- 4 Clamp

**Note:** The piston ring surface should project over the heat screening plate by at least 0.1 mm. The heat screening plates for the inner and outer piston are different.

16. Install the friction pads in the brake caliper, install the cross leaf spring and secure the friction pads in position by means of the lock pins. In the case of the 1<sup>st</sup> version install the locking clips.

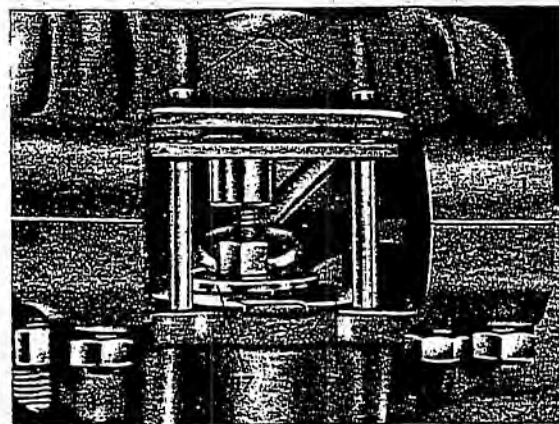


Fig. 42-12/22

- 1 Brake caliper
- 5 Retaining pins
- 7 Heat screening plate
- 17 Fixture 000 589 49 63 00

**Note:** The locking clips are different; they must be inserted in the lock pins in such a way that the rounded leg on the upper lock pin points upward and the lower lock pin points downward.

17. Install the brake caliper, bleed the brake system and then check the brake caliper for leaks.

## b) Brake Caliper for Rear Wheel Brake (Model 300 SE)

The two halves of the brake caliper must not be disturbed since the fastening screws have been tightened by the manufacturers with a specific tightening torque.

### Disassembly:

1. Remove the brake calipers (see Job No. 42-7).
2. Remove the friction pads. Take out the locking clips (3), push out the lock pin (5), and remove the crossleaf spring (2), the screening plate in front of the outer piston and the friction pads (Fig. 42-12/23).

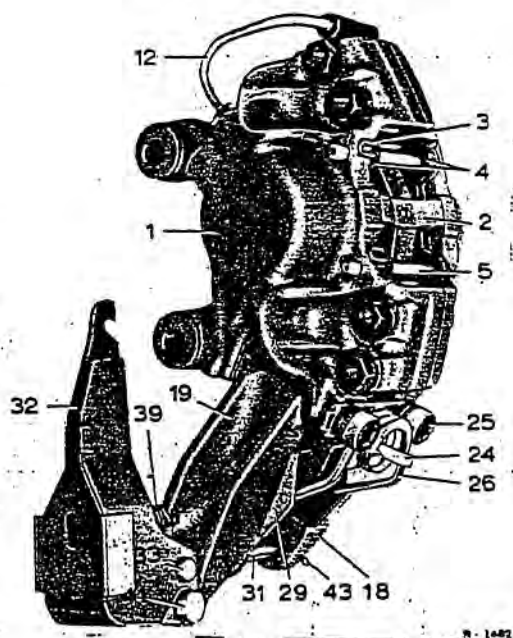


Fig. 42-12/23

- |                                   |                                 |
|-----------------------------------|---------------------------------|
| 1 Brake caliper                   | 25 Swing bolt                   |
| 2 Crossleaf spring                | 26 Leg spring                   |
| 3 Locking clip                    | 29 Friction pad (parking brake) |
| 4 Friction pad (service brake)    | 31 Adjusting screw              |
| 5 Lock pin                        | 32 Tension lever                |
| 12 Connecting line                | 33 Crosshead                    |
| 18 Inner lining carrier           | 39 Return spring                |
| 19 Outer lining carrier           | 41 Collar bolt                  |
| 24 Retaining plate for leg spring | 43 Catter pin                   |

3. Detach the connecting line (12) from the brake caliper.
4. Remove the clamp ring (1) and the dust cap (2) from the pressure cylinder (5) and the piston (4) (Fig. 42-12/24).

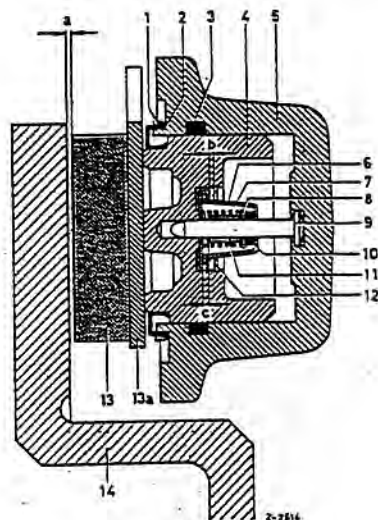


Fig. 42-12/24

- |                                   |                     |
|-----------------------------------|---------------------|
| 1 Clamp ring                      | 8 Spacer washer     |
| 2 Dust cap                        | 9 Guide pin         |
| 3 Piston seal                     | 10 Clamp rings      |
| 4 Piston                          | 11 Spacer sleeve    |
| 5 Brake caliper pressure cylinder | 12 Piston stop ring |
| 6 Stop cap                        | 13 Friction pad     |
| 7 Pressure spring                 | 13a Back plate      |
|                                   | 14 Brake disk       |

5. Fit the piston resetting tongs (18) in the brake caliper in such a way that the rubber plate (18a) points inward and press out the opposite piston (Fig. 42-12/26).

**Note:** The rubber plate prevents damage to the piston.

The required pressure is about 8 atm. since the piston does not move easily on the guide pin.

6. Again fit the piston resetting tongs with the rubber plate pointing inward and press out the other piston.
7. Remove the piston seals (3) from the grooves in the cylinder bore (Fig. 42-12/24).
8. Check the cylinder bores in the brake caliper for signs of wear. If the bores are scored or rusted, replace the brake caliper assembly.

**Note:** Narrow faint rust rings in the cylinder can be removed with abrasive cloth (grain no. 380-500). Rust on the piston should only be removed with a coarse cleaning rag since abrasive cloth will damage the chrome surface of the piston. If the piston surface is flaked or rusty, the piston must be replaced.

The disk wobble compensator in the piston cannot be repaired. It can only be removed from the piston to provide better access for cleaning the piston. To do this remove the circlip (12) from the piston (4) (Fig. 42-12/25).

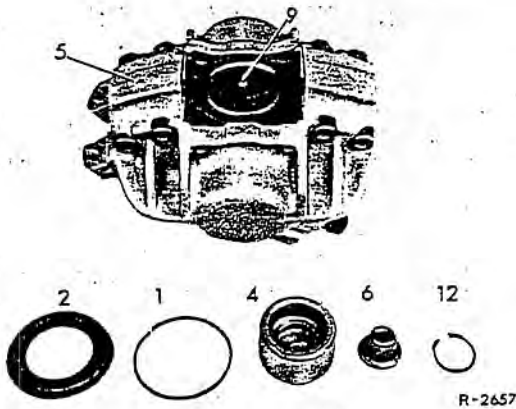


Fig. 42-12/25

- 1 Clamp ring
- 2 Dust cap
- 4 Piston
- 5 Brake caliper
- 6 Stop cap with disk wobble compensator
- 9 Guide pin
- 12 Circlip

9. Thoroughly clean all parts in methylated alcohol. Never use gasolin, kerosene or trichloroethylene since mineral oil and chemically related fluids will cause the sealing rings to swell which provide the seal between the two caliper halves; as a result the brake caliper will be full of leaks in no time.

#### Reassembly:

10. Lightly rub new piston seals with ATE Brake Cylinder Paste and install in the grooves of the cylinder bores.
11. Put the piston (4) on the guide pin (9) and push it into the pressure cylinder by exerting an even pressure on the piston with the piston resetting tongs. Take care to ensure that the piston is pressed into the cylinder in complete alignment with the cylinder walls (Fig. 42-12/14 and 42-12/26).
13. Fit the screening plate to the outer piston and install the friction pads. Install the lock pins and the locking clips.
14. Install the brake caliper, bleed the brake system, and check for leaks.

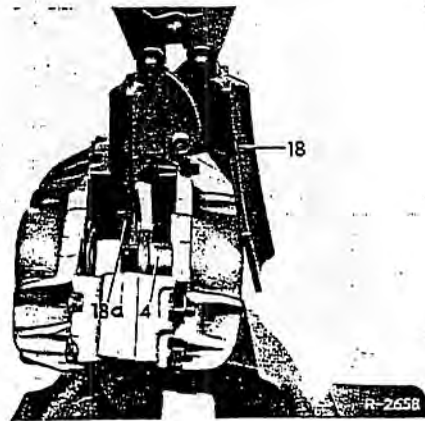


Fig. 42-12/26

- 4 Piston
- 18 Piston resetting tongs
- 18a Rubber plate on piston resetting tongs



### C. Make Girling 4th Version (Type 17/2)

The two halves of the brake calipers must not be disturbed since the hexagon screws have been tightened by the manufacturers with a specific tightening torque.

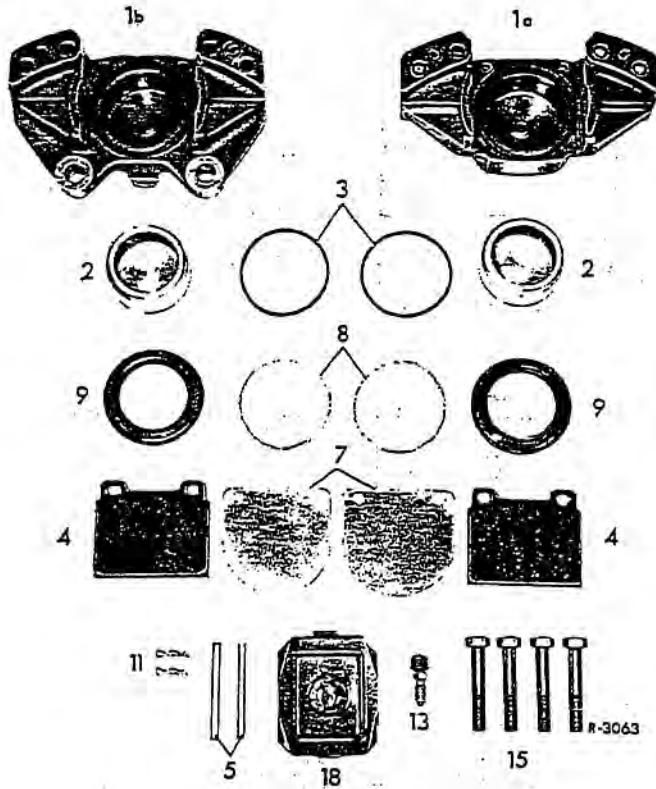


Fig. 42-12/27

- 1 a Outer brake caliper half
- 1 b Inner brake caliper half
- 2 Piston
- 3 Piston seal
- 4 Friction pad
- 5 Retaining pins
- 7 Heat screening plates
- 8 Clamping wire
- 9 Dust cap
- 11 Locking clip
- 13 Bleed screw with rubber cap
- 15 Hexagon screw
- 18 Cover plate

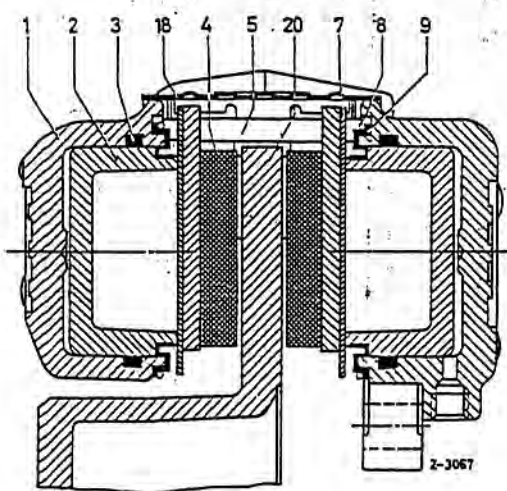


Fig. 42-2/28

- 1 Brake caliper
- 2 Piston
- 3 Piston seal
- 4 Friction pad
- 5 Retaining pin
- 7 Heat screening plate
- 8 Clamping wire
- 9 Dust cap
- 18 Cover plate
- 20 Brake disk

#### Removal:

1. See Section B, paras 1-8.

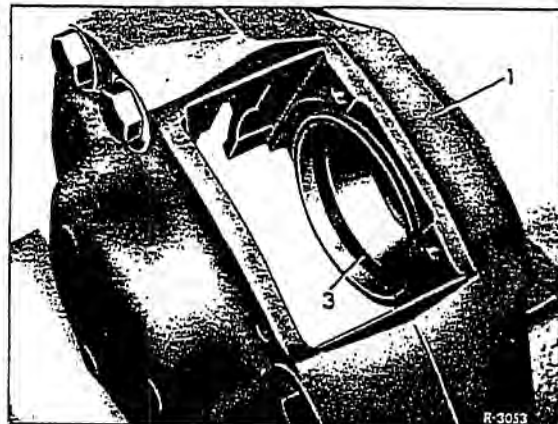


Figura 42-12/29

- 1 Brake caliper
- 3 Piston seal

**Installation**

2. Lightly coat a new piston seal (3) with brake paste or brake fluid and install it in the cylinder bore groove (Fig. 42-12/29).
3. Insert the piston (2) in the bore of the brake caliper (1) (Fig. 42-12/30).

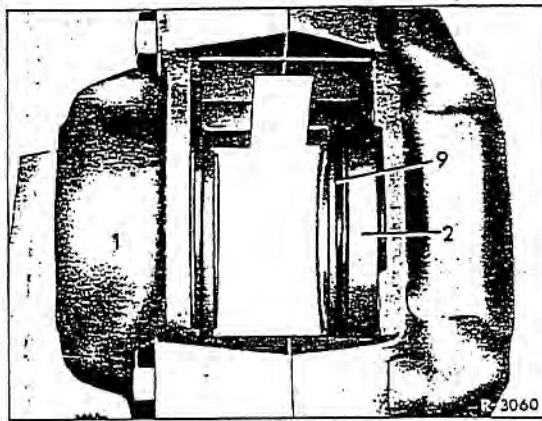


Fig. 42-12/30

1 Brake caliper      2 Piston      9 Dust cap

On no account must the Girling brake calipers be exchanged by mistake for the Teves brake calipers.

**Note:** The piston for the Girling brake caliper, Part No. 000 421 40 83 is bright chromium-plated whereas the piston for the Teves brake caliper is matt chromium-plated. Apart from that there are the following differences:

Teves-pistons: dished piston head and an 0.3 mm face projection over 240° of the circumference (Fig. 42-12/31).

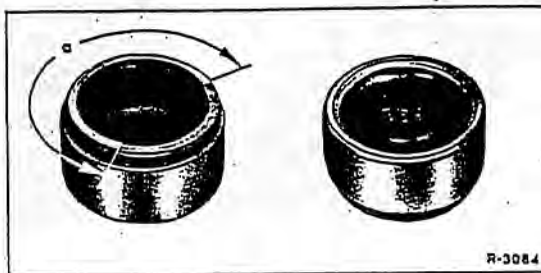


Fig. 42-12/31

Girling pistons: level pistons head (Fig. 42-12/32).

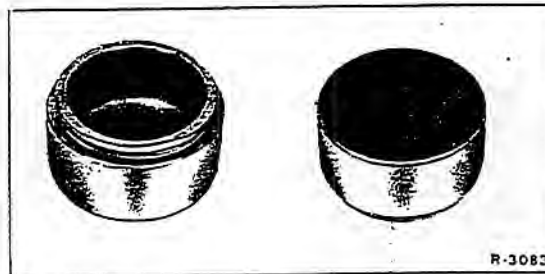


Fig. 42-12/32

4. Put a new dust cap (9) on the piston (2) (Figs. 42-12/28 and 30).

**Note:** Make sure that the dust cap and the sealing surface of the caliper housing are carefully cleaned and are free from brake paste and brake fluid. This is the only way to ensure a proper fit between dust cap and housing.

5. Put the dust cap (9) on the collar of the brake caliper (1) and fasten by means of the clamping wire (8) (Fig. 42-12/33).

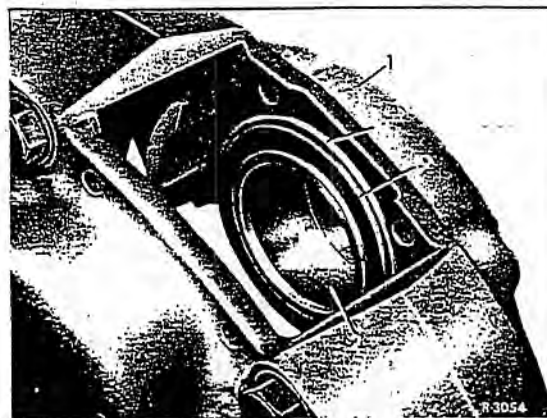


Fig. 42-12/33

1 Brake caliper      2 Piston  
8 Clamping wire      9 Dust cap

6. Install heat screening plates, friction pads, and retaining pins in the brake caliper and secure the retaining pins with the spring clips.
7. Install the shaft cover plate.
8. Install the brake caliper, bleed the brake system and check the brake caliper for leaks.

# Pressure Cylinder

Job No.

42-13

## A. Removal and Installation of Pressure Cylinder

### Removal:

1. Detach the connecting line (4) and the brake line (11) from the pressure cylinder (Fig. 42-13/1).

**Note:** When the inner pressure cylinder is removed it is not necessary to detach the brake line.

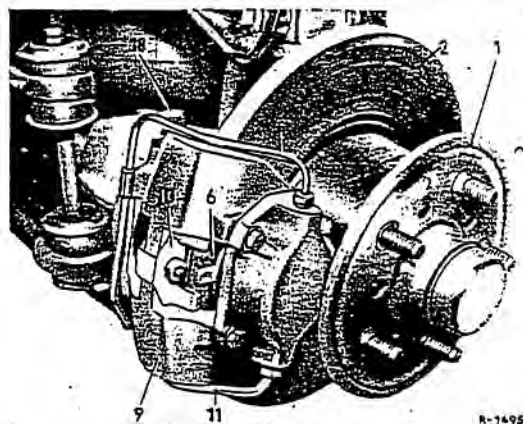


Fig. 42-13/1

- |                   |                 |
|-------------------|-----------------|
| 1 Front wheel hub | 9 Brake caliper |
| 2 Brake disk      | 10 Stirrup      |
| 4 Connecting line | 11 Brake line   |
| 6 Friction pad    | 18 Bleed screw  |

2. Remove the stirrup (10) and the friction pad (6) from the aperture of the brake caliper (9) (Fig. 42-13/1).

3. Unscrew the four hexagon screws and remove the pressure cylinder and the connecting line.

4. Clean the guide for the lining pressure plate in the caliper and remove any pressure marks and rust.

### Installation:

5. Attach the pressure cylinder to the caliper (9) making sure that the lining pressure plate of the piston is properly seated in the guide of the caliper. Install friction pad (6) and stirrup (10) (Fig. 42-13/1).

6. Attach the connecting line (4) and the brake line (11) to the pressure cylinder (Fig. 42-13/1).

**Note:** The connecting line is attached to the inner cylinder by an additional pipe clip.

7. Bleed the brake system and check for leaks.

8. Depress the brake pedal hard several times to make sure that the friction pads make contact with the brake disk. Then check and if necessary top up the brake fluid reserve in the reservoir.

**Note:** Do not fail to depress the brake pedal several times before driving the car away because the brakes will not operate unless the friction pads make contact with the brake disk and the correct clearance is obtained.

## B. Disassembly and Reassembly of Pressure Cylinder

### Disassembly:

**Note:** The pressure cylinder can only be disassembled and reassembled by means of Assembly Fixture Part No. 000 589 29 63 00. This assembly fixture consists of the following parts: ring, assembly ram, disassembly ram and bushing.

1. Remove the pressure cylinder.

2. Take the dust cap out of the groove of the pressure cylinder. Plug one connection on the pressure cylinder. Install the pressure cylinder (1) in the bushing (2), clamp the two parts in a vise and force the piston out of the pressure cylinder with compressed air (at approx. 2 atm) (Fig. 42-13/3).

**Force the piston out very carefully.**

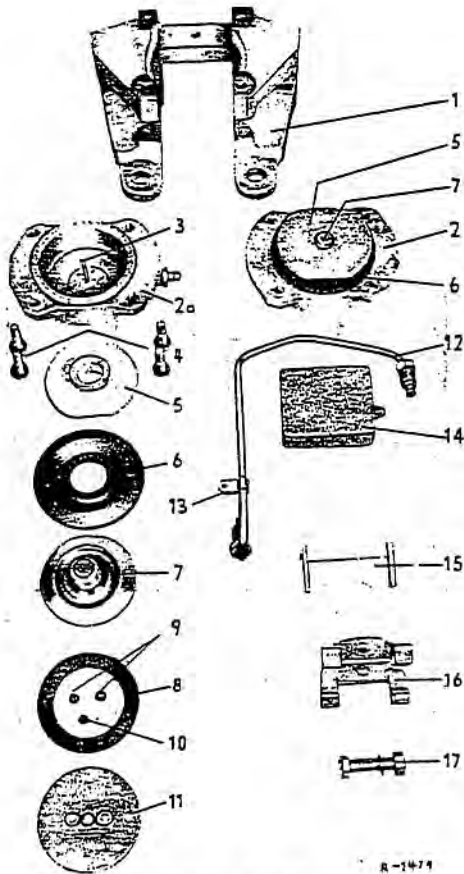


Fig. 42-13/2

- |   |  |
|---|--|
| 1 Brake caliper                           | 10 Friction spring   |
| 2 Pressure cylinder assembly              | 11 Piston plate  |
| 2a Pressure cylinder housing              | 12 Connecting line   |
| 3 Return pin                              | 13 Pipe clip   |
| 4 Hexagon screw with serrated lock washer | 14 Friction pad  |
| 5 Lining pressure plate                   | 15 Retaining plate   |
| 6 Dust cap                                | 16 Stirrup   |
| 7 Piston                                  | 17 Hexagon screw with hexagon nut and serrated lock washer |
| 8 Piston seal                             |  |
| 9 Countersunk screw                       |  |

- Unscrew the countersunk screws (9) from the piston (7) and take out the piston plate (11), the piston seal (8), and the friction spring (10) (Fig. 42-13/2).
- Use an arbor press to press the lining pressure plate (4) off the piston by means of the disassembly ram (1). Remove the dust cap (3) (Fig. 42-13/4).
- Thoroughly clean all parts with alcohol or brake fluid. Make sure that the dust cap groove on the pressure cylinder is thoroughly cleaned from dirt.

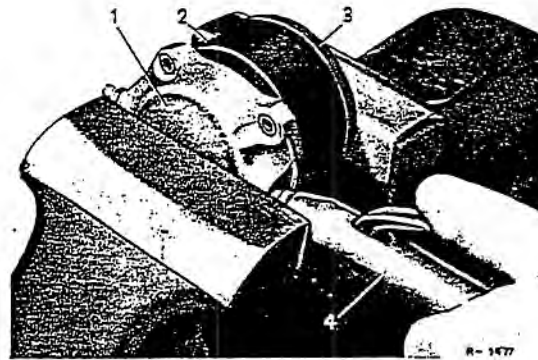


Fig. 42-13/3

- |                     |                  |
|---------------------|------------------|
| 1 Pressure cylinder | 3 Ring           |
| 2 Bushing           | 4 Compressed air |

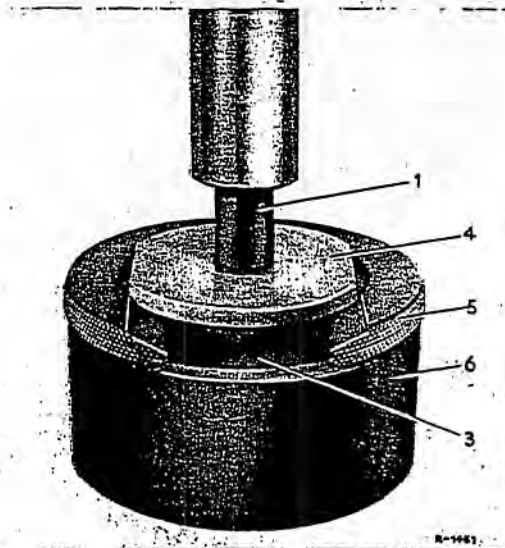


Fig. 42-13/4

- |                         |           |
|-------------------------|-----------|
| 1 Disassembly ram       | 5 Ring    |
| 3 Dust cap              | 6 Bushing |
| 4 Lining pressure plate |           |

**Reassembly:**

- Install a new dust cap in the annular groove of the lining pressure plate.
- Press the lining pressure plate (4) into the piston (2) by means of the reassembly ram (1) (Fig. 42-13/5).
- Insert the friction spring (10) in the bore of the piston (7) (Fig. 42-13/2).

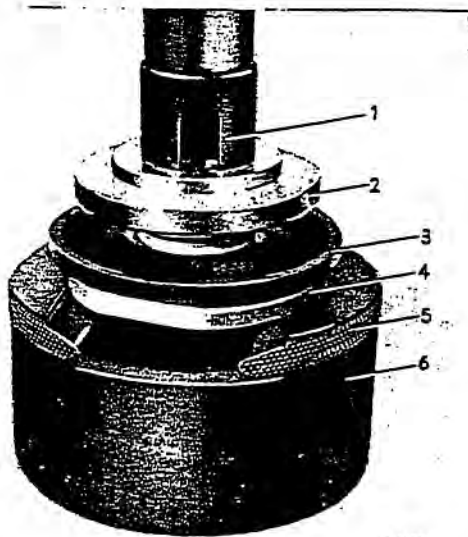


Fig. 42-13/5

- |                  |                         |
|------------------|-------------------------|
| 1 Reassembly rom | 4 Lining pressure plate |
| 2 Piston         | 5 Ring                  |
| 3 Dust cap       | 6 Bushing               |

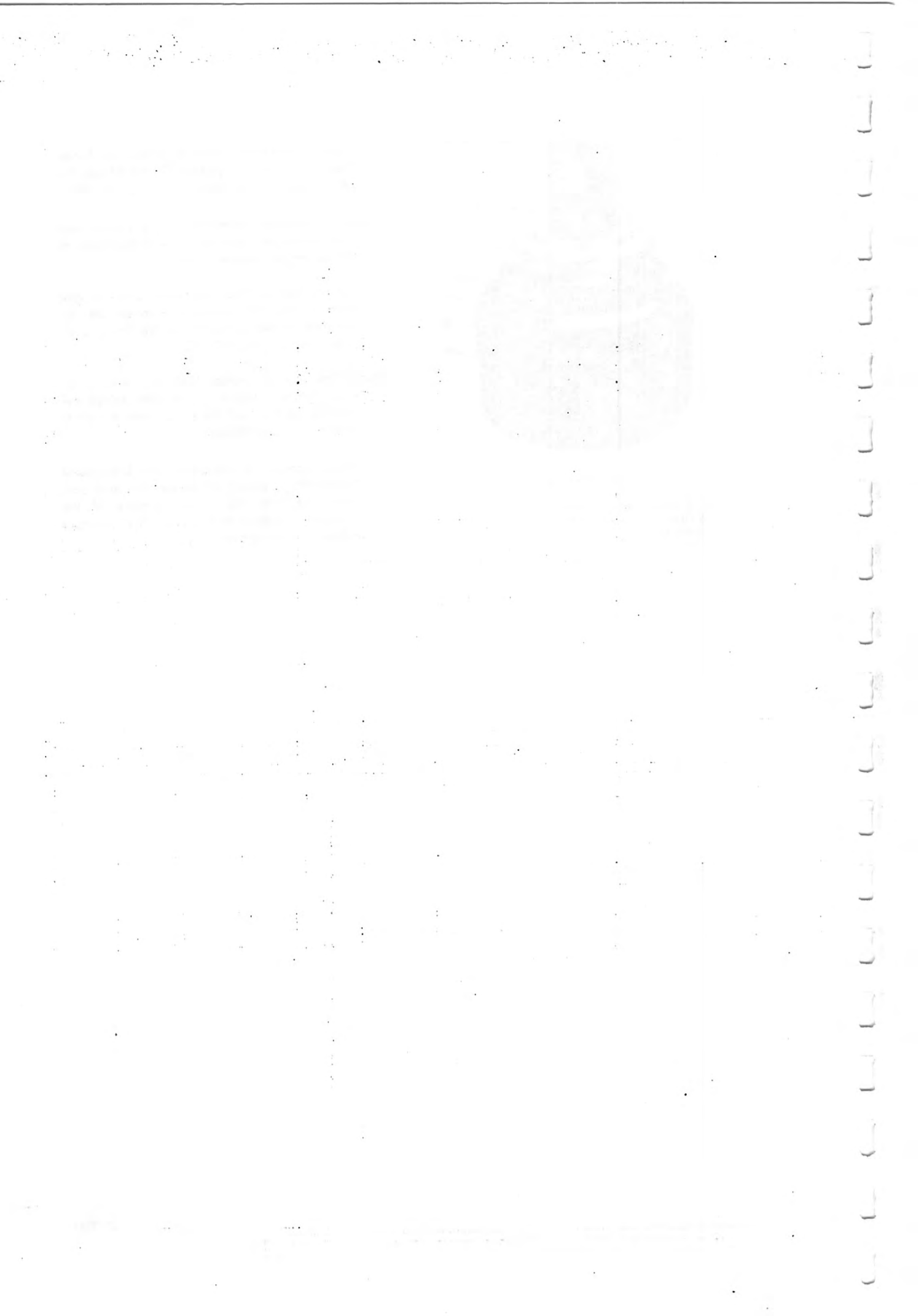
9. Coat a new piston seal (8) with ATE Brake Paste, put it on the piston (7) and attach the piston plate (11) to the piston (Fig. 42-13/2).

**Note:** The outside diameter of the piston seal must be larger than the outside diameter of the piston by approx. 1 mm.

10. Put the piston (7) on the return pin (15) and press it into the pressure cylinder (2a) by exerting an even pressure on the lining pressure plate (5) (Fig. 42-13/2).

**Note:** Take care to ensure that the piston is always properly aligned in relation to the cylinder bore and that the piston seal is neither squeezed nor distorted.

11. Spray some anti-corrosion oil (Wakefield "viscous") or castor oil under the dust cap. Insert the dust cap in the groove of the pressure cylinder and install the pressure cylinder in the brake caliper.



# ATE Power Brake T 50

Job. No.
42-14

Modification: Notes added to Paras 2 and 4

## A. General

The 1st version ATE Power Brake T 50/24 is installed in Models 220 b and 220 SEb and as optional equipment in Model 220 b. Since the check valve in the associated master cylinder maintains a residual pressure of approx. 0.4–1.2 atm., this pressure is present in the whole hydraulic system of the power brake.

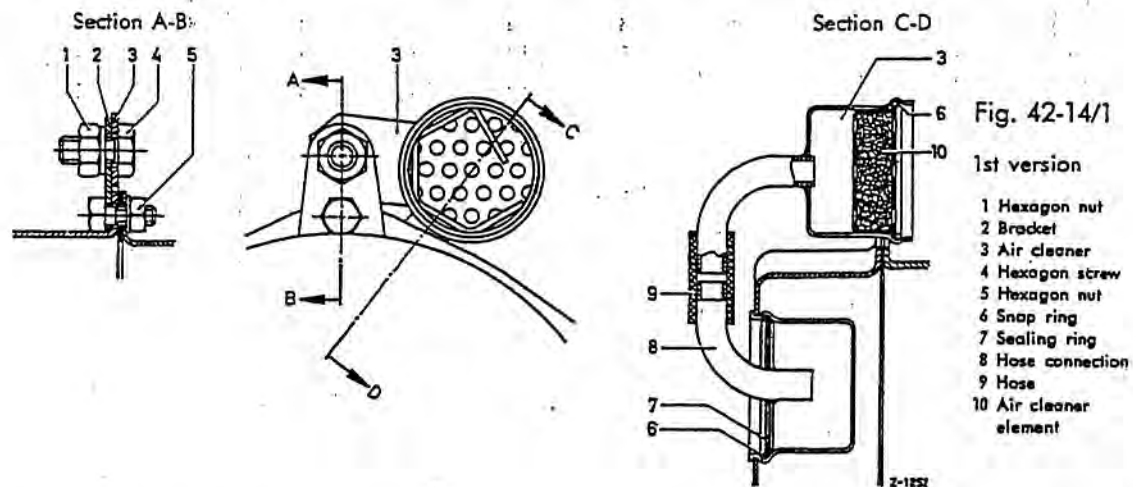
The 2nd version is ATE Power Brake T 50/24/1 which is installed together with a master cylinder with special check valve. This unit has the check valve in the hydraulic slave cylinder and the check valve in the master cylinder has an 0.7 mm diameter bore. As a result there is no residual pressure in the power brake and in the lines leading to the master cylinder. Since there is no counter-pressure on the control valve piston of the power brake, the brake can be released quickly and safely. In addition, the ATE Power Brake T 50/24/1 has a bleed screw.

ATE Power Brake T 50/26 is installed in cars which are provided with disk brakes on the front and rear axles or on the front axle only. The associated master cylinder also has a special check valve so that the hydraulic system also in this power brake is not under pressure when the brakes are in the non-applied position. The residual pressure necessary for the proper functioning of the rear wheel drum brake is maintained by a primary pressure valve installed between the distributor fitting on the master cylinder and the brake line to the rear wheel drum brake.

## B. Replacing the Air Cleaner Element

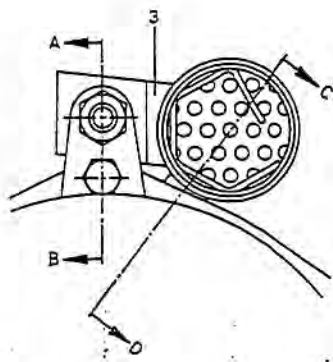
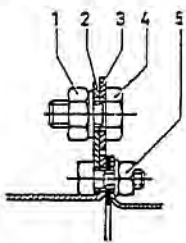
The air cleaner element of the ATE power brake is located at the front of the power brake. Since its position protects it from dust, the air cleaner element does not under normal circumstances require replacing, until a mileage of 100 000 km has been reached. For this purpose remove the power brake.

A special type of power brake can be supplied for use in a very dusty country. In this type the air cleaner element is in an easily accessible position, so that it can be replaced readily as required (Figs. 42-14/1 and 14/2).



42-14/1

Section A—B



Section C—D

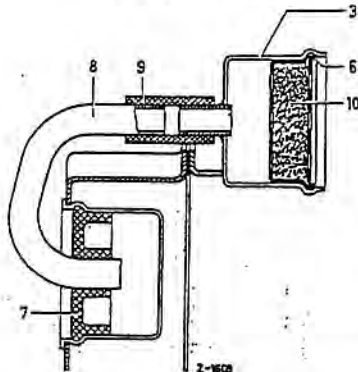


Fig. 42-14/2

2nd version

- 1 Hexagon nut
- 2 Bracket
- 3 Air cleaner housing
- 4 Hexagon screw
- 5 Hexagon nut
- 6 Snap ring
- 7 Plug
- 8 Pipe
- 9 Hose
- 10 Air cleaner element

### C. Removal and Installation of ATE Power Brake

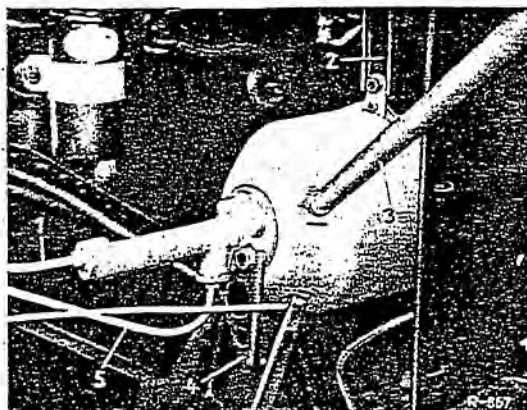


Fig. 42-14/3

ATE Power Brake T 50/24

- 1 Brake line (pressure supply)
- 2 Bracket on reinforcement plate
- 3 Vacuum line.
- 4 Bracket on chassis base panel
- 5 Feed line

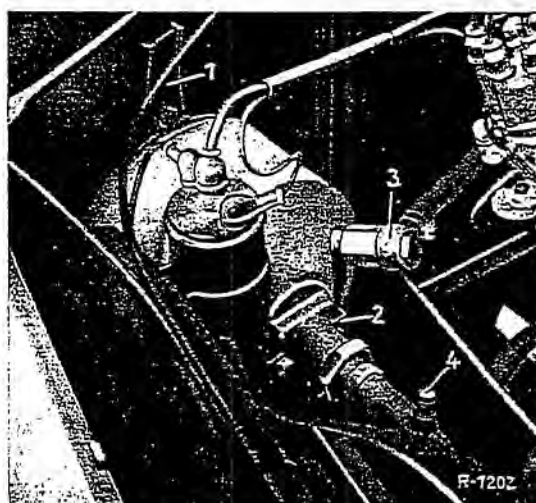


Fig. 42-14/4

ATE Power Brake T 50/26

- 1 Bracket on reinforcement plate
- 2 Bracket on chassis base panel
- 3 Annular fitting for vacuum connection
- 4 Bleed screw

#### Removal:

1. Disconnect brake lines (1) and (5) and the vacuum hose (3) from the power brake (Fig. 42-14/3).
2. Unscrew the power brake at the bracket (4) on the chassis base panel and the bracket (2) at the reinforcement plate and remove (Fig. 42-14/3).

**Note:** As a result of installing the disk brake in Models 220 Sb and 220 SEb and the consequent changeover to power brake T 50/26, the bracket (2) on the chassis had to be moved backward since power brake T 50/26 has a longer vacuum cylinder than power brake T 50/24/1. When power brake T 50/24/1 is installed in Model 220 b, a spacer sleeve has to be added between the bracket on the power brake and the bracket (1) on the reinforcement plate (Fig. 42-14/4).

#### Installation:

3. Attach the power brake to the brackets.
- Note:** When installing a new power brake make sure that it is the correct type for the master cylinder installed (see Table in Job No. 42-0).
4. Connect the brake lines and the vacuum hose to the power brake.
- Note:** Tighten the hollow screw for fastening the annular fitting (3) on power brake T 50/26 with a torque of 2.5–3.0 mkg (Fig. 42-14/4).
5. Bleed the brake system and check for leaks.
- Note:** Power Brakes T 50/24/1 and T 50/26 are provided with a bleed screw on the hydraulic slave cylinder.



# Power Brake T 51

Job No.

42-16

## A. Removal and Installation of Power Brake

**Note:** The power brake is removed from the vehicle together with the tandem master cylinder.

### Removal:

1. On all models with the exception of Models 190 c and 230 SL remove the battery. On Model 300 SE also remove the reservoir for the high pressure oil pump.
2. Pump the brake fluid out of the reservoir (2) of the tandem master cylinder (3) via an opened bleed screw in the front wheel and rear wheel brake circuits, making sure that both chambers of the reservoir are emptied. Then detach the brake lines from the master cylinder (Fig. 42-16/1).

**Note:** Close the brake lines by means of the rubber caps of the bleed screws, and the tandem master cylinder connections by means of dummy plugs.

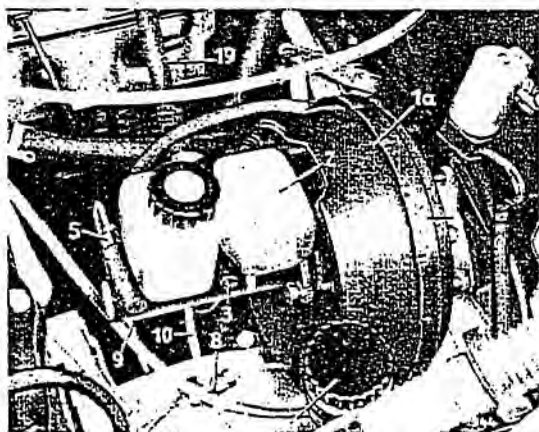


Fig. 42-16/1

Arrangement on Models 190 c and 190 Dc  
(Tandem master cylinder 1st version)

- 1a Power brake T 51/100
- 2 Reservoir
- 3 Tandem master cylinder
- 5 Residual pressure valve
- 6 Intermediate flange
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 10 Brake line to distributor fitting
- 11 Reservoir for supply cylinder
- 19 Vacuum hose

3. Detach the vacuum hose (19) from the check valve (21) of the power brake (Figs. 42-16/5 to 42-16/7).

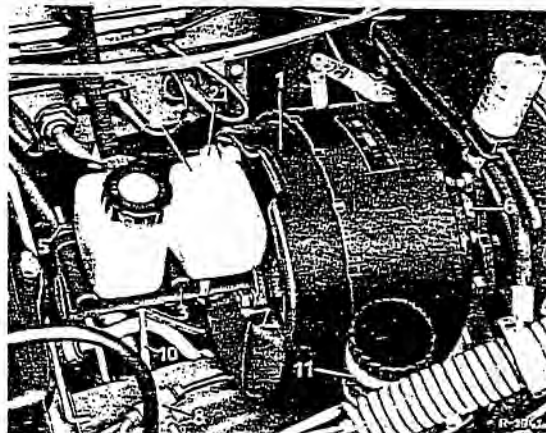


Fig. 42-16/2

Arrangement on Models 220 b, 220 Sb, 220 SEb  
(Tandem master cylinder 1st version)

- 1 Power brake T 51/200
- 2 Reservoir
- 3 Tandem master cylinder
- 5 Residual pressure valve
- 6 Intermediate flange
- 8 Distributor fitting
- 10 Brake line to distributor fitting
- 11 Reservoir for supply cylinder
- 19 Vacuum hose
- 21 Check valve

4. On Model 230 SL detach the piston rod (18) of the power brake (1) from the relay lever (15) by backing out the adjusting screw (14) (Fig. 42-16/3).
5. On all other models detach the piston rod of the power brake from the brake pedal (9) by backing out the adjusting screw (2) (Fig. 42-16/6).
6. On all models with the exception of Model 230 SL remove the power brake (1) together with the intermediate flange (6). To do this, back out two hexagon nuts in the engine compartment and one hexagon nut in the passenger compartment (Fig. 42-16/5).

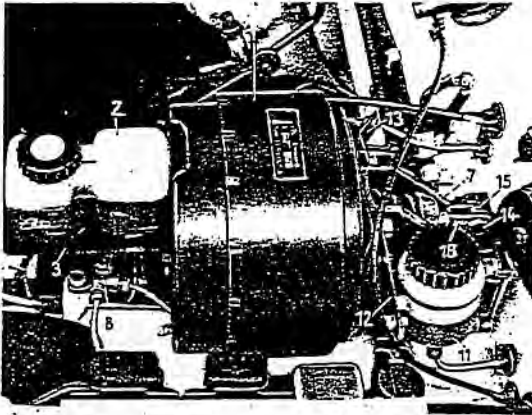


Fig. 42-16/3

Arrangement on Model 230 SL  
(Tandem master cylinder 1st version)

- 1 Power brake T 51/200
- 2 Reservoir
- 3 Tandem master cylinder
- 7 Bearing bracket
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 11 Reservoir for supply cylinder
- 12 Bracket for reservoir
- 13 Bracket for oil pressure gage line
- 14 Adjusting screw with hexagon nut and lock washer
- 15 Relay lever
- 18 Piston rod of power brake

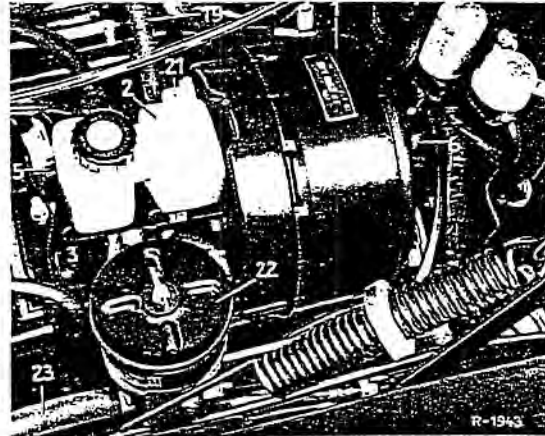


Fig. 42-16/5

Arrangement on Model 300 SE  
(Tandem master cylinder 1st version)

- 1 Power brake
- 2 Reservoir
- 3 Tandem master cylinder
- 5 Special check valve
- 6 Intermediate flange
- 19 Vacuum hose
- 21 Check valve
- 22 Reservoir for high pressure oil pump
- 23 Connecting line to high pressure oil pump

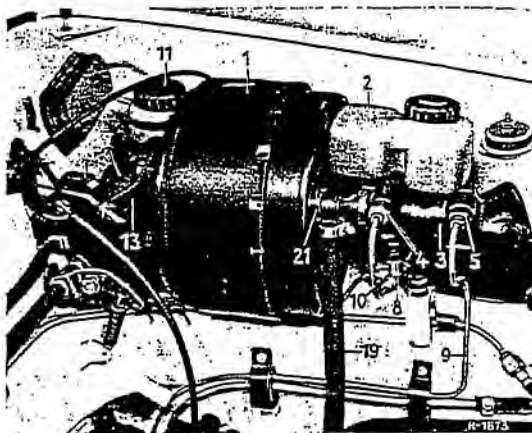


Fig. 42-16/4

Arrangement on Model 230 SL  
(Tandem master cylinder 1st version)

- 1 Power brake T 51/200
- 2 Reservoir
- 3 Tandem master cylinder
- 4 Special check valve
- 5 Residual pressure valve
- 7 Bearing bracket
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 10 Brake line to distributor fitting
- 11 Reservoir for supply cylinder
- 13 Bracket for oil pressure gage line
- 18 Piston rod
- 19 Vacuum hose
- 21 Check valve

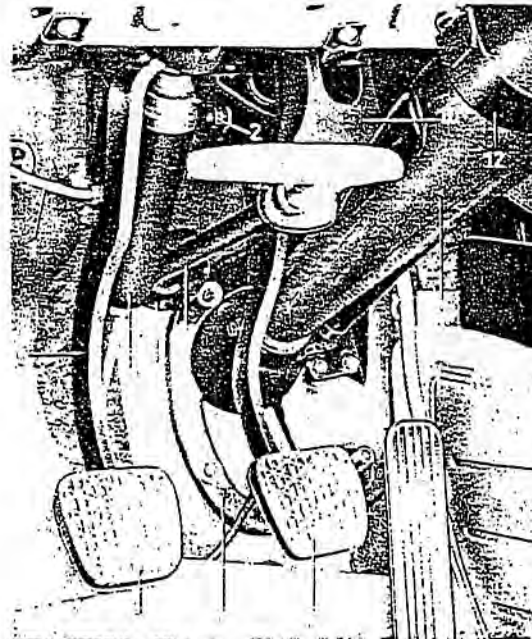


Fig. 42-16/6

- 1 Line from reservoir to supply cylinder
- 2 Adjusting screw with hexagon nut and lock washer
- 3 Clutch pedal
- 4 Supply cylinder
- 5 Rubber sleeve
- 6 Guide tube for ratchet
- 7 Foot plate of clutch pedal
- 8 Cover plate
- 9 Brake pedal
- 10 Bracket for guide tube
- 11 Steering column jacket
- 12 Tightening strap

7. On Model 230 SL detach the power brake (1) from the bearing bracket (7) and remove (Fig. 42-16/3).

**Note:** The control housing of the power brake has a very low impact strength. It is made of plastics and may break off if not treated carefully. On no account must the brake be dropped.

**Installation:**

**Note:** Before installing the power brake make sure that the leak port in the tandem master cylinder is not clogged.

8. On all models with the exception of Model 230 SL install the power brake (1) together with the intermediate flange (6) (Fig. 42-16/5).
9. On Model 230 SL attach the power brake (1) to the bearing bracket (7) (Fig. 42-16/3).

**Note:** On Model 230 SL also attach the bracket (13) for the oil pressure gage line and the bracket (12) for the reservoir of the supply cylinder to the bearing bracket (Fig. 42-16/3).

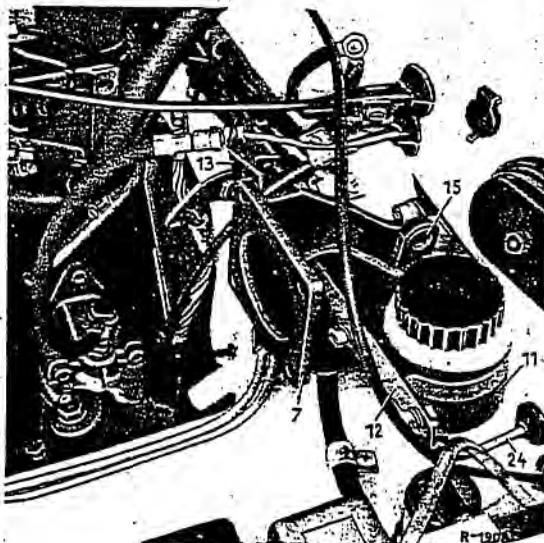


Fig. 42-16/7

Arrangement on Model 230 SL

- 7 Bearing bracket
- 11 Reservoir for supply cylinder
- 12 Bracket for reservoir
- 13 Bracket for oil pressure gage line
- 15 Relay lever
- 24 Line to supply cylinder

10. On Model 230 SL attach the piston rod (18) of the power brake (1) to the relay lever (15) by means of the adjusting screw (14) (Fig. 42-16/3).
11. On all other models attach the piston rod to the brake pedal (9) (Fig. 42-16/6).
12. Adjust the brake pedal travel (see Job No. 42-20, Section C).
13. Attach the brake lines and the vacuum hose to the tandem master cylinder and the power brake.

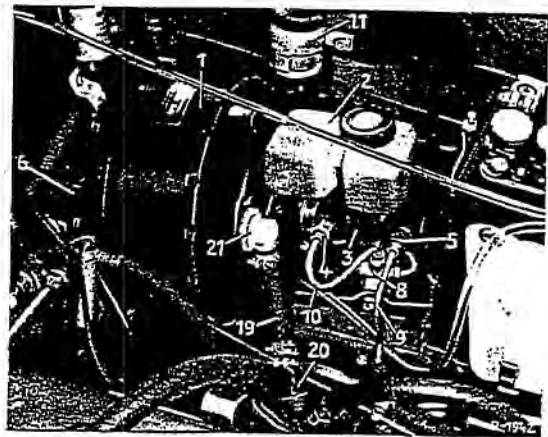


Fig. 42-16/8

Arrangement on Models 220 b, 220 Sb, 220 SEb

- 1 Power brake T 51/200
- 2 Reservoir
- 3 Tandem master cylinder
- 4 Special check valve
- 5 Residual pressure valve
- 6 Intermediate flange
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 10 Brake line to distributor fitting
- 11 Reservoir for supply cylinder
- 19 Vacuum hose
- 20 Gasoline separator
- 21 Check valve

14. Bleed the brake system and check for leaks.

15. On all models with the exception of Models 190 c and 230 SL install the battery and on Model 300 SE also install the reservoir for the high pressure oil pump.

## B. Replacement of Filter in Power Brake

### Removal:

1. Remove the power brake and the tandem master cylinder (see Section A).
2. Remove the protective cap (5) from the vacuum cylinder (7) and pull off toward the rear over the piston rod (1) (Fig. 42-16/9).

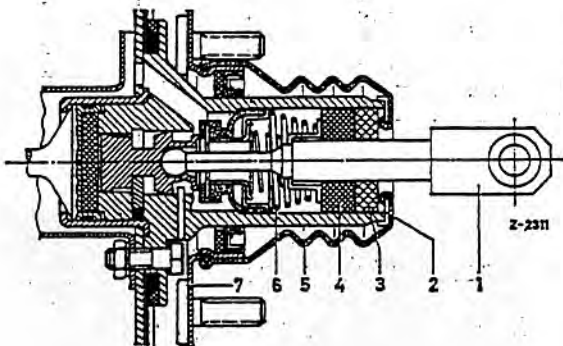


Fig. 42-16/9

- 1 Piston rod
- 2 Silencer bracket
- 3 Silencer
- 4 Filter
- 5 Protective cap
- 6 Control housing
- 7 Vacuum cylinder

3. Use two small screw drivers to remove the silencer bracket (2) from the control housing (6) and use a hooked needle to take the filter (4) and the silencer (3) out of the control housing and pull them over the piston rod.

### Installation:

4. Insert a new filter and silencer into the control housing.

**Note:** The filter is twice as thick as the silencer and should be installed first. After installation turn the silencer so that the slots of the two elements are staggered by approx. 90°.

5. Insert the silencer bracket and pull on the rubber protective cap.
6. Install the power brake and the tandem master cylinder.

Modification: Note extended

## C. Replacement of Vacuum Check Valve

**Note:** On the 1<sup>st</sup> version power brake the vacuum check valve (21) in the form of an angle valve is attached directly to the power brake (Fig 42-16/10), whereas as from chassis end numbers

Model 190 c	091 158	Model 220 SE sedan	066 097
190 Dc	156 102	220 SE/c	066 143
220 b	060 922	300 SE	005 689
220 Sb	135 193	230 SL	006 869

the check valve (23) has been separated from the power brake and has been installed in the vacuum hose (19) (Fig. 42-16/11). The power brake itself is now only provided with a connector. Since there is no physical difference between the check valve and the connector the vacuum check valve has a white housing and the connector a black housing.

On Model 200 D as from chassis end no. 254 609 the separate check valve is no longer installed since the plate valve in the vacuum pump ensures proper functioning of the power brake. On diesel cars with a previous version vacuum pump the separate check valve can be removed provided that the two-piece vacuum hoses are replaced by hoses 230 mm long on left-hand drive cars and by hoses 500 mm long on right-hand drive cars.

### 1<sup>st</sup> Version

#### Removal:

1. Detach the vacuum hose (19) for the check valve (21) (Fig. 42-16/10).

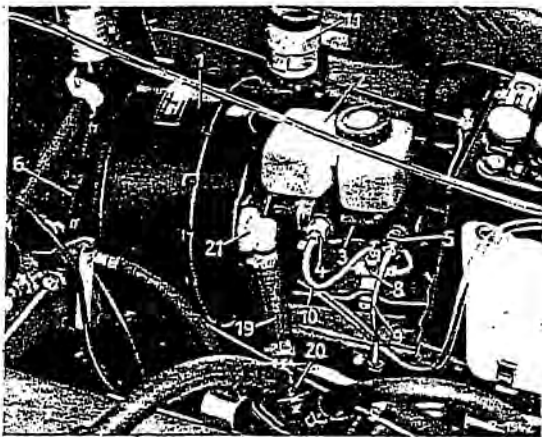


Fig. 42-16/10

Arrangement on Models 220 b, 220 Sb, 220 SEb

- 1 Power brake T 51/200
- 2 Reservoir
- 3 Tandem master cylinder
- 4 Connector with special check valve
- 5 Residual pressure valve
- 6 Intermediate flange
- 8 Distributor fitting
- 9 Brake line to rear wheel brake
- 10 Brake line to distributor
- 11 Reservoir for supply cylinder
- 19 Vacuum hose
- 20 Evaporator jar
- 21 Check valve

2. Use an SW 27 wrench to turn the check valve approx. 30° toward the tandem master cylinder and remove together with the sealing ring.

#### Installation:

3. Give the sealing ring a thin coat of special grease ESSO Norva 275 and put it on top

of the check valve in such a way that the coated surface points toward the power brake.

4. Fit the check valve to the power brake in such a way that the hose connection points toward the tandem master cylinder at an angle of 30°. Then use a hammer handle to push the valve toward the power brake and turn it downward.
5. Attach the vacuum hose to the check valve and check the connection for leaks.

### 2<sup>nd</sup> Version

During installation pay attention to the fact that the arrows on the check valve (23) point in the direction of the intake pipe and on Model 190 Dc in the direction of the vacuum pump.

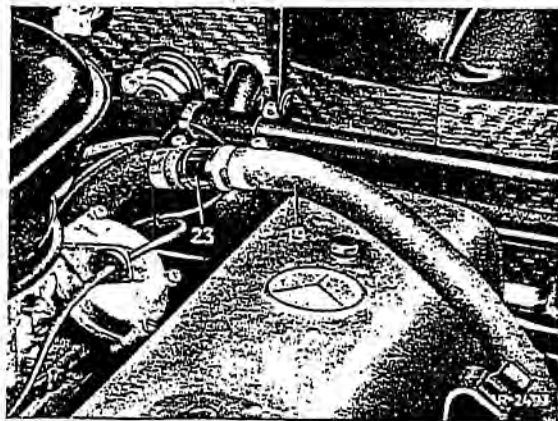


Fig. 42-16/11

Arrangement on Model 220 Sb

- 19 Vacuum hose 23 Check valve

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author details the various methods used to collect and analyze the data. This includes both primary and secondary data collection techniques. The analysis focuses on identifying trends and patterns over time, which is crucial for making informed business decisions.

The final part of the document provides a comprehensive summary of the findings. It highlights the key insights gained from the research and offers practical recommendations for future actions. The author concludes by stating that the data clearly indicates a strong correlation between the variables studied, and that the proposed strategies are likely to yield positive results.



# Ratched and Brake Lever of Pistol-Grip Hand-Brake

Job No.

42-18

Modification: Two-circuit brake and Section D added

## A. Removal and Installation of the Ratchet of the Pistol-Grip Hand-Brake together with the Hand-Brake Cable

### Single-Circuit Brake

#### Removal:

1. Pull out the cotter pin from the brake lever (3) and detach the brake cable (2) from the brake lever (see Fig. 42-18/2).

Note: On the 2nd version without cotter pin, swivel the brake cable inward and then detach it from the brake lever.

2. Remove the inside cover and unscrew the bracket (21) of the ratchet at the support of the pedal system (see Fig. 42-18/1).

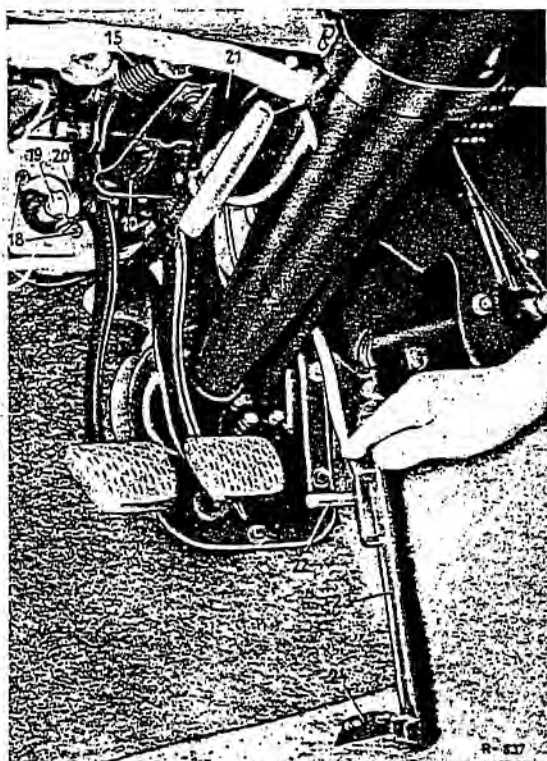


Fig. 42-18/1

- |  |                        |
|--|------------------------|
| 10 Pedal Stop                              | 21 Bracket for ratchet |
| 15 Pressure spring<br>(dead center spring) | 22 Adjustment lever    |
| 19 Adjusting screw                         | 23 Foot plate          |
| 20 Push rod                                | 24 Ball-head bracket   |

Note: On cars with hand-brake warning light pull the plug out of the socket on the bracket of the ratchet.

3. Push the ratchet right to the front (in direction of travel) and tap out the guide pin from below through the bore in the guide tube.
4. Pull the ratchet out of the guide tube and detach the brake cable.
5. Pull the brake cable together with the rubber sleeve out of the cowl.

#### Installation:

6. Install the rubber sleeve of the brake cable in the cowl and push the cable inside.

Note: The rubber sleeve on the brake cable has been changed. Only the 2nd version (drawn out and dot-dash line) is supplied as a replacement part. If this version is installed as replacement of the 1st version rubber sleeve (drawn out line), the dot-dash part of the rubber sleeve must be cut off (Fig. 42-18/1a).

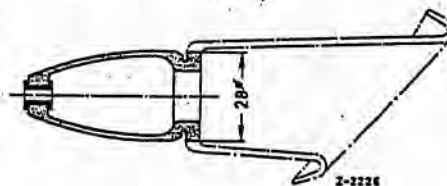


Fig. 42-18/1a

7. Lightly coat the ratchet with vaseline. Push the brake cable through the guide tube and attach it to the ratchet.

42-18/1

**Note:** The 2nd version ratchet has only 10 or 12 notches.

- Use a screw driver to lift the pawl on the guide tube, and insert the ratchet with the cable in the guide tube.

**Note:** The 2nd version guide tube has a smoother guide curve in order to facilitate the return of the ratchet.

- Knock the guide pin into the ratchet from above.

### Two-Circuit Brake

#### Removal:

- Swivel the front brake cable (1) inward and detach from the brake lever (4) (see Fig. 42-18/5).

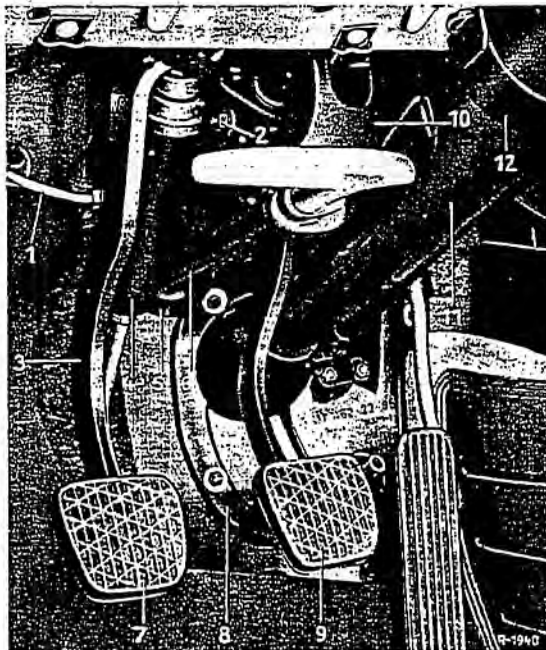


Fig. 42-18/2

- |  |                           |
|--|---------------------------|
| 1 Line from reservoir to supply cylinder           | 6 Guide tube for ratchet  |
| 2 Adjusting screw with hexagon nut and lock washer | 7 Clutch pedal foot plate |
| 3 Clutch pedal                                     | 8 Cover plate             |
| 4 Supply cylinder                                  | 9 Brake pedal             |
| 5 Rubber sleeve                                    | 10 Bracket for guide tube |
|  | 11 Steering column jacket |
|  | 12 Tightening strap       |

- Screw the bracket to the support and install the cover.  
On cars with hand-brake warning light put the plug in the socket before installing the cover.
- Check the functioning of the hand-brake warning light. When the hand-brake is applied the white pilot light must light up in the instrument cluster.
- Attach the front brake cable to the brake lever, and on the 1st version, cotter.
- Adjust the hand-brake (see Job No. 42-20, Section C).

- Remove the inside cover and pull the plug for the hand brake warning light out of the switch on the guide tube bracket (10) and unscrew the bracket from the pedal support (Fig. 42-18/2).
- Remove the ratchet together with guide tube, the front brake cable, and the rubber sleeve.
- Push the ratchet in the guide tube right to the front and tap out the guide pin from below through the bore in the guide tube. Detach the brake cable.

#### Installation:

- Push the rubber sleeve (1) over the guide tube (3) (Fig. 42-18/3).

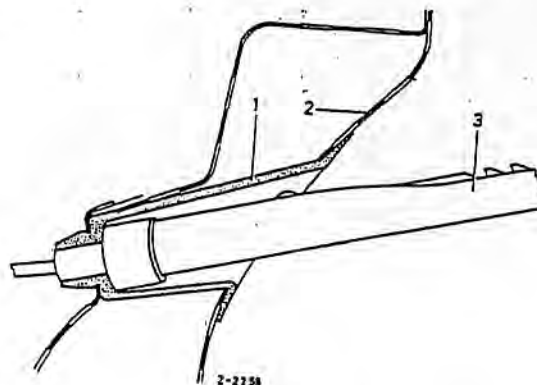


Fig. 42-18/3

- |                 |        |              |
|-----------------|--------|--------------|
| 1 Rubber sleeve | 2 Cowl | 3 Guide tube |
|-----------------|--------|--------------|



6. Lightly coat the ratchet with vaseline. Push the brake cable through the guide tube and attach it to the ratchet.
7. Use a screw driver to lift the pawl on the guide tube, and insert the ratchet with the cable in the guide tube.
8. Knock the guide pin into the ratchet from above.
9. Push the brake cable through the cowl, and attach the bracket to the pedal sup-

port, making sure that the rubber sleeve is properly installed in the cowl.

10. Plug the hand brake warning light plug into the switch and check whether the warning light is working properly. When the hand brake is applied, the white light in the instrument cluster must light up.
11. Attach the brake cable to the brake lever.
12. Adjust the hand brake (see Job No. 42-20).

### B. Removal and Installation of the Hand-Brake Lever, 1st version

#### Removal:

1. Unscrew the wing nut (1) from the center brake cable (7) and remove (Fig. 42-18/4).

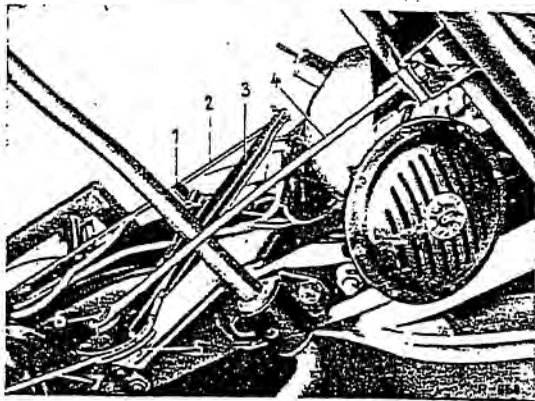


Fig. 42-18/4  
1st version

- |                     |                      |
|---------------------|----------------------|
| 1 Wing nut          | 5 Cotter pin         |
| 2 Front brake cable | 6 Pivot pin          |
| 3 Brake lever       | 7 Center brake cable |
| 4 Pull rod          |                      |

2. Pull out the cotter pin from the brake lever (3) and detach the front brake cable (2) (Fig. 42-18/4).
3. Pull out the cotter pin (5) from the brake cable guide of the brake lever and remove the center brake cable from the brake lever (Fig. 42-18/4).
4. Remove the circlip from the pivot pin (6) of the brake lever (Fig. 42-18/4).
5. Screw out the hexagon nut of the pull rod (4) and remove the pull rod and the brake lever (3) (Fig. 42-18/4).

#### Installation:

6. When reinstalling the brake lever, make sure that the pull rod can be pushed easily on the pivot pin.
7. Adjust the hand brake (see Job No. 42-20, Section C).

### C. Removal and Installation of 2nd version Brake Lever of Pistol-grip Hand-Brake

#### Removal:

1. Unscrew the wing nut (8) at the relay lever (5) (see Fig. 42-20/4).
2. Pull out the cotter pin from the brake lever (4) and detach the front brake cable (1) (Fig. 42-18/5).
3. Pull out the cotter pin (6) from the cable guide of the hand brake lever (4) and remove the center brake cable (5) (Fig. 42-18/5).
4. Bend the locking plate upward and screw out the hexagon screw (2) (Fig. 42-18/5).
5. Screw out the front hexagon nut at the pull rod (3) and remove the hand brake lever (4) together with the pull rod (Fig. 42-18/5).

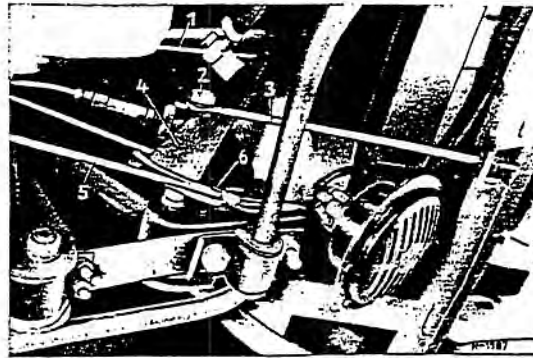


Fig. 42-18/5

2nd version

- 1 Front brake cable
- 2 Hexagon screw and locking plate
- 3 Pull rod for supporting hand-brake lever mounting
- 4 Hand brake lever
- 5 Center brake cable
- 6 Cotter pin

#### Installation:

6. When reinstalling the brake lever, make sure that the pull rod is adjusted to the

correct length and that a new locking plate is used for the hexagon screw (2) (Fig. 42-18/5).

## D. Removal and Installation of Hand Brake Lever on Model 230 SL

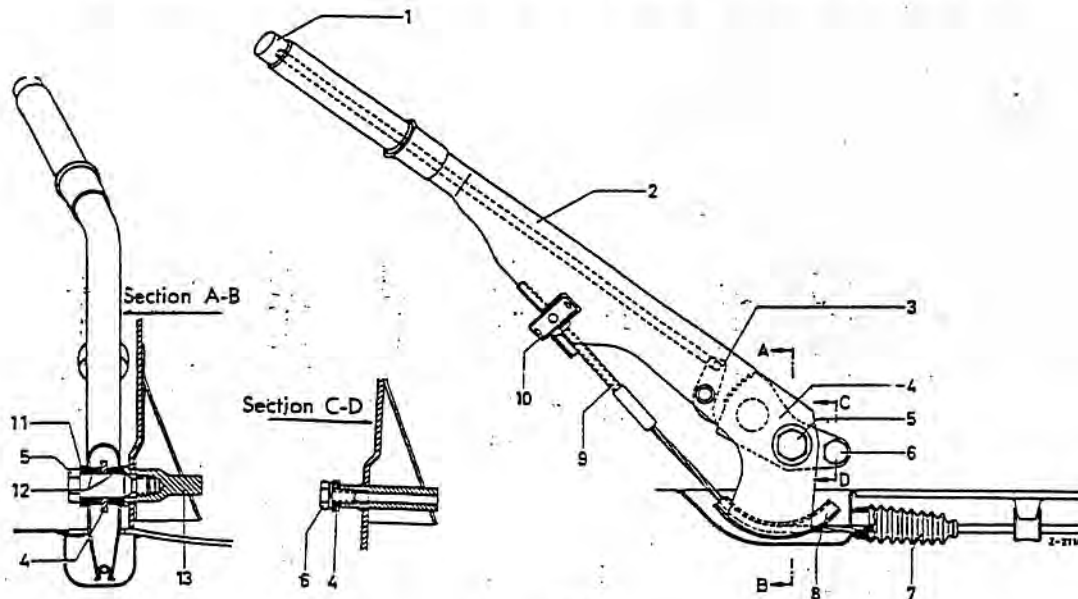


Fig. 42-18/6

- |                                  |  |
|----------------------------------|--|
| 1 Push button                    | 8 Brake cable guide  |
| 2 Hand brake lever               | 9 Front brake cable  |
| 3 Pawl                           | 10 Circular four-hole nut  |
| 4 Toothed segment                | 11 Washer  |
| 5 Pivot pin                      | 12 Bearing bushing   |
| 6 Hexagon screw with lock washer | 13 Threaded member for fastening brake lever to chassis base panel |
| 7 Rubber sleeve                  |  |

### Removal:

1. Unscrew the circular four-hole nut (10) from the front brake cable (9) (Figs. 42-18/6 and 42-18/7).

**Note:** Use a 5 mm  $\phi$  steel rod to unscrew the circular four-hole nut.

2. Unscrew the pivot pin (5) from the threaded member (13) and remove together with the washer (11).

**Caution:** Left-hand thread!

3. Push the push button (1) home and remove the brake lever (2) toward the front.
4. If the teeth of the toothed segment (4) should be damaged, remove the segment after unscrewing the hexagon screw (6).
5. Check the bearing bushings (12) in the brake lever for wear and replace, if necessary (Fig. 42-18/6).

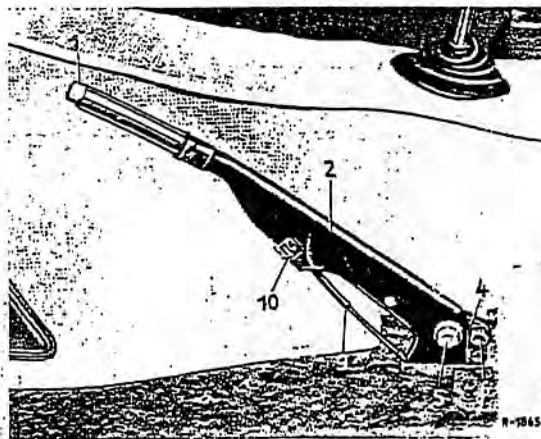


Fig. 42-18/7

- |                    |                                  |
|--------------------|----------------------------------|
| 1 Push button      | 6 Hexagon screw with lock washer |
| 2 Hand brake lever | 9 Front brake cable              |
| 4 Toothed segment  | 10 Circular four-hole nut        |
| 5 Pivot pin        |                                  |

### Installation:

6. Attach the toothed segment (4) to the transmission tunnel without, however, tightening the hexagon screw (6).

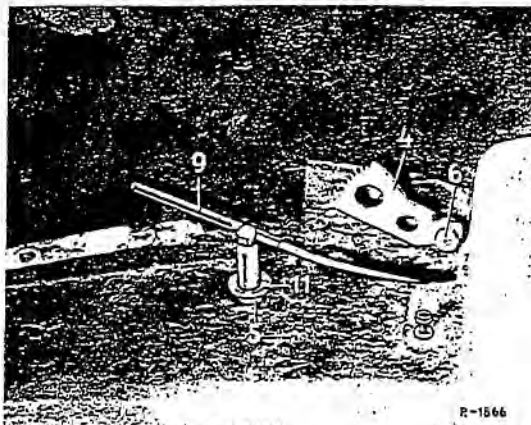


Fig. 42-18/8

- 4 Toothed segment
- 5 Pival pin
- 6 Hexagon screw with lock washer
- 9 Front brake cable
- 11 Washer

7. Push the push button (1) home and insert the brake lever (2) from the front over the toothed segment.
8. Coat the pivot pin (5) with Molycote Paste Type "G" and screw into the threaded member (13).
9. Tighten the hexagon screw (6).
10. Check the hand brake lever for freedom of movement by pulling the lever and releasing it several times.
11. Insert the front brake cable (9) into the brake lever (2), making sure that the offset side of the rear brake cable threaded member points toward the front.
12. Screw on the circular four-hole nut and adjust the hand brake (see Job No. 42-20).

### E. Removal and Installation of Front Brake Cable on Model 230 SL

#### Removal:

1. Detach the return spring (2) from the chassis base panel bracket and from the equalizer (3) (Fig. 42-18/9).

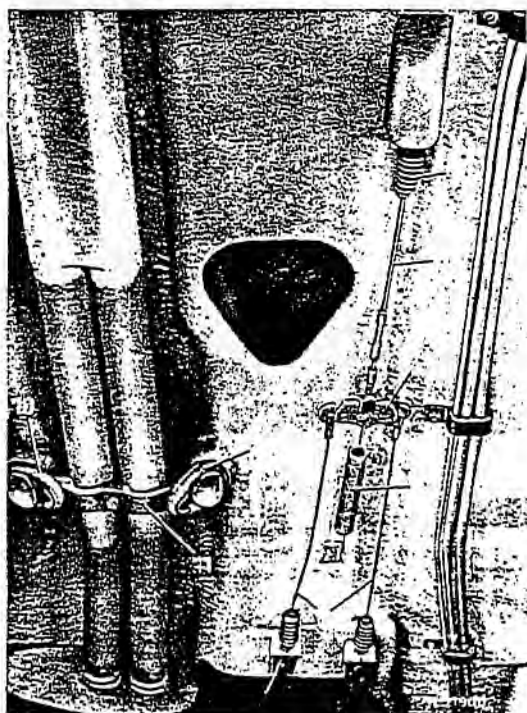


Fig. 42-18/9

- 1 Rear brake cable
- 2 Return spring
- 3 Equalizer
- 6 Front brake cable
- 9 Rubber grommet
- 10 Rubber ring
- 11 Lower bracket

2. Pull the cotter pin out of the collar bolt and remove the collar bolt from the equalizer and remove the front brake cable (6) from the equalizer (Fig. 42-18/9).
3. Remove the hand brake lever (see Section D).
4. Remove the brake cable.
5. Remove the rubber grommet (9) from the brake cable.

#### Installation:

6. Push a new rubber grommet on the front brake cable.
7. Insert the brake cable into the passenger compartment and install the brake lever.
8. Attach the front brake cable to the equalizer and attach the return spring.
9. Push the rubber grommet (9) on the bracket (Fig. 42-18/9).
10. Insert the brake cable (9) in the brake lever (2) making sure that the offset side of the threaded part on the brake cable points toward the front (see Fig. 42-18/7).
11. Screw on the circular four-hole nut and adjust the hand brake (see Job No. 42-20).

# Center and Rear Brake Cable

Job No.

42-19

Modification: Note in para 8 added

## A. Replacement of 1st version Center Brake Cable

### Removal:

1. Unscrew the wing nut (1) from the center brake cable (7) and remove (see Fig. 42-18/4).
2. Pull the cotter pin (5) out of the cable guide plate of the brake lever (3). Pull the center brake cable (7) downward out of the brake lever (see Fig. 42-18/4).
3. Detach the return spring (3) from the collar bolt and from the bracket (4) on the chassis base panel (Fig. 42-19/1).
4. Remove the collar bolt from the center brake cable (1) and the equalizer (2).
5. Pull out the center brake cable toward the rear through the cable guides.

### Installation:

6. During installation make sure that the guide lug on the center brake cable engages the brake lever.
7. Adjust the hand-brake (see Job No. 42-20, Section C).

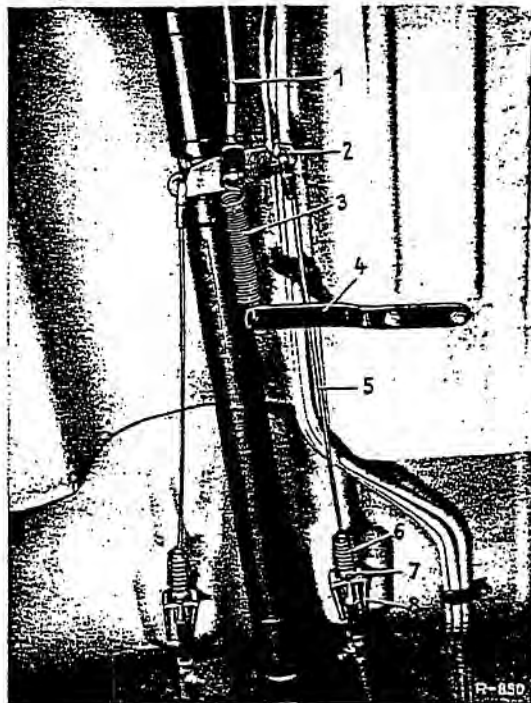


Fig. 42-19/1  
1st version

- |                      |                                 |
|----------------------|---------------------------------|
| 1 Center brake cable | 5 Rear brake cable              |
| 2 Equalizer          | 6 Rubber sleeve                 |
| 3 Return spring      | 7 Hexagon collar nut            |
| 4 Bracket            | 8 Bracket on chassis base panel |

## B. Replacement of 2nd version Center Brake Cable

### Removal:

1. Loosen the wing nut (8) at the relay lever (5) (Fig. 42-19/2).
2. Remove the collar bolt from the relay lever (5) (Fig. 42-19/2).
3. Pull out the cotter pin from the brake cable guide of the brake lever (4) and remove the brake cable (Fig. 42-18/4).

### Installation:

4. During installation make sure that the brake cable at the multiple eyelet is properly fastened in the relay lever (5), i. e. when the hand brake is applied the relay lever must not bear against the guide end (7) (Fig. 42-19/2).

42-19/1

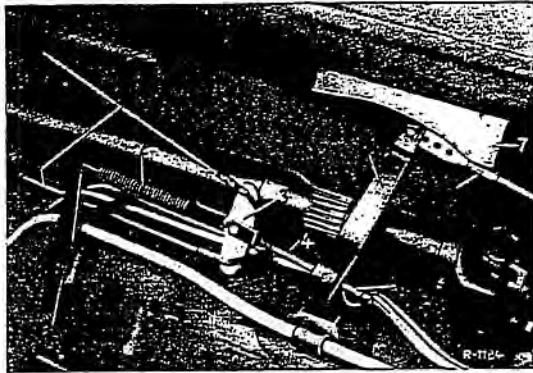


Fig. 42-19/2

2nd version

- |                    |  |
|--------------------|--|
| 1 Rear brake cable | 6 Center brake cable                       |
| 2 Return spring    | 7 Guide for relay lever                    |
| 3 Equalizer        | 8 Wing nut for adjusting<br>the hand brake |
| 4 Tensioning screw |  |
| 5 Relay lever      |  |

**Note:** If the relay lever is removed or replaced take care to ensure that the proper relay lever corresponding to the particular version of the hand brake is installed (see Job No. 42-0).

### C. Replacement of Rear Brake Cable (Drum Brake)

#### Removal:

1. Remove the brake shoes on both sides (see Job No. 42-9).
2. Unscrew the pulley housing (5) from the brake anchor plate and pull it out of the brake anchor plate (Fig. 42-19/4).
3. After loosening the hexagon nut and lock washers and pulling out the hexagon screw, remove the pulleys from the two pulley housings.
4. Loosen the clamping screw (6) and pull out the cable guide from the two pulley housings (Fig. 42-19/4).
5. Detach the return spring from the equalizer and the bracket on the chassis base panel.
6. Loosen the wing nut on the brake or relay lever.
7. Loosen the hexagon collar nut (7) which secures the cable guide, remove the cables from the brackets (8) and detach them from the equalizer (2) (see Fig. 42-19/1).

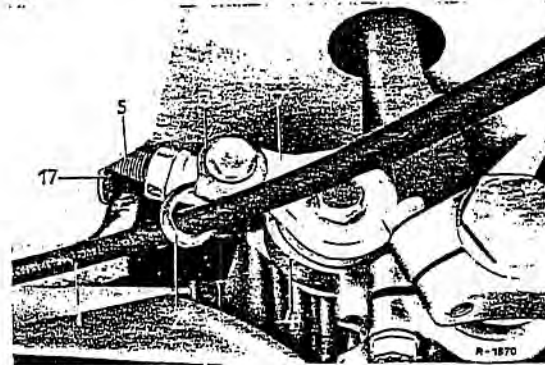


Fig. 42-19/2a

- |  |                               |
|--|-------------------------------|
| 1 Rear brake cable                                     | 5 Cross strut                 |
| 2 Rubber eyelet  | 7 Link                        |
| 3 Fixing clip  | 17 Sleeve for lateral support |
| 4 Bracket for rear axle suspension with rubber bearing |                               |

9. Tighten the hexagon screw (6) on the pulley housing sufficiently for the cable guide to be firmly in position (Fig. 42-19/4).

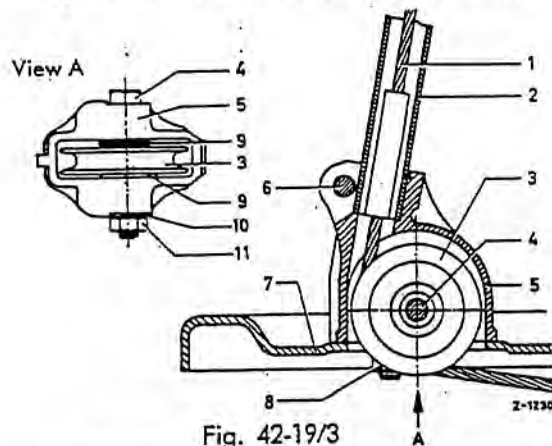


Fig. 42-19/3

- |                  |                                  |
|------------------|----------------------------------|
| 1 Brake cable    | 6 Hexagon screw (clamping screw) |
| 2 Cable guide    | 7 Brake anchor plate             |
| 3 Pulley         | 8 Hexagon nut                    |
| 4 Hexagon screw  | 9 Washer                         |
| 5 Pulley housing | 10 Spring washer                 |
|                  | 11 Hexagon nut                   |

#### Installation:

8. During installation make sure that the rubber sleeves (6) sit properly on the collar of the hexagon nut (7) since otherwise dirt will get into the cable guides (Fig. 42-19/1).

**Note:** On Model 230 SL attach the right brake cable to the rubber eyelet (Fig. 42-19/2a).

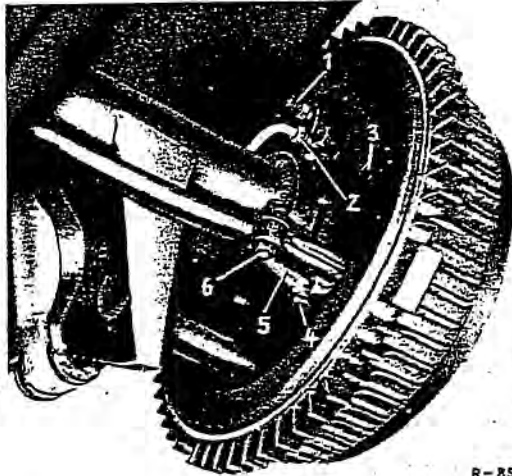


Fig. 42-19/4

- |              |                  |
|--------------|------------------|
| 1 Protector  | 4 Hexagon screw  |
| 2 Brake line | 5 Pulley housing |
| 3 Guide pin  | 6 Hexagon screw  |

10. After installation grease the rear brake cable. Do not overgrease, otherwise the grease may get into the rear wheel brake.

**Note:** On recent models the rear brake cables need no maintenance.

11. Adjust the hand brake (see Job No. 42-20, Section C).

### D. Replacement of Rear Brake Cable

(Disk brake)

1. Back off the wing nut on the relay lever.
2. Loosen the hexagon collar nuts (7) for fastening the cable guides (Fig. 42-19/1), detach the cables (1) from the brackets and from the equalizer (3) (Fig. 42-19/5).
3. Unscrew the bracket (35) of the brake cable (39) from the brake support lever (41) (Fig. 42-19/6).

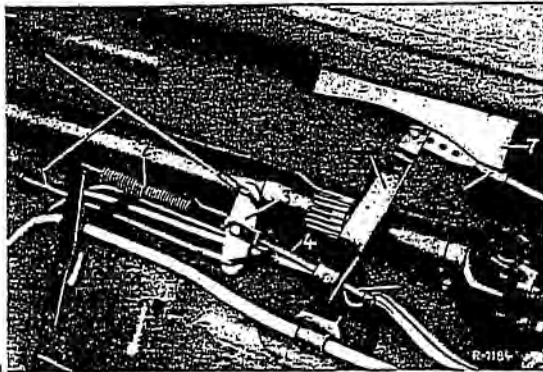


Fig. 42-19/5

- |                     |   |
|---------------------|---|
| 1 Rear brake cables | 6 Center brake cable                    |
| 2 Return spring     | 7 Guide for relay lever                 |
| 3 Equalizer         | 8 Wing nut for adjusting the hand brake |
| 4 Tensioning screw  |   |
| 5 Relay lever       |   |

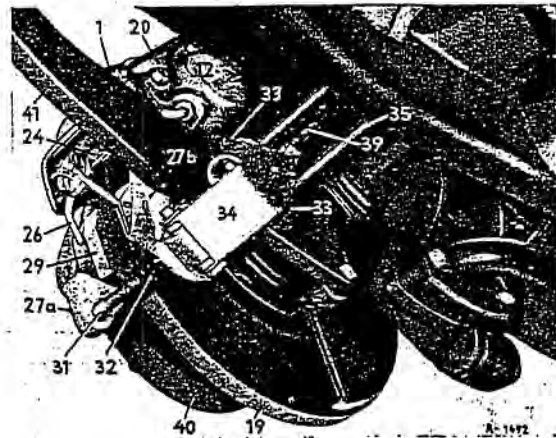


Fig. 42-19/6

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1 Brake caliper              | 31 Adjustment screw               |
| 12 Pressure cylinder         | 32 Rubber grommet                 |
| 19 Brake disk                | 33 Hexagon screw with lock washer |
| 20 Connecting line           | 34 Tension lever                  |
| 24 Locking plate             | 35 Rear brake cable bracket       |
| 26 Leg spring                | 37 Rear brake cable               |
| 27a Outer lining carrier     | 40 Wheel fixing disk              |
| 27b Inner lining carrier     | 41 Brake support lever            |
| 29 Friction pad (hand brake) |                                   |

#### Installation:

5. Attach the brake cable (39) to the tension lever (34) and fasten it to the brackets on the chassis base panel (Fig. 42-19/6).

**Note:** During installation make sure that the rubber sleeves are properly seated on the collar of the hexagon nut and the bracket.

6. Attach the bracket (35) of the brake cable to the lever (41) (Fig. 42-19/6).
7. Attach the cables (1) to the equalizer (3) and attach the return spring (2) (Fig. 42-19/1).

**Note:** When the relay lever has been removed or has been replaced take care to ensure that the proper relay lever for the car is installed (see Job No. 42-0).

8. Adjust the hand brake (see Job No. 42-20, Section C).



# Adjustment of Brakes

Job No.
42-20

Modification: Section C and D added; Section E extended

## A. Mechanical Adjustment of the Service Brake

1. After jacking up the car, check whether all the wheels turn freely.
  2. Turn the adjustment bolts on each wheel outward until the brake shoes fit snugly against the brake drums, i. e. until a considerable resistance can be felt when the wheel is turned.
  3. Back out the adjustment bolt until the wheel turn freely again.
  4. Check the free play of the brake pedal (see Section B).
  5. Press down the brake pedal to make sure that when the brake pedal is released the wheels can move freely again.
  6. Adjust the hand-brake (see Section C).
  7. After a trial run check again whether the brake releases properly.
- Note:** The brake shoes should be readjusted only when the brake drums are cold.

## B. Adjusting the Free Play of the Brake Pedal

(Single-circuit brake)

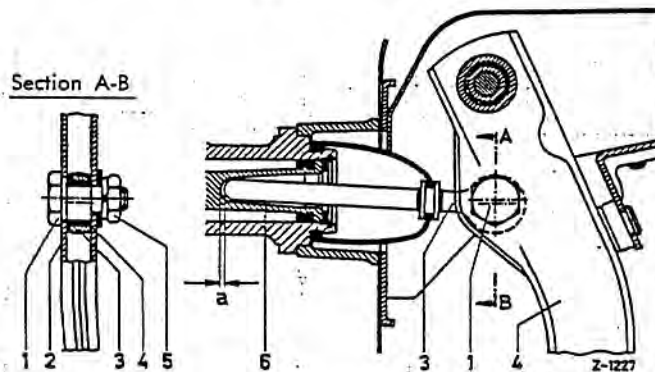


Fig. 42-20/1

- |                     |   |
|---------------------|---|
| 1 Adjusting screw   | 5 Hexagon nut                             |
| 2 Polyamide bushing | 6 Piston                                  |
| 3 Push rod          | a = Clearance between push rod and piston |
| 4 Brake pedal       |   |

1. Check the free play of the brake pedal; it should be 4-5 mm.
2. If adjustment is necessary, loosen the hexagon nut (5) on the brake pedal and turn the adjustment screw (1) until the prescribed amount of free play has been reached (Fig. 42-20/1).

**Note:** The 4-5 mm free play of the brake pedal corresponds to a clearance of  $a = 0.5$  to 0.7 mm between the piston push rod and the piston of the master cylinder (see also Fig. 42-3/1).

This clearance must be present under all circumstances otherwise the compensating port in the brake master cylinder cannot open and the brake fluid cannot flow back

to the fluid reservoir. It is most important to carry out this check in the case of suspended brake pedals.

### C. Adjusting the Brake Pedal Travel

(Two-circuit brake)

**Note:** On cars with two-circuit brake system the brake lever has no free play.

The adjusting screw on the brake lever, and on the relay lever on Model 230 SL, serves to adjust the brake pedal travel which on all models should be 152 mm.

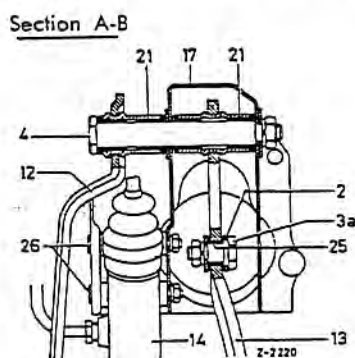


Fig. 42-20/2

Arrangement on all models with the exception of Model 230 SL

- 2 Piston rod of power brake
- 3a Adjusting screw with hexagon nut and lock washer
- 4 Pivot pin with hexagon nut and lock washer
- 12 Clutch pedal
- 13 Brake pedal
- 14 Supply cylinder
- 17 Pedal support
- 21 Bushings in the pedals
- 25 Bushings in the brake pedal
- 26 Hexagon screw with hexagon nut and lock washer

1. On all models with the exception of Model 230 SL, turn the adjusting screw (3a) until the notch in the hexagon head points toward the rear. In this position the maximum brake pedal travel is obtained (Fig. 42-20/2).

**Note:** The notch in the hexagon head of the adjusting screw is in the direction of maximum eccentricity.

Since the brake pedal has no firm stop on the pedal support, adjustment must proceed

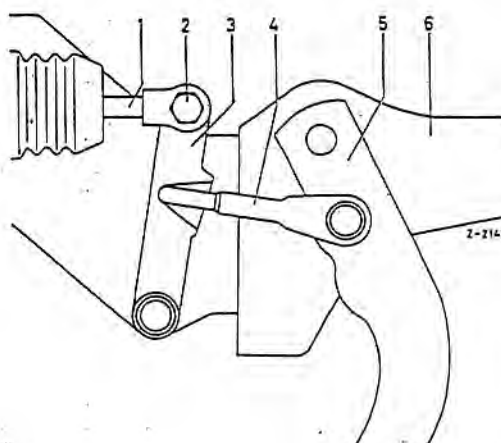


Fig. 42-20/3

Arrangement on Model 230 SL

- 1 Piston rod of power brake
- 2 Adjusting screw with hexagon nut and lock washer
- 3 Relay lever
- 4 Push rod
- 5 Brake pedal
- 6 Pedal support

2. On Model 230 SL remove the plastic stop ring (11) from the hexagon nut and remove the stop light switch (10) (Fig. 42-20/4).
- from the final position of the power brake piston rod, making sure that the brake pedal does not rest against the brass threaded member of the stop light switch. The brown contact button should be visible approx. 4 mm. If the brake pedal comes into contact with the brass sleeve of the switch, the switch must be corrected by means of shims.

**Note:** Model 230 SL is provided with a plastic cap above the threaded member of the stop light switch which serves as a stop for the brake pedal. This stop is necessary since on Model 230 SL the push rod attached to the brake pedal loosely engages the relay lever; the brake pedal is not firmly attached to the piston rod of the power brake.

3. Turn the adjusting screw (2) on the relay lever until the notch which is arranged in the direction of maximum eccentricity points toward the rear.

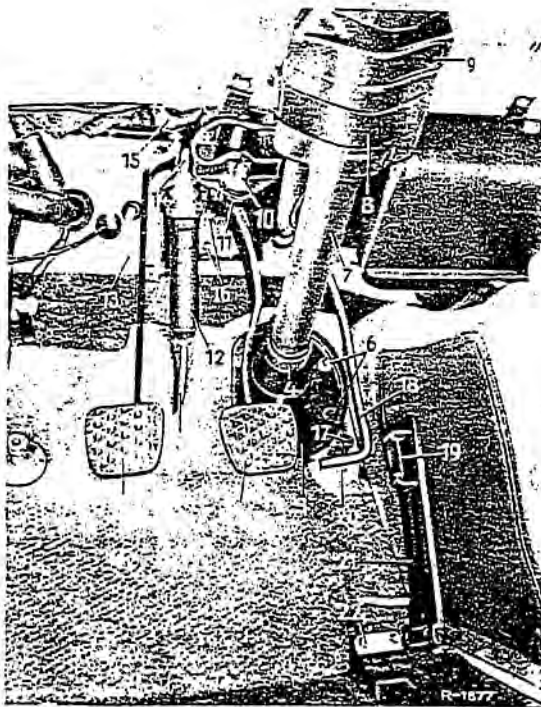


Fig. 42-20/4

- |  |   |
|--|---|
| 1 Clutch pedal                                     | 12 Supply cylinder                      |
| 2 Brake pedal                                      | 13 Line from reservoir                  |
| 3 Cover plate                                      | 14 Piston rod                           |
| 4 Pipe clip  | 15 Pressure spring (dead center spring) |
| 5 Line to extraction cylinder                      | 16 Hexagon nut with lock washer         |
| 6 Hexagon screw with lock washer and shim          | 17 Stop screw                           |
| 7 Steering column jacket                           | 18 Control lever                        |
| 8 Tightening strap                                 | 19 Plastic plate                        |
| 9 Opening for clamp ring in steering column jacket | 20 Hexagon nut                          |
| 10 Mechanical stop light switch                    | 21 Foot plate                           |
| 11 Stop ring                                       | 22 Ball-head bracket                    |

4. Adjust the contact point of the mechanical stop light switch (see Section D).
5. After adjusting the contact point, the following check should be made:

#### 1<sup>st</sup> Checking Method

Depress the brake pedal vigorously several times. Then turn one wheel on the front axle and open the bleed screw on the brake caliper of this wheel. If after opening the bleed screw the wheel is easier to turn, there is a residual pressure in the hydraulic system and the adjustment of the stop light switch must be checked again.

#### 2<sup>nd</sup> Checking Method

Attach the residual pressure gage to the distributor fitting under the power brake and measure the decrease of pressure after depressing the brake pedal several times. If after releasing the brake the pressure does not fall to zero, the adjustment is wrong and should be corrected.

#### 3<sup>rd</sup> Checking Method

If no residual pressure gage is available, the check can be made as follows:

Disconnect the brake line to the front wheel brake from the adaptor of the tandem master cylinder. Use a compressed air hose to blow air into the adaptor (max. air pressure 2 atm.) and check whether the air escapes into the reservoir via the compensating port. Caution: this compressed air check must only be used on cars delivered after the beginning of November 1963. On these cars the support ring on the piston of the tandem master cylinder has been peened.

## D. Adjustment of Mechanical Stop Light Switch

The mechanical stop light switch (3) should be adjusted in such a way that the stop light lights up when the brake pedal (13) is being depressed by approx. 20 mm. This contact point of the stop light switch can be adjusted by means of shims (1).

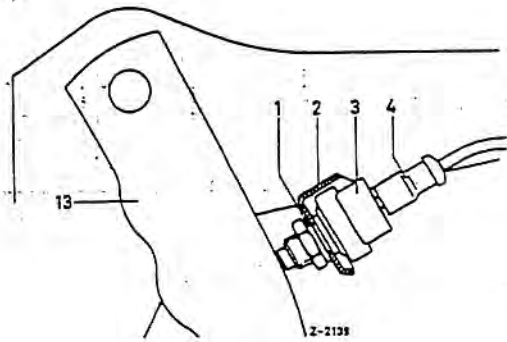


Fig. 42-20/5

- 1 Shim
- 2 Bracket for stop light switch
- 3 Stop light switch
- 4 Plug connection
- 13 Brake pedal

**Note:** The shims are available in 0.5 and 1.0 mm thicknesses.

When the brake is in the released position, the brake pedal must not rest against the brass threaded member of the brake light switch, but the brown plastic contact button must be visible about 4 mm.

On Model 230 SL the flat brass hexagon nut has been replaced by a hexagon collar nut to which the plastic stop ring is fastened. The hexagon collar nut represents the stop for the brake pedal and is required only on this model since the push rod on the brake pedal is not firmly connected to the relay lever.

On Model 230 SL the stop light switch is provided with a lock plate in order to prevent accidental turning of the switch.

## E. Adjustment of Hand Brake

### a) 1<sup>st</sup> Version Rear Wheel Brake (Malleable Cast Iron Brake Shoes)

Tighten the wing nut (1) on the brake lever (3) (Fig. 42-20/6) or the wing nut (8) on the relay lever (5) (Fig. 42-20/8) until the hand brake begins to take effect when there is a distance of 60—65 mm between the bracket of the guide tube and the damper ring on the ratchet. Correct adjustment of the wing nut enables the ratchet to be pulled out about 12—13 notches to provide a firm grip of the hand brake (Fig. 42-20/9).

**Note:** When the hand brake is in the released position, the rear wheel brakes must be free. The brake drums must not heat up noticeably when the brake is not actuated over a stretch of several miles. The car must coast to a halt without a jerk.

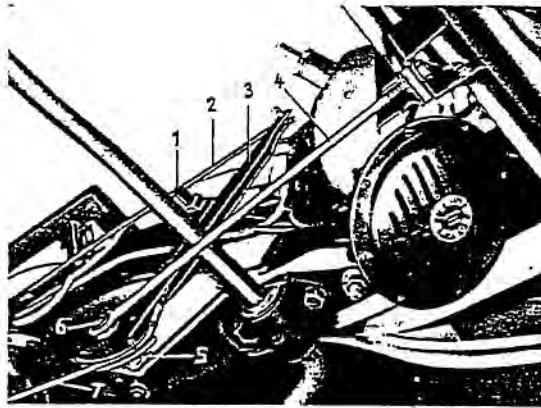


Fig. 42-20/6

1st version

- 1 Wing nut
- 2 Front brake cable
- 3 Brake lever
- 4 Support rod
- 5 Cotter pin
- 6 Pivotal pin
- 7 Center brake cable

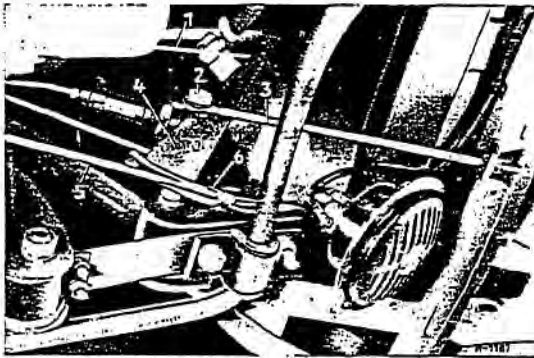


Fig. 42-20/7

2nd version

- 1 Front brake cable
- 2 Hexagon screw with locking plate
- 3 Pull rod for supporting the hand brake lever mounting
- 4 Hand brake lever
- 5 Center brake cable
- 6 Cotter pin

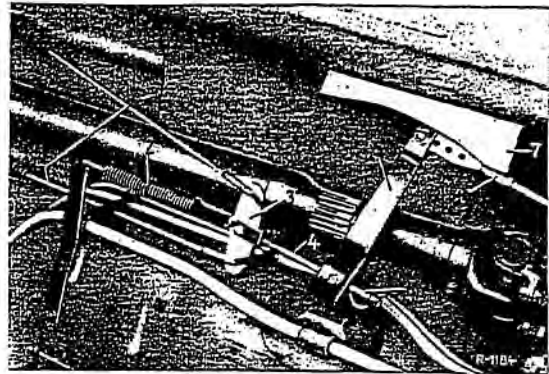


Fig. 42-20/8

2nd version

- 1 Rear brake cables
- 2 Return spring
- 3 Equalizer
- 4 Tensioning screw
- 5 Relay lever
- 6 Center brake cable
- 7 Guide for relay lever
- 8 Wing nut for adjusting the hand brake

**Note:** It is advisable to make a spacer sleeve in accordance with the dimensions given in Fig. 42-20/10.

On cars with malleable cast-iron brake shoes the dimension "a" should be 50 mm, and on cars with light metal brake shoes 60 mm.

The spacer sleeve is put on the ratchet in order to facilitate the adjustment of the hand brake.

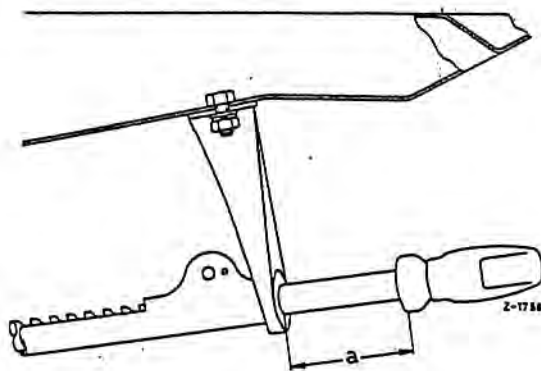


Fig. 42-20/9

- a = 60—65 mm, in case of malleable cast iron brake shoes
- a = 50—60 mm, in case of light-metal brake shoes

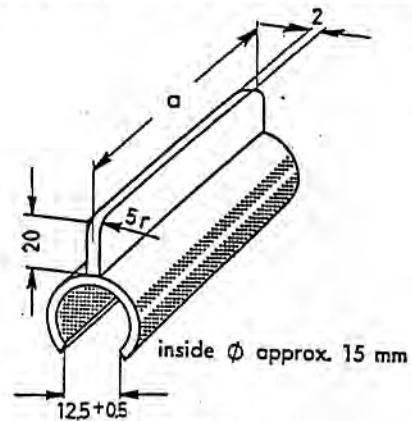


Fig. 42-20/10

- Spacer sleeve
- a = 65 mm

## b) 2<sup>nd</sup> Version Rear Wheel (light-metal brake shoes)

The ratio of the 2<sup>nd</sup> version hand brake has been increased considerably with the result that the effective travel of the hand brake is much longer than in the case of the 1<sup>st</sup> version brake. When correctly adjusted the ratchet travel is approx. 17 to 19 notches before the hand brake is properly locked. The larger ratio considerably improves the braking action of the hand brake.

When adjusting the hand brake please note the following points:

The wing nut (8) at the relay lever (5) in the propeller shaft housing (see Fig. 42-20/8) should be adjusted in such a way that the brake takes effect when there is a distance  $a = 50-60$  mm between the bracket at the guide tube and the ratchet.

In order to lock the hand brake the ratchet can be pulled by approx. 17 to 18 notches when 20 or 22 are available and it can be pulled out by approx. 5 to 6 notches when 10 notches are available (see Group 42-0). The 10-notch ratchet can be pulled out much further until the first notch is engaged since the first 10 notches have been dispensed with.

**It is imperative that after adjustment a check is made to ensure that the rear wheels turn freely when the hand brake is completely released. There must be no contact whatsoever between brake shoes and drum.**

If the relay lever should move toward the end of its guide when the wing nut is being turned, the lever must be attached to the next hole of the center brake cable (change the position of the bolt and cotter again).

**Note:** Check the free movement of the relay lever on the bottom of the guide and if necessary use a punch to dish it.

If in the case of badly worn linings this adjustment proves insufficient, i. e. if no or insufficient braking effect is produced on the rear wheels, further adjustments must be made on the rear wheel brakes themselves. Before this is done check the service brake for proper adjustment and if necessary adjust it by means of the eccentrics. Then back out the wing nut of the relay lever until the two brake cables for the rear wheel brake are slack. Then adjust the push rod (3) by turning the adjusting wheel (2) until the prescribed clearance "b" between push rod and brake shoe is obtained (Fig. 42-20/11). Although the push rod can be adjusted through the opening in the brake anchor plate, the push rod, contrary to our previous instructions, should only be adjusted after the brake drum has been removed.

With a screw-driver clamped between the brake lever and the rear brake shoes and by slightly moving the brake lever it is possible to check whether the necessary clearance "b" is present at the push rod, since if there is no or too small a clearance one of the two brake shoes will move immediately.

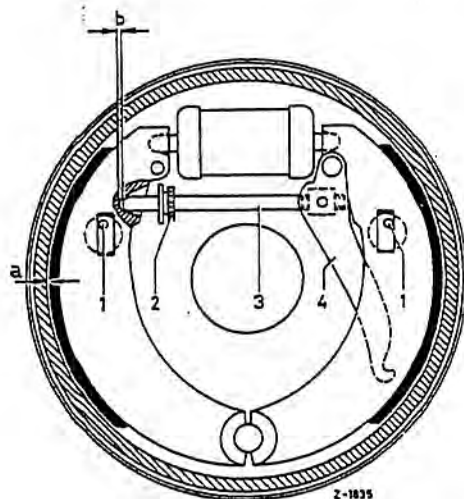


Fig. 42-20/11

- 1 Eccentric
- 2 Adjusting wheel
- 3 Push rod
- 4 Brake lever

- a Clearance between brake shoe and brake drum appr. 0.3 mm
- b Clearance between push rod and brake shoe appr. 1.0 mm

Please note that if the upper return spring exerts heavy pressure on the adjusting wheel of the push rod, the push rod is pulled back insufficiently.

The push rod should therefore always be pushed back before the clearance is checked. When the brake drum and the rear wheels have been installed, adjust length of the brake cables by means of the wing nut on the relay lever (see Job No. 42-0). With the hand brake in the released position the rear wheels must be able to move without any friction. The brake drums must not be warm to the touch after the car has traveled several miles without the brake having been applied.

**Note:** When the service and hand brakes have been adjusted correctly the brake shoes should rest against the eccentrics and should on no account bear against the push rods.

When the hand brake is adjusted by means of the wing nut, the clearance "b" between push rod and front brake shoe is reduced; however a certain amount of clearance is essential.

On recent cars a warning light has been installed which lights up white when the ignition is switched on and the hand brake is either locked or only partially released. This warning light is actuated by a lug on the ratchet handle which presses against the pin of a pressure switch attached to the bracket of the guide tube.

At the same time the ratchet grip was extended by 40 mm in order to improve the accessibility of the hand brake.

#### c) Rear Wheel Brake 3<sup>rd</sup> Version (malleable cast iron brake shoes)

As on previous models, the hand brake should be adjusted by means of the wing nut of the relay lever in the propellor shaft housing. The hand brake is properly adjusted when the ratchet can be pulled out by approx. 5 to 6 notches of the 10 or 12 notches available on the ratchet. The hand brake can no longer be adjusted on the rear wheel brake since the adjustable push rod on the brake lever has been replaced by the brake lever strut.

#### d) Disk Brake on Model 300 SE

On Model 300 SE adjustment or readjustment of the hand brake is no longer necessary since the lining carriers with the friction pads are automatically adjusted in the hand brake caliper, i. e. when the hand brake is released, there is always a distance of approx. 0.2 mm between the brake disk and the friction pads. The wing nut in the relay lever in the propeller shaft housing only serves to correct the length of the brake cables. If after certain repair procedures it should be necessary to check or adjust the hand brake, please proceed as follows:

##### Center Brake Cable:

With the ratchet completely released, attach the four-hole end-piece of the center brake cable (6) to the relay lever (5) in such a way that the distance from center cotter pin hole of the guide plate (7) to center bore relay lever (for center brake cable) is a = 20 to 40 mm (Fig. 42-20/12).

##### Rear Brake Cables

Back out the wing nut (8) on the tensioning screw (4) until the tension levers of the hand brake caliper are in their released position (see Fig. 42-20/12). Then tighten the wing nut until the tension levers are just beginning to move. Proceeding from this adjustment, back off the wing nut one half turn. Then actuate the ratchet several times so that the distance between lining carrier and brake disk can adjust itself properly (approx. 0.2 mm clearance between the brake lining of the friction pad and the brake disk). When the length of the brake cable has been properly adjusted, it should be possible to pull out the ratchet 5 to 10 notches with medium force.

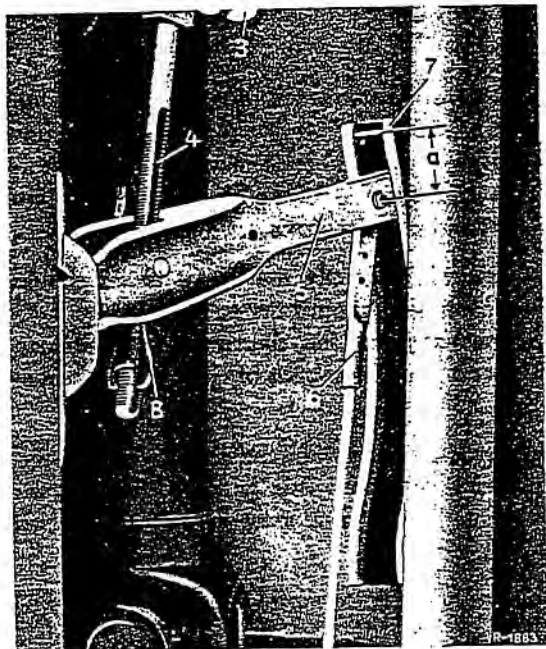


Fig. 42-20/12

- 3 Equalizer
- 4 Tensioning screw
- 5 Relay lever
- 6 Center Brake cable
- 7 Guide for relay lever
- 8 Wing nut

e) Lever Hand Brake on Model 230 SL

Use a steel rod to tighten the circular four-hole nut (10) on the brake lever (2) to the point where with medium force the brake lever can be pulled about 3 notches of the 6 notches on the toothed segment.

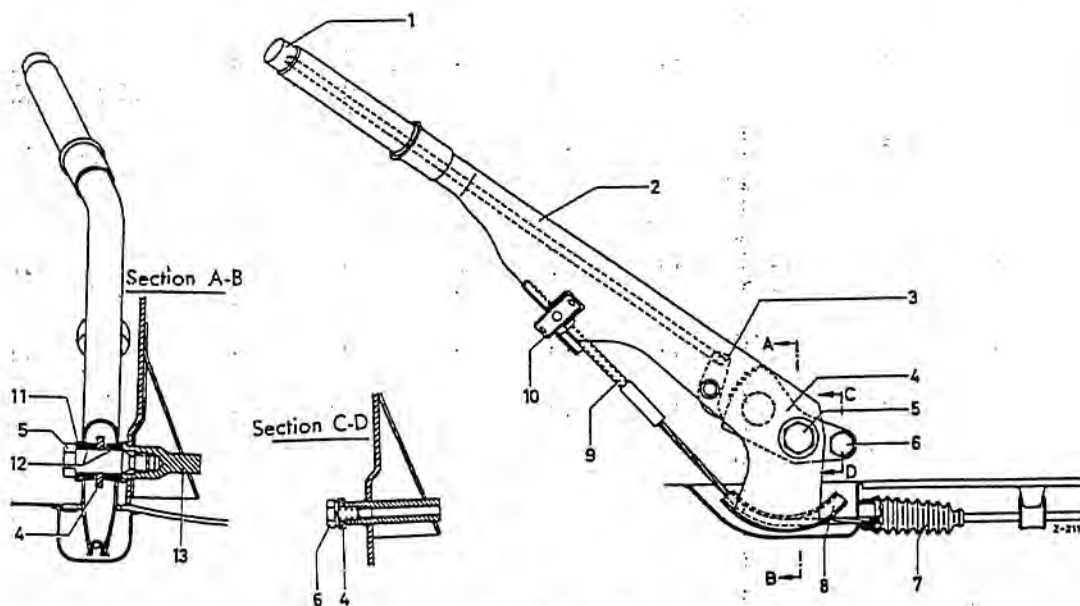


Fig. 42-20/13

- 1 Push button
- 2 Hand brake lever
- 3 Pawl
- 4 Toothed segment
- 5 Pivot pin
- 6 Hexagon screw with lock washer
- 7 Rubber sleeve
- 8 Brake cable guide
- 9 Front brake cable
- 10 Circular four-hole nut
- 11 Washer
- 12 Bearing bushing
- 13 Threaded member for fastening brake lever to chassis base panel



## F. Duo Servo Brake

### Readjustment:

**Note:** The hand brake must be readjusted if with medium force the ratchet can be pulled more than 8 notches (of a total of 16) without producing any brake action.

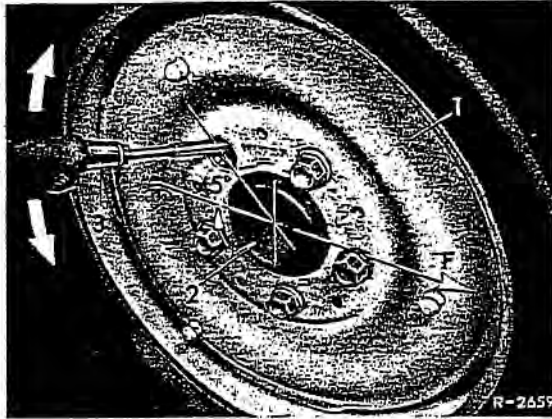


Fig. 42-20/14

- |                   |                         |
|-------------------|-------------------------|
| 1 Disk wheel      | 3 Screwdriver           |
| 2 Rear axle shaft | F = Direction of travel |

1. Screw out one spherical collar screw each at the left and right rear axle.
2. Jack up the car and turn one wheel until the screw hole from which the spherical collar screw was removed points in the upper rear direction at an angle of approx. 45° (Fig. 42-20/14).
3. Insert a screwdriver with a 4.5 mm. blade through the hole in the disk wheel and engage the toothed wheel of the readjusting device. Turn the toothed wheel until the road wheel is on the point of being locked. Turn the toothed wheel back by 2-3 teeth, i.e. as much, as is necessary to free the road wheel completely.

### Basic Adjustment:

**Note:** Basic adjustment is necessary when e.g. the rear axle or one of the brake cables have been replaced.

1. Turn out the wing nut (8) on the relay lever (5) (see Fig. 42-20/8).
2. Adjust the duo servo brake (see Section F, paras 1-4).
3. Tighten the wing nut on the relay lever until the ratchet can be pulled out with medium force (appr. 40 kg) appr. 5-6 notches. Then check whether the rear wheels turn freely when the ratchet is pulled out 1 notch.

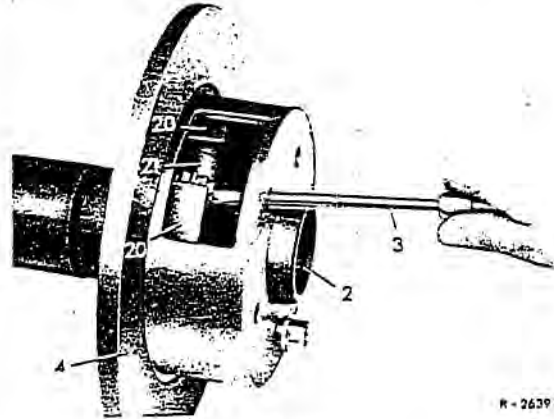


Fig. 42-20/15

- |                   |                       |
|-------------------|-----------------------|
| 2 Rear axle shaft | 20 Brake shoes        |
| 3 Screwdriver     | 21 Readjusting device |
| 4 Brake disk      |                       |

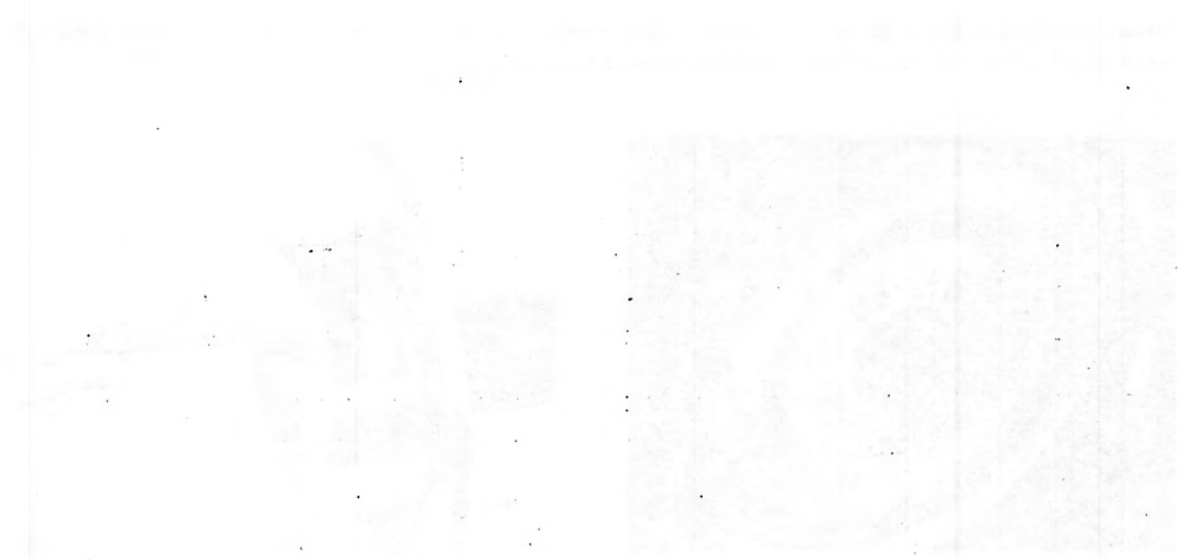
**Caution:** On the left side move the screwdriver upward to force the brake shoes against the drum. On the right side move the screwdriver downward.

4. After readjustment make the following check:

Pull out the ratchet one notch; in this position the rear wheels must still have full freedom of movement.

**Note:** When readjusting the hand brake never adjust the wing nut of the relay lever. Its only purpose is to equalise the brake cable lengths.

REPORT



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# Checking the Brake System

Job No.

42-21

*Modification: Revised, Instructions for Model 230 SL added in Section A. Sections F, G and H added.*

## A. Excessive Brake Pedal Free Play

All hydraulic brakes must be thoroughly bled and carefully adjusted in order to achieve the maximum braking effect and the shortest possible brake pedal free play. If complaints are received about excessive brake pedal free play, this may be due to the following causes:

### 1. Bleeding

It is possible that in certain cases the air mixes with the brake fluid and as a consequence is finely suspended in the brake fluid. Since the air is not always eliminated immediately, it is advisable to bleed the brake system carefully several times and if necessary to repeat this after some days.

### 2. Adjustment of the brake shoes

Make sure that the brake shoes with mechanical adjustment are properly adjusted. On models 220 Sb and 220 SEb 1<sup>st</sup> version with automatic brake shoe adjustment check the proper functioning of the automatic brake shoe adjustment.

### 3. Master Cylinder (only for vehicles with single-circuit brake system)

Check whether the master cylinder is functioning properly. When the brake is in the non-applied position, i. e. when there is a play of 0.5–0.7 mm between the piston and the push rod, the piston must rest against the piston stop washer.

### 4. Residual pressure in the lines

Check the residual pressure which is only required in cars with drum brakes. If the residual pressure in the system is not available the check valve must be removed and replaced. According to the design of the brake system the check valve may be installed in the master cylinder, in the primary pressure valve or in the hydraulic slave cylinder of the power brake T 50/24/1 or in the tandem master cylinder.

### 5. Leak test of the brake system

Check the whole hydraulic system for leaks. To do this remove the dust caps of the wheel cylinders, in the case of Girling brake calipers lift the dust cap in the groove of the piston after having removed the friction pads, and in the case of Dunlop brake calipers remove the dust cap from the pressure cylinder after having removed the friction pads. Check possible loss of brake fluid at the leak bore of power brake T 50 or the tandem master cylinder. When no leaks are discovered and brake fluid is lost nevertheless there is a chance that on vehicles with a power brake of the T 50 series the fluid gets into the vacuum cylinder because the leak bore is choked or there is a leak in the sleeve of the control valve piston of the power brake.

### 6. Rear Wheel brake with light metal brake shoes

A difference in brake pedal free play has sometimes been observed on individual cars when the car was braked for the first time after a certain mileage.

As a rule, increasing wear of the brake linings is clearly indicated by a corresponding increase in brake pedal free play and this can be used as a safe guide for determining when brake shoe ad-

42-21/a

justment is necessary. However, it may happen in individual cases that brake shoes with a considerable amount of wear, particularly on the rear wheels, are not immediately pulled right back to the eccentrics by the return springs; they stick. This condition is not noticeable when braking is repeated immediately. If, however, the car is braked after a few miles the brake pedal free play is suddenly larger because in the meantime the brake shoes have reached their end position as a result of travel vibrations, and the increased distance from the brake drum requires a larger brake fluid volume. Such faults will be less noticeable on cars with a larger master cylinder and a large brake fluid volume than on cars with a smaller master cylinder and a corresponding smaller fluid volume.

As a remedy the following procedures are recommended:

#### a) Front wheel brake

Carefully remove any dust from the brake system and remove the brake shoes. Lightly coat the contact plate for the brake shoes and the anchor pins with Molykote Paste type "G" and reinstall the brake shoes.

**Caution, do not use too much Molykote Paste!** When installing the washer (6) take care to ensure that there is no ridge on the washer and that the smooth side of the washer points toward the brake shoe. Also lightly coat the contact face of the washer with Molykote Paste (Fig. 42-21/1).

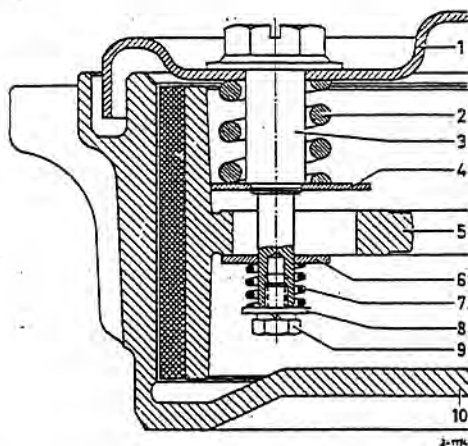


Fig. 42-21/1

- 1 Brake anchor plate
- 2 Pressure spring
- 3 Adjustment bolt
- 4 Eccentric
- 5 Brake shoe
- 6 Washer
- 7 Pressure spring
- 8 Washer
- 9 Hexagon screw
- 10 Brake drum

#### b) Rear wheel brake

Carefully remove any dust from the brake system and remove the brake shoes. It is advisable to replace all return springs. Before reinstalling the brake shoes, coat all contact points with Molykote Paste, especially the contact surfaces, the anchor pin on the brake anchor plate and the brake lever on the rear brake shoe.

When reinstalling the brake shoes make sure that the return springs are not overtensioned.

#### c) Master cylinder

On models 190 c and 190 Dc replace any 1<sup>st</sup> version master cylinder of 7/8"  $\phi$  by a 2<sup>nd</sup> version master cylinder of 15/16"  $\phi$  according to Part No. 000 420 93 01. This 15/16" master cylinder has been installed as a standard part as from chassis end numbers:

Model 190 c 10 368  
 Model 190 Dc 14 450

## 7. Model 230 SL

If the brake pedal free play is found to be variable and the brakes fail to release or to release properly, a binding relay lever (19) in the bearing bracket (20) is responsible. When the relay lever, which transmits the pressure on the brake pedal to the piston rod (2) of the power brake (1), does not move easily the power brake returns very slowly to its released position. To prevent relay lever binding, the diameter of the bore in the relay lever for the collar bolt (18) has been increased as from chassis end no. 011 319 (Fig. 42-21/1b). For repairs on older cars, a thinner collar bolt, Part No. 113 991 00 07 is available, which can be easily recognised by its 5 mm projection (Fig. 42-21/1a).

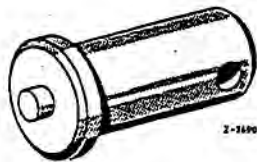


Fig. 42-21/1a

Whenever complaints are received about excessive brake pedal free play, check the freedom of movement of the relay lever as follows:

- a) Open a bleed screw in the front axle brake circuit and depress the brake pedal as far as it will go.
- b) In this position hold the piston rod of the power brake and screw out the adjusting screw (3) connecting the piston rod to the relay lever.
- c) Move the relay lever. If it moves easily proceed as described in para i.

Whenever there is the slightest stiffness in the relay lever movement install the new thinner collar bolt as described below:

- d) Draw off the brake fluid from the reservoir of the clutch actuating mechanism and remove the reservoir together with the bracket.
- e) Pull the cotter pin out of the collar bolt (18). Remove the washer and take the collar bolt out of the bearing bracket (20).
- f) Remove the spring washer from the collar bolt and put it on the new collar bolt. Grease the collar bolt and install it in bearing bracket and relay lever.
- g) Put the washer on the collar bolt and cotter.
- h) Install the reservoir and fill it with brake fluid.
- i) Close the bleed screw in the front axle brake circuit. Screw the adjusting screw into relay lever and piston rod, making sure that the screw slot points toward the rear.

42-21/1c

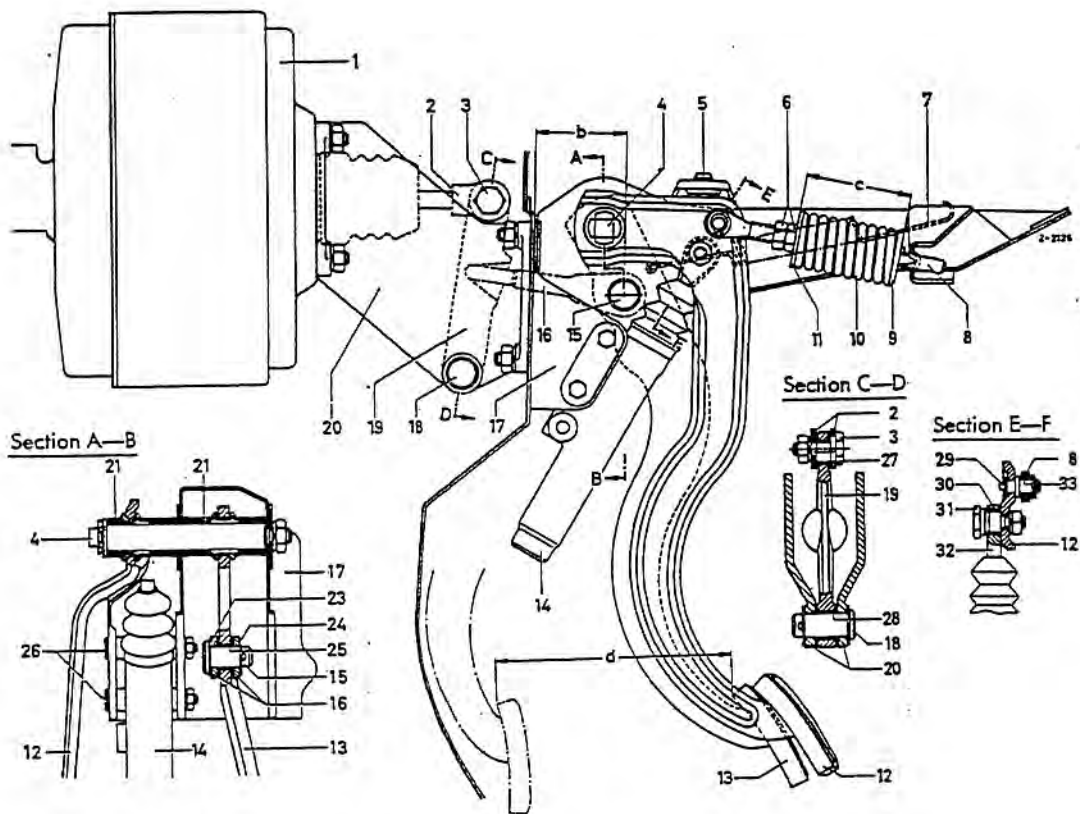


Fig. 42-21/1b

- b = Control dimension for brake pedal
- c = Adjusting dimension for pressure spring (dead center spring)
- d = Brake pedal free play until it rests against the cowl

- |   |   |
|---|---|
| 1 Power brake T 51/200                  | 18 Collar bolt with washer and cotter pin                           |
| 2 Piston rod of power brake             | 19 Relay lever  |
| 3 Adjusting screw with lock washer      | 20 Bearing bracket  |
| 4 Anchor pin                            | 21 Bushing for brake and clutch pedals                              |
| 5 Rubber stop for clutch pedal          | 22 Spring washer  |
| 6 Hexagon nut                           | 23 Washer   |
| 7 Return spring for brake pedal         | 24 Washer   |
| 8 Push rod for pressure spring          | 25 Bushing in brake pedal for collar bolt                           |
| 9 Spring retainer                       | 26 Hexagon screw with lock washer and hexagon nut                   |
| 10 Pressure spring (dead center spring) | 27 Bushing in relay lever for adjusting screw                       |
| 11 Spring retainer                      | 28 Bushing in relay lever for collar bolt                           |
| 12 Clutch pedal                         | 29 Anchor pin for push rod  |
| 13 Brake pedal                          | 30 Bushing in piston rod  |
| 14 Supply cylinder                      | 31 Adjusting screw with lock washer and hexagon nut on clutch pedal |
| 15 Collar bolt                          | 32 Piston rod   |
| 16 Push rod for relay lever             | 33 Bushing in push rod  |
| 17 Support for pedal system             |   |

## B. Roughness of the Brake and Tendency to Rattle

In case of complaints that the brakes are rough and have a tendency to rattle, it is necessary not only to check the brake system, but also to make sure that the wheels are properly balanced and that the rims have no excessive eccentricity or run-out, that the front and rear shock-absorbers work properly (shock-absorbers on one axle should be adjusted to the same dimensions as far as possible), and that the rear axle is properly installed and is not subject to any stress. It should also be remembered that the proper functioning of the brake system depends to a large extent on the proper installation of the brake shoes. The following procedures should be followed to reestablish proper brake functioning:

### 1. Brake linings

First of all check the wear pattern of the brake linings. In order to improve the wear pattern lightly sandblasted brake drums can be used or else the brake linings can be reconditioned e. g. by the Zanchi turning attachment. Sandblasted brake drums should not be used for Johns-Manville brake linings since these linings are too soft. When these soft brake linings are installed, the brake drums should be precision-turned since this produces sufficient roughness to obtain a satisfactory wear pattern after a few brake actions. Lightly sandblasted brake drums need not be removed from the vehicle since the roughness of these brake drums will disappear after a few brake actions.

If even sandblasted or precision-turned brake drums do not produce a satisfactory wear pattern on the brake linings, the brake linings are deformed and must be replaced.

### 2. Spring-loaded Pressure Pins

Any spring-loaded pressure pins installed on models 220 Sb and 220 SEb 1st version must be checked for ease of movement. The pin must easily move in the sleeve. Dirty pressure pins should be cleaned and the sliding surfaces should be lightly coated with Molykote Paste Type 'G'. In addition check whether cup springs of 15 mm diameter have been installed since these produce a travel at the brake shoe which is approx 0.3 mm shorter than the travel on the 1st version with a 20 mm diameter. The cup springs must be properly mounted and must have sufficient initial tension.

When spring-loaded pressure pins are installed subsequently make sure that particularly on cars without power brake the brake pedal free play is not excessive. For this reason no more than two spring-loaded pressure pins should be installed in any one vehicle.

### 3. Brake drums

Check the brake drums for accurate wall thickness over the whole circumference. Center displacement of the brake drums which can be recognized by uneven wall thickness has an unfavourable influence on brake rattle even when the brake drums are properly balanced. Such brake drums should always be replaced.

Brake drums with scores or burnt spots should be returned as accurately as possible. Burnt spots of any considerable size cannot be removed by turning, and such brake drums should therefore always be replaced. When turning brake drums make sure that the specified dimensions are maintained (see Job No. 42-0). When using well-ground and lapped Widia tools a cutting speed of approx. 80 meters/minute at a feed of 0.12 mm/rev. should not be exceeded.

Check the contact of the dished wheel disk with the brake drum. It may happen in some cases that the dished wheel disk presses against the bevel of the brake drum (see arrow in Figs. 42-21/2 and 42-21/3). As a result the brake drum will be strained when the wheel nuts are tightened. The dished wheel disk should only rest against the faced part of the brake drum; if this is not the case

the brake drum must be replaced. On the 2nd version brake drum the bevel was moved slightly toward the outer diameter. Consequently the distance 'a' (see Fig. 42-22/4) indicates the difference in the two brake drum designs;

distance 'a' 1st version 174.5 mm Ø

distance 'a' 2nd version 178 mm Ø

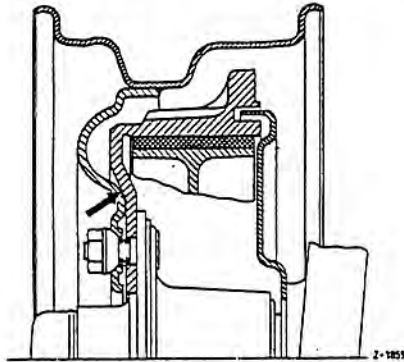


Fig. 42-21/2  
1st version

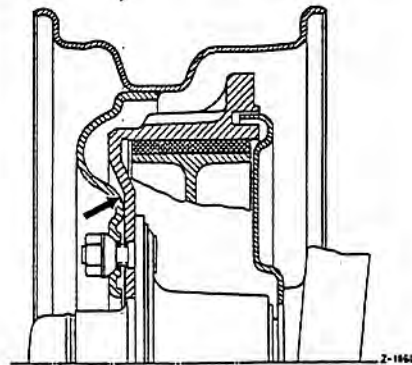


Fig. 42-21/3  
2nd version

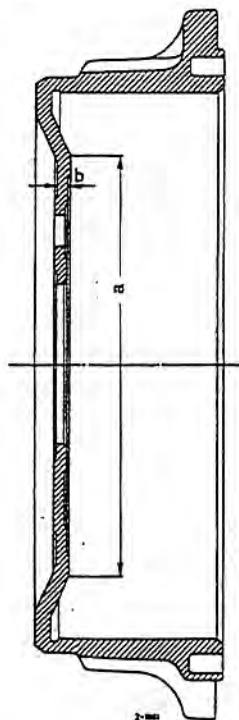


Fig. 42-21/4

Check the run-out of the brake drum at point 'b' (see Job No. 42-0 and Fig. 42-21/4). The run-out should be measured between the two centers of a lathe since measurements are inaccurate when the drum is mounted on the front wheel hub or on the rear axle shaft. If the run-out is excessive the outer face of the brake drum must be reconditioned until the prescribed measure is obtained. Afterwards the braking surface inside the brake drum should be precision turned.

## C. Brake Lines and Brake Hoses

### 1. Brake Hoses of the Front Axle

The brake hoses (7) of the front axle must be fastened to the bracket (1) at the chassis base panel in such a way that they cannot under any circumstances rub against the upper control arms or the tires. When connecting the brake line (3) to the brake hose, always make sure that the



brake hose is not twisted. The position of twisted brake hoses must be corrected by repositioning the hexagon nut on the brake hose in the protection plate (6) (Fig. 42-21/5).

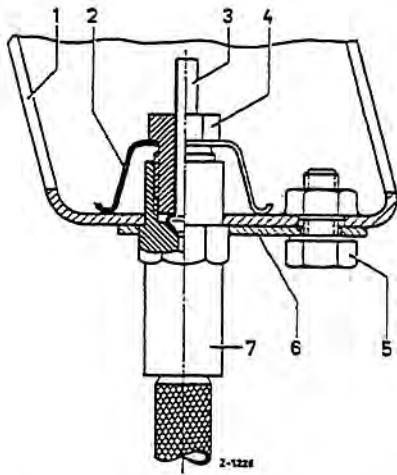


Fig. 42-21/5

- 1 Bracket at the chassis base panel
- 2 Brake-hose retainer
- 3 Brake line
- 4 Sleeve nut
- 5 Hexagon nut and spring washer
- 6 Protection plate
- 7 Brake hose

When repairs have been carried out following an accident, check the correct position of the brake hoses, since even small changes in the position of the bracket on the chassis base panel may result in the brake hose rubbing against the control arm or the tire. To check this, turn the steering to both right and left full lock, and repeatedly move the front axle half to its highest and lowest position before installing the front springs. On model 300 SL pay attention to the instructions in Job No. 32-11 Section D.

**Note:** It is a well-known rule that all brake hoses should be replaced after 5 years. When installing new brake hoses please make sure that the brake hoses correspond exactly to the brake system installed in the vehicle.

## 2. Brake Lines on Axle Tube to Rear Wheel Brakes

The brake line (3) must have a certain minimum distance from the wheel arch in order to ensure that it cannot rub against the wheel arch in any position of the rear axle. The distance from the flange of the rear axle tube to the outer edge of the brake line must be  $23 \pm 1$  mm. Always

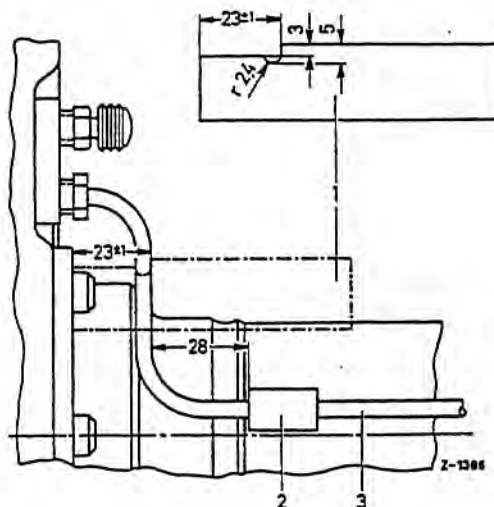


Fig. 42-21/6

- 1 Gage
- 2 Rubber ring
- 3 Brake line

check this distance when repairing a car after an accident. To do this, make a special gage (1), which is the easiest way to check this distance. Furthermore make sure that the rubber rings (2) are properly installed on the brake line, so that the brake line does not touch the axle tube (Fig. 42-21/6).

On recent models the brake lines on the axle tube of the rear axle has been provided with three rubber rings (1). In addition the brake line is fastened to the axle tube by means of a hose strap (2).

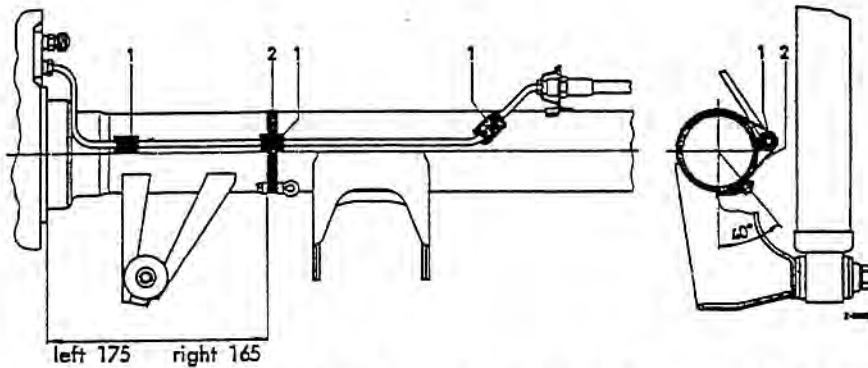


Fig. 42-21/7

- 1 Rubber ring
- 2 Hose strap

### 3. Retaining Angle for the Brake Hoses in Relation to the Rear Wheel Brake on Model 300 SE

A retaining angle (2) has been welded to the chassis base panel (1) left and right and the brake hoses for the rear wheel brakes are attached to these retaining angles. The proper positioning of the brake hoses depends on the proper position of the retaining angles. These angles must not be bent (see dash-dotted line in Fig. 42-21/8). On recent models the retaining angles have been reinforced.

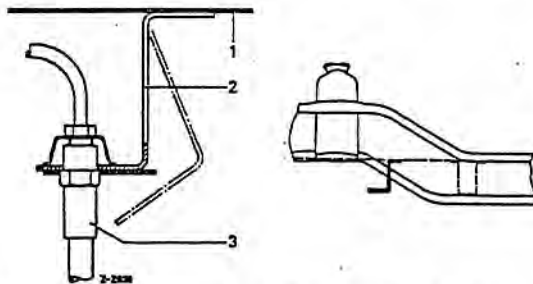


Fig. 42-21/8

- 1 Chassis base panel
- 2 Retaining angle
- 3 Brake hose

### 4. Brake Line from Master Cylinder to Rear Wheel Brake

The brake line (2) to the rear wheel brake has been laid in such a way that it lies against the side member of the chassis base panel and passes behind the steering coupling. Whenever work is being done on the master cylinder make sure that there is no contact between this line and the steering coupling; as an additional safety measure the pipe clip (4) can be installed slightly underneath the steering (Fig. 42-21/8a).



Fig. 42-21/8a

- 1 Line to extraction cylinder
- 2 Brake line
- 3 Rubber cross piece
- 4 Pipe clip

## D. ATE Power Brake T 50

### 1. Power Brake T 50/24

During the cold season it is common practice to drive for quite some time with the choke control pulled out. As a result, it is practically impossible to prevent fuel drops reaching the rubber check valve Part No. 000 430 08 81. Although the valve is made of gasoline resistant material, it is possible that the surface may be affected by the gasoline, with the result that the valve sticks to the valve seat. When the car is braked for the first time, the valve will not immediately be lifted from its seat, particularly since the pulled-out choke control results in a lower vacuum in the intake pipe. In order to produce a sufficiently high vacuum in such cases, the engine speed must be increased and the accelerator pedal released suddenly. Furthermore, the car should not be driven with the choke control pulled out any longer than is absolutely necessary.

The ball check valve Part No. 000 430 08 81 has been replaced by the plate valve Part No. 000 430 22 81, which shows less tendency to stick. On power brakes with screwed-in check valves the complete plate valve can be installed subsequently, whereas on power brakes with brazed check valves, a threaded union Part No. 111 431 00 75 is required. After removal of the rubber ball the threaded union is screwed into the check valve housing of the power brake and the plate valve is then screwed into the threaded union. Please note that the vacuum hose must be shortened slightly.

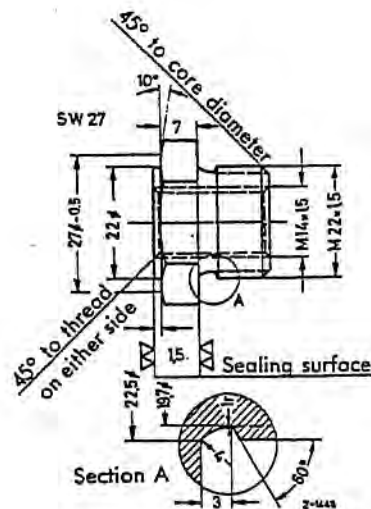


Fig. 42-21/9

Threaded union

### 2. Gasoline Separating Vessel in Vacuum Line

It may happen under certain circumstances that fuel drops enter the vacuum line between intake pipe and power brake and form a condensate there. Since the power brake is on a level lower than the intake pipe these fuel drops enter the check valve and the power brake and damage or destroy the rubber sleeves. To prevent this, a plastic separating vessel is installed between intake pipe and power brake. The separating vessel which is installed at the lowest point prevents the intrusion of fuel into the check valve or the power brake. Any fuel condensate will be sucked out of the vessel by the engine.

When the separating vessel is installed subsequently take care to ensure that it is installed in a hanging position at the lowest point of the connecting hose. The vacuum hose of the vehicle can be used again after it has been cut in half.

42-21/7

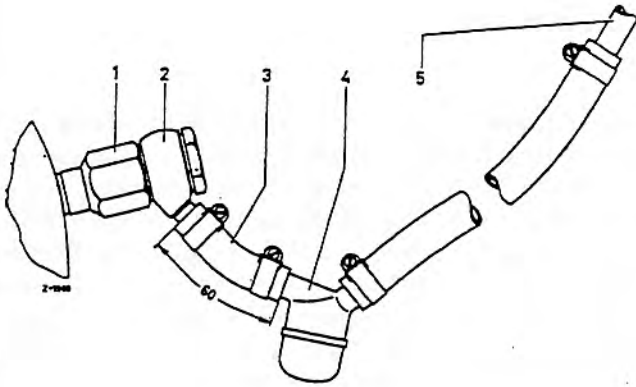


Fig. 42-21/10

Arrangement of ATE Power Brake  
T 50/24/1 with  
Gasoline Separating Vessel

- 1 Check valve
- 2 Short connecting pipe
- 3 Vacuum hose
- 4 Gasoline separating vessel
- 5 Vacuum line

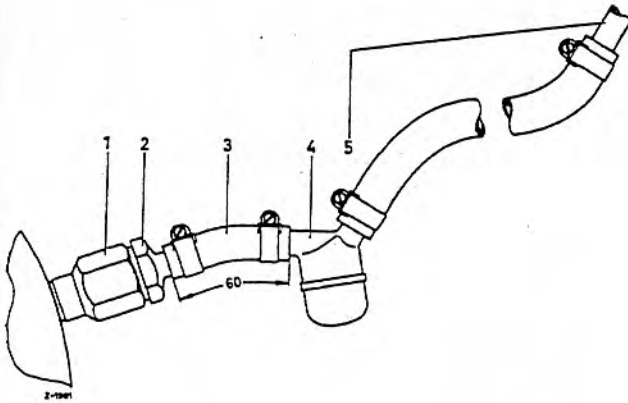


Fig. 42-21/11

Arrangement of ATE Power Brake  
T 50/26 with  
Gasoline Separating Vessel

- 1 Check valve
- 2 Ring piece
- 3 Vacuum hose
- 4 Gasoline separating vessel
- 5 Vacuum line

## E. Leak Check

Whenever work has been done on the hydraulic part of the braking system, a leak check should be made. This leak check consists of three procedures:

1. High pressure leak check
2. Low pressure leak check
3. Primary and residual pressure leak check

### High Pressure Leak Check

1. Attach a high pressure gage to a wheel cylinder or to the distributor fitting for the rear wheel brake. To do this, unscrew the bleed screw and screw in the connecting union for the high pressure gage. Bleed the high pressure gage.

**Note:** Since the bleed screw on the Dunlop brake caliper is sealed by the pressure of a steel ball against the seat of the pressure cylinder, the tester cannot be attached to the pressure cylinder.

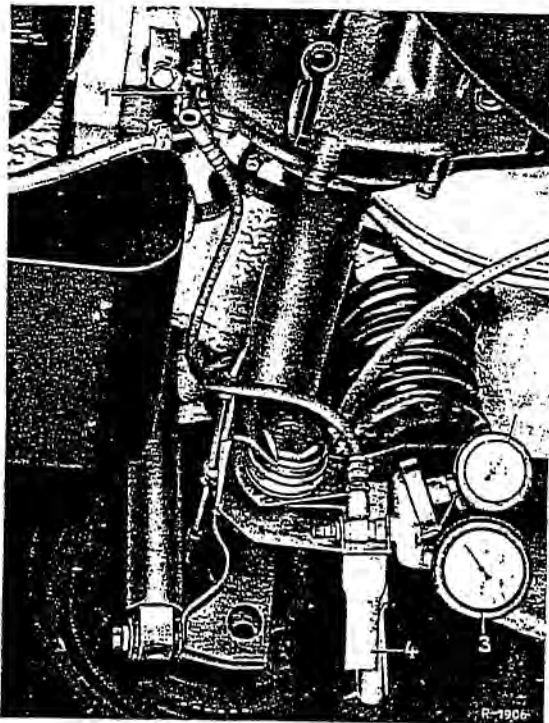


Fig. 42-21/12

- 1 Distributor fitting
- 2 Low pressure gage
- 3 High pressure gage
- 4 Tester bracket

For the Girling brake caliper 1<sup>st</sup> and 2<sup>nd</sup> version, a connecting union with inch thread is not available. The 3<sup>rd</sup> version brake caliper has a metric thread.

On cars with two-circuit brake system attach one high pressure gage each to the two brake circuits.

2. On cars with ATE power brake run the engine at medium speed and produce maximum vacuum by suddenly releasing the gas pedal.
3. Use the pedal support (1) in order to depress the brake pedal (2) as far as possible to produce the maximum line pressure which should be between 50 and 100 atm. and then fix the brake pedal in this position (Fig. 42-21/13).

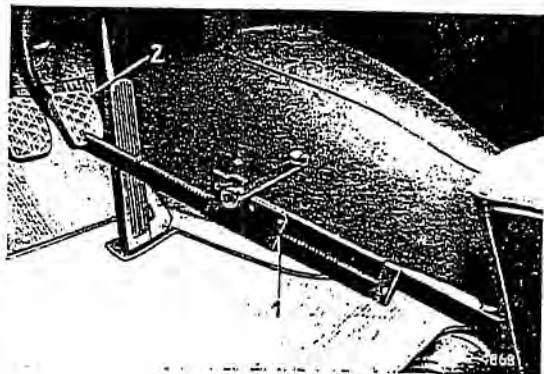


Fig. 42-21/13

- 1 Pedal support
- 2 Brake pedal

4. During the testing period, which should be at least 10 minutes, the decrease in pressure should not exceed 10% of the adjusted value. If the decrease is larger, look for the leak and seal it.

**Note:** On cars with power brake make a second check without vacuum support; in order to do this, switch off the engine and depress the brake pedal approx. 10 times in order to remove the vacuum in the power brake.

#### Low Pressure Leak Check

1. Move the pedal support back until the pressure gage shows a line pressure of approx. 3 atm.
2. During the testing period of approx. 5 minutes the adjusted pressure must not decrease (brake calipers have a tendency to show a leak under comparatively low pressure).

#### Primary and Residual Pressure Check

**Note:** On cars provided with disk brakes on both front and rear axle the hydraulic system has no pressure when the brakes are in the non-applied position.

1. Attach a high pressure tested low pressure gage to a wheel cylinder or to the distributor fitting for the rear wheel brake.
2. Bleed the low pressure gage and depress the brake pedal several times.
3. With the brake released, read off the residual pressure on the pressure gage (see also Job No. 42-0).

**Note:** The residual pressure must not decrease below the minimum pressure value. If necessary, replace the check valve. According to the brake system employed, the check valve may be arranged as follows:

On cars without a power brake: in the master cylinder.

On cars with power brake T 50/24: in the master cylinder.

On cars with power brake T 50/24/1: in the slave cylinder head. The special check valve installed in the master cylinder has a cone with an axial through-bore.

On cars provided with disk brakes: on the front axle the check valve is arranged in the primary pressure valve for the rear wheel brake. This primary valve maintains the residual pressure only for the drum brake on the rear axle.

On cars with two-circuit brake system and tandem master cylinder 1st version: on the front connecting union of the tandem master cylinder. The hexagon is bonderized. The rear connecting union (to the front wheel brake) has a special check valve and is cadmium-plated.

On cars with two-circuit brake system and tandem master cylinder 2nd and 3rd version: on the rear connecting union. The connecting union is bonderized.

## F. Uneven Brake Action on Cars with Disk Brakes

Uneven brake action may be due to defects in the brake system; it can also be caused by tire wear and by varying road conditions. There is an important difference between brake dragging on wet roads and on dry roads. On wet roads slight brake dragging is unavoidable since splash will affect the left and right brakes differently and tire grip on the road surface is bound to be uneven. Brake action can therefore only be judged when the brakes are dry.

Before and during the brake test make the following checks:

- a) Check and correct the tire pressure. Check the tire tread; unevenly worn tires and different tire makes will produce differing frictional contact with the road surface. Furthermore brake tests should always be made with standard tires and never with special purpose tires.
- b) Check whether the car runs straight ahead when the brakes are not applied. If this is not the case check and correct all wheel adjustment values.

If brake dragging persists, proceed as follows:

*Modification: 2<sup>nd</sup> paragraph*

Disconnect the brake line to the rear wheel brake and close the union with a dummy plug. Check the road holding of the car on a trial run. If uneven dragging has disappeared the fault was in the rear axle.

Possible sources:

Inadequate wear pattern of the brake linings, brake linings not released by our Service Organization and with friction values out of harmony with the disk brake friction pads.

If uneven brake action persists although the rear wheel brake has been disconnected, the disk brake is responsible and the following checks should be made:

### Brake Calipers

Jack up the front of the car and check whether the two wheels turn evenly. If this is not the case the cause may be as follows:

**Dunlop brake caliper:** automatic adjustment not functioning properly: replace the pressure cylinder. Caliper gap heavily corroded or fouled. Friction pad installed incorrectly.

**Teves or Girling brake caliper:** piston binding in pressure cylinder (Remedy see Job No. 42-12).

**Girling brake caliper:** heat screening plates dented. (Remedy: replace heat screening plate).

**Note:** If both wheels are equally difficult to turn there may be a fault in the special check valve which produces a residual pressure in the hydraulic system. If this is the case replace the special check valve.

### Friction Pads

Remove the friction pads and inspect the wear pattern of the linings. The surface of the linings must be the same on all friction pads. Linings with better brake action have a rough, porous surface, whereas linings with less effective brake action have a smooth, shiny surface. In accordance with the wear pattern the friction pads should be installed in such a way that each brake caliper is provided with one rough-surface and one smooth-surface friction pad.

### Brake Disks

Scores along the circumference of no more than 0.5 mm depth have no influence on even brake action. When brake disks are dirty with grey or black-blue deposits they must be reconditioned by means of cleaning pads (see Job No. 42-11a).

## G. Squeaking Brakes

On cars with disk brakes, squeaking occurs mainly when the brakes are applied lightly and usually disappears with higher brake pedal pressure. On new cars or with new friction pads, brake squeaking decreases after a few hundred miles. Slight squeaking, which to some extent depends on weather conditions anyway, is unavoidable. If squeaking is excessive the following remedies are available:

- a) Check the clearance between the lateral faces of the friction pads and the brake caliper gap. On Teves and Girling calipers the clearance should be 0.1–0.2 mm.

b) Rub the lateral and rear faces of the friction pads with Molykote Paste "U".

**Caution:** The paste must on no account contaminate the braking areas.

c) In the case of Girling brake calipers check the heat screening plates and if necessary replace them; they should never be dented.

## H. Testing the Power Brake

The T 51 power brakes can be tested without removing them from the car. The following instruments are required:

1. Vacuum gage
2. High pressure gage (e. g. Testometer)
3. Dynamometer

Connect the vacuum gage to the vacuum line between intake manifold and power brake, on Diesel engine cars to the vacuum line between vacuum pump and power brake, and in cars in with a 2<sup>nd</sup> version power brake with separate check valve at a point behind the check valve. Connect the high-pressure gage to one of the brake calipers to measure the pressure in the brake lines. Measure the brake-pedal pressure by means of a dynamometer or a pressure-operated spring scale.

The test can only be carried out when the vacuum is between 0.7 and 0.8 kg/sq. cm. If necessary the required vacuum can be produced on gasoline engine cars by accelerating the engine and suddenly releasing the gas pedal.

If the vacuum is considerably below the prescribed value or if it drops immediately, the following defects may be responsible:

1. Leaks in the vacuum line or in the connections.
2. Check valve not working properly.
3. Damaged O-ring between power brake and tandem master cylinder.
4. Damaged vacuum seals in tandem master cylinder, so that outside air can enter the vacuum cylinder via the leak oil bore in the master cylinder.
5. Damaged sealing ring in the control housing of the power brake. The sealing ring cannot be replaced with the tools available in the workshop and the power brake must be replaced.
6. Damaged vacuum pump on diesel engine cars.
7. Throttle valve not fully closed at idling speed on cars with gasoline injection engine.

The brake line pressure listed in Job No. 42-0 must be reached when the power brake is functioning properly.

**Note:** It happens frequently that repairshops replace the power brake when the customer complains about insufficient brake action. In our experience the fault lies very often with the insufficient friction of the friction pads. The power brake should therefore never be removed before it has been thoroughly tested in the car.



## I. Rattling of the Friction Pads

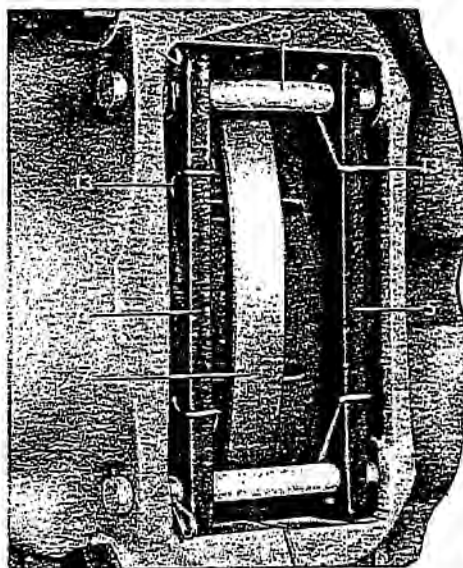
Girling brake calipers occasionally produce rattling noises when the car is being driven on bad roads. The cause is excessive radial play of the friction pads in the brake caliper housing. Only in a few cases can the noise be eliminated by installing new friction pads. Wire springs, Part No. 000 421 01 91, have now become available which can do much to prevent the rattling (see no. 13 in Fig. 42-21/14). These wire springs should only be installed when the friction pads have been conclusively proved to be responsible for the noise.

### Installation of Wire Springs

1. Remove the friction pads (see Job No. 42-10).
2. Remove the heat screening plate. The inner screening plate can be removed without any difficulty; the outer plate must be cut up along the middle with a finner's snip or rolled up with pliers. Do not damage the dust cap.

**Note:** The heat screening plates must be removed because one leg of the wire spring rests against the back of the friction pad. As a result the heat screening plate can no longer lie evenly against the friction pad, which would cause trouble when new pads are to be installed.

3. Install the wire spring (13) on the friction pads (5) and insert the pads in the brake caliper (Fig. 42-21/14).
4. Install the lock pins (6) taking care to ensure that both wire ends press against the lock pins under initial tension.



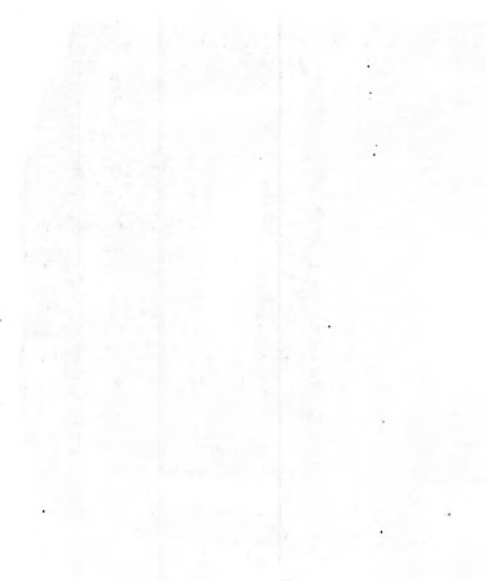
R-2807

Fig. 42-21/14

- 1 Brake caliper
- 5 Friction pad
- 6 Lock pin
- 7 Brake disk
- 12 Locking clip
- 13 Wire spring

5. Insert the locking clips (12) in the lock pins.

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# Replacement and Resurfacing of Brake Linings

Job No.
42-22

## A. Replacement of Brake Linings

1. If the brake linings are worn down to a thickness of approx. 1.5 mm, they must be replaced. In our workshops the brake linings are bonded to the brake shoes without riveting in a special process under pressure and at a temperature of 160—180° C. To make sure that the bonding is completely satisfactory, a small corner is cut off every brake lining to make a shearing test. The bonding of the brake linings requires much experience and expert knowledge and is not possible with the equipment available in repair shops. For this reason only brake linings bonded to brake shoes are supplied by way of exchange.
2. If in countries outside Germany it should be difficult to import brake shoe assemblies, it is possible to use special linings that can be riveted to the brake shoes. Completely remove the old lining, together with the cement, from the brake shoes (grind off the lining or, if necessary, chisel or file it off). After the surface of the brake shoes has been thoroughly cleaned of all traces of cement, the brake linings and the brake shoes must be drilled according to the drillhole diagram below. If the brake linings are already provided with rivet holes, the drillhole pattern is transferred to the brake shoes and holes are drilled accordingly (Fig. 42-22/1).

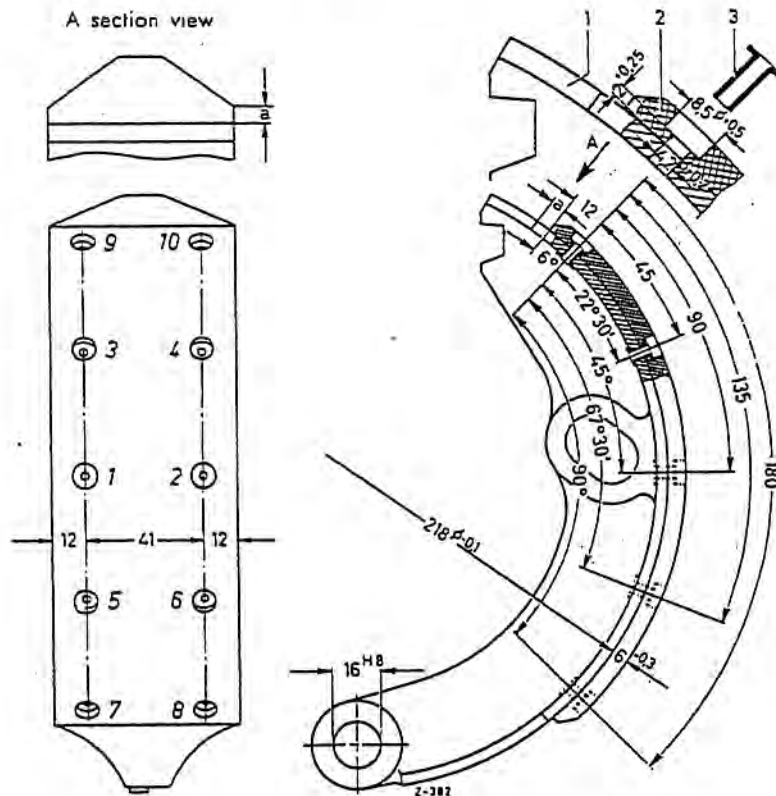


Fig. 42-22/1

Core location diagram for 65 mm brake shoes

- |                 |  |
|-----------------|--|
| 1 Brake shoes   | a = Distance between brake lining and toe edge |
| 2 Brake lining  | at rear brake shoe = 2 mm                      |
| 3 Tubular rivet | at front brake shoe = 4 mm                     |

42-22/1

**Note:** The medium center distance between the holes on the 50 mm brake shoes of the 1st version rear wheel brake on Model 220 b is 32 instead of 41 mm and the lateral distance is 9 instead of 12 mm.

Coat the brake shoe surface with sealing compound and rivet the brake lining to the shoe by means of tubular rivets (3) Part No. 183 990 02 95.

The riveting sequence is shown in Fig. 42-22/1. Start in the middle of the lining 1, then install the rivets 2,3 etc. This procedure is necessary in order to make sure that the brake lining snugly fits the whole surface of the brake shoe.

Use only the brake linings approved by our works.

When riveting the brake linings to the light metal brake shoes on the rear wheel brake, please note the following: after drilling the holes, use a 4×8.5 mm  $\Phi$  shank cutter to mill holes nos. 1, 2, 9, and 10 (Fig. 42-22/2) in the web and the shoe reinforcement down to the standard brake shoe thickness of 5 mm so that tubular rivet Part No. 183 990 02 95 can be used for all bores.

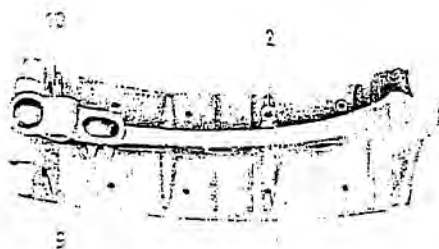


Fig. 42-22/2

## B. Reconditioning of Brake Linings

The brake linings must be reconditioned if the surface shows glazed spots or signs of overheating, or if the wear pattern of the linings is unsatisfactory.

### 1. Reconditioning with sandblasted brake drums

The best method of reconditioning brake shoes is the use of sandblasted brake drums. The brake drums should be lightly sandblasted with a medium-size grain. If a special set of sandblasted brake drums is not available, the drums of the car to be repaired can be used since such lightly sandblasted brake drums lose their roughness after a few brake operations. The brake should then be worn in on a trial run by carefully applying the brakes several times.

**Note:** Soft brake linings, e. g. Johns-Manville linings cannot be reconditioned by means of sandblasted brake drums since the roughness of the brake drums would produce scores in the brake lining even when the brakes are applied very carefully.

### 2. Reconditioning with precision-turned brake drums

Soft brake linings are reconditioned by means of precision-turned brake drums. The roughness produced by the turning operation is sufficient to obtain a satisfactory wear pattern on the brake linings even after a few braking operations.

### 3. Reconditioning with the Zanchi turning attachment

The Zanchi turning attachment can be used for both soft and hard brake linings. If the attachment is used properly, a good wear pattern of the brake linings can be obtained.

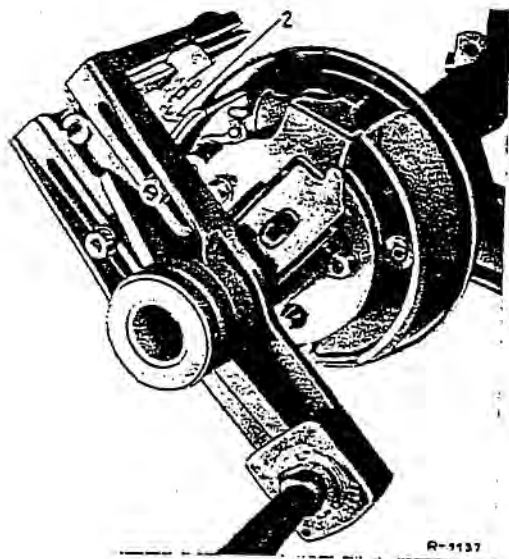


Fig. 42-22/3

2 Turning tool

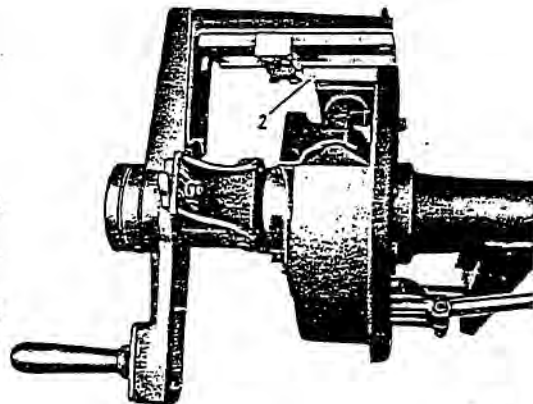


Fig. 42-22/5

2 Turning tool

If the Zanchi turning attachment is used the following points need attention:

1. On all models with automatic brake shoe adjustment vigorously depress the brake pedal so that the brake shoes are adjusted properly by the automatic adjustment device. Then use the turning tool of the attachment to find the highest spot on the brake lining and fix the turning tool in this position.
2. On models with mechanical brake shoe adjustment, measure the diameter of the brake drum with the gage (3) and install the gage in the turning attachment (1). When the turning tool (2) has been adjusted to the diameter of the gage, turn the adjusting screw toward the left approx.  $\frac{1}{6}$  turn. This adjustment will provide the diameter to which the brake shoes should be returned.
3. Re-turn the brake linings by removing as little stock as possible (0.1 to 0.2 mm). After adjusting the brake shoes, the operation must be repeated as often as necessary until the whole lining surface has been reconditioned.

**Note:** The front wheel hub must not have excessive play, since this would make proper re-turning of the brake linings impossible.

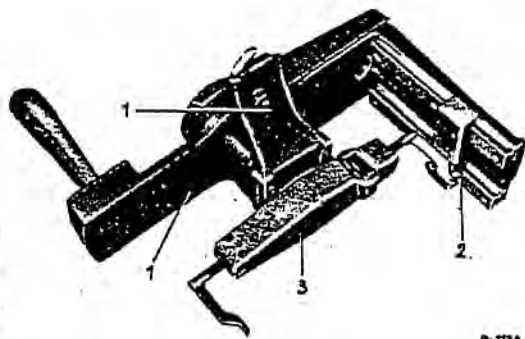
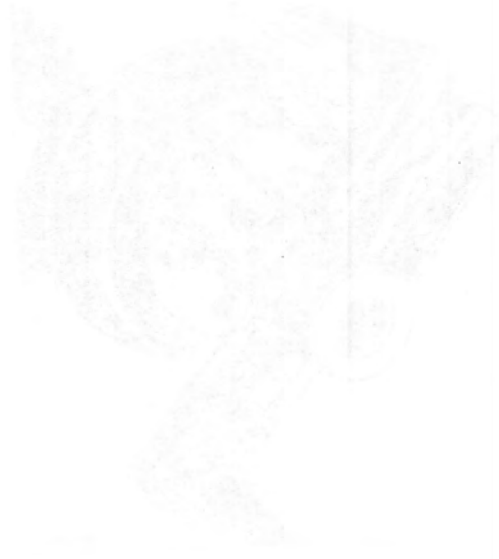


Fig. 42-22/4

1 Turning attachment  
2 Turning tool  
3 Gage



This drawing shows the front view of the component. The component is a rectangular plate with a central rectangular cutout. There are four circular holes, one in each corner. The drawing is a technical drawing and should be read in accordance with the drawing standards.

This drawing shows the top view of the component. The component is a circular plate with a central circular hole. There are four rectangular slots, one in each quadrant. The drawing is a technical drawing and should be read in accordance with the drawing standards.



# Bleeding of the Brake System

Job No.

42-23

The brake system must be bled whenever the closed hydraulic system is opened during repairs or when the brake pedal is soft and spongy. Various types of special bleeding equipment are available such as the ARC 50 pressure bleeder or the ATE filler and bleeder. Carefully observe the manufacturers' instructions when using this special equipment.

The brake fluid removed during the bleeding operation must be discarded since it may contain foreign particles that must be prevented from getting into the hydraulic system. Another important consideration is that in the course of time the highly hygroscopic brake fluid constantly absorbs moisture from the atmosphere and its boiling point decreases. As a result vapor bubbles may form in the brake system under extreme conditions, in particular in cars with disk brakes.

The brake fluid contains constituents that act as a solvent on the car finish and should therefore never be allowed to come into contact with the car finish.

The bleeding process is finished when clear bubble-free brake fluid emerges from the bleeder hose.

After bleeding the fluid reservoir should be filled with brake fluid up to the mark "maximum".

**Note:** When the brake system is bled by "pumping" the brake pedal, always close the appropriate bleed screw to make sure that air cannot be drawn in via the bleed screw thread.

## Sequence of Bleeding Operations:

### 1. On Cars with One-Circuit Brake System

#### a) On cars with drum brakes and cars with disk brakes on both front and rear axles

First bleed the master cylinder, then the power brake (if installed) and then start with the bleeding point farthest from the main cylinder, which as a rule will be the right rear wheel.

#### b) On cars with a combined drum and disk brake system

First bleed the master cylinder and the power brake and then proceed to the brake caliper farthest from the master cylinder. Bleed the second brake caliper and bleed the drum brakes by starting at the bleeding point farthest from the master cylinder.

### 2. On Cars with Two-Circuit Brake System

If both circuits have been opened, first bleed the circuit connected to the push rod space and then the circuit connected to the floating space. If only one circuit has been opened, only bleed this circuit.

## Removal and Installation of Hand Brake Caliper

### Removal:

1. Unscrew the bracket (35) of the brake cable (39) from the lever (41) of the brake support (Fig. 42-25/1).
2. Detach the leg spring (26) from the fitting plate of the friction pad (29) (Fig. 42-25/1).

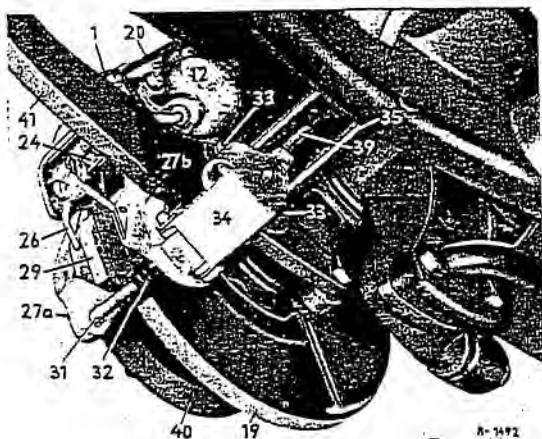


Fig. 42-25/1

#### View of the brake caliper from inside

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1 Brake caliper              | 31 Adjustment screw               |
| 12 Pressure cylinder         | 32 Rubber grommet                 |
| 19 Brake disk                | 33 Hexagon screw with lock washer |
| 20 Connecting line           | 34 Tension lever                  |
| 24 Locking plate             | 35 Rear brake cable bracket       |
| 26 Leg spring                | 39 Rear brake cable               |
| 27a Outer lining carrier     | 40 Wheel fixing disk              |
| 27b Inner lining carrier     | 41 Brake support lever            |
| 29 Friction pad (hand brake) |                                   |

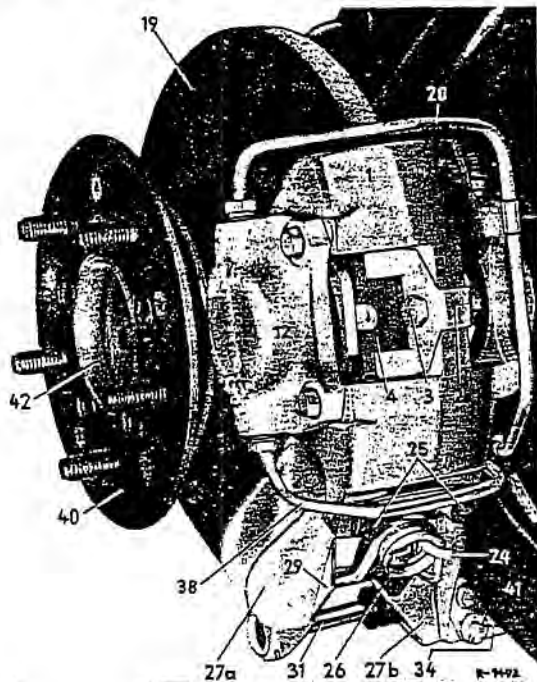


Fig. 42-25/2

#### View of the brake caliper from outside

- |   |   |
|---|---|
| 1 Brake caliper   | 25 Swing bolt                                   |
| 2 Stirrup   | 26 Leg spring                                   |
| 3 Hexagon screw with hexagon nut and serrated lock washer | 27a Outer lining carrier                        |
| 4 Friction pad with fitting plate (service brake)         | 27b Inner lining carrier                        |
| 12 Pressure cylinder                                      | 29 Friction pad with fitting plate (hand brake) |
| 19 Brake disk   | 31 Adjustment screw                             |
| 20 Connecting line with pipe clip                         | 34 Tension lever                                |
| 24 Locking plate  | 38 Brake line                                   |
|   | 40 Wheel fixing disk                            |
|   | 41 Brake support lever                          |
|   | 42 Rear axle shaft                              |

3. Tap up the locking plate (24) and unscrew the swing bolt (25) (Fig. 42-25/1).
4. Remove the hand brake caliper and detach the brake cable from the tension lever.

### Installation:

5. Clean the recess for the lining carrier in the brake caliper. Coat the contact points and the swing bolt with Molycote Paste Type G.
6. Put a new locking plate (24) on the swing bolt (25) (Fig. 42-25/1).
7. Attach the brake cable to the tension lever. Insert the hand brake caliper in the brake caliper, screw in the swing bolt and tighten with the prescribed torque (see Job No. 42-0).
8. Check whether the lining carriers swivel easily on the swing bolt. Cotter the swing bolt.
9. Put the leg spring on the locking plate and bend the lug of the locking plate in such a way that there is a clearance of approx. 1.0 mm between the upper spring coil and the lug.
10. Attach the legs of the spring in the fitting plate of the friction pads.
11. Attach the bracket to the brake support lever.
12. Check the hand brake.



# Removal and Installation of Automatic Hand Brake Adjustment on the Dunlop Brake Caliper

Job. No.  
42-27

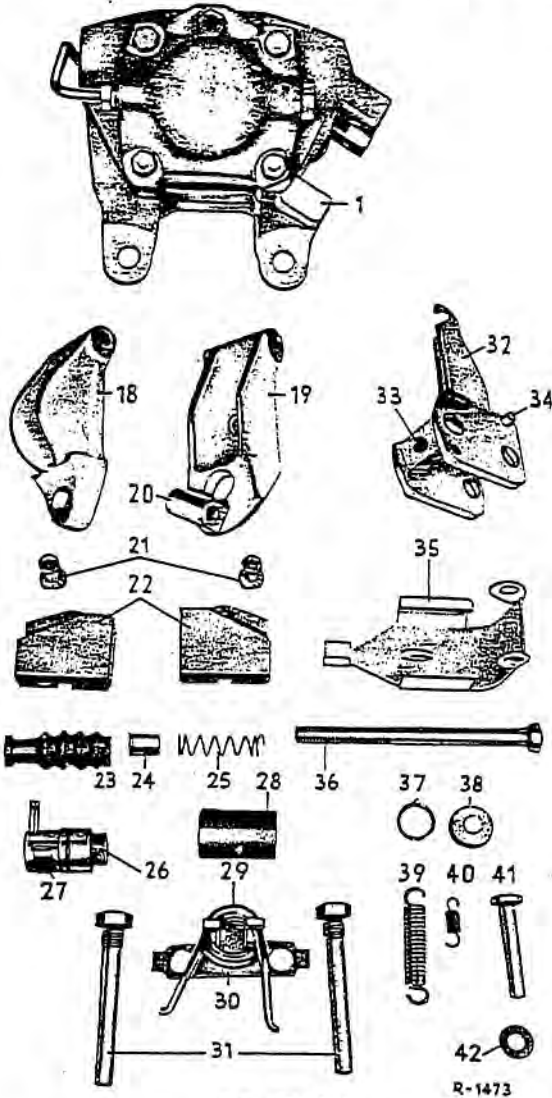


Fig. 42-27/1

- |  |                         |
|--|-------------------------|
| 1 Brake caliper  | 29 Leg spring           |
| 18 Outer lining carrier                                  | 30 Locking plate        |
| 19 Inner lining carrier                                  | 31 Swing bolt           |
| 20 Bearing bracket for tension lever                     | 32 Tension lever        |
| 21 Cheese-head screw with hexagon nut and toothed washer | 33 Driving block        |
| 22 Friction pad with fitting plate                       | 34 Pin on tension lever |
| 23 Rubber grommet  | 35 Cover plate          |
| 24 Plastic bushing                                       | 36 Adjustment screw     |
| 25 Pressure spring                                       | 37 Retaining spring     |
| 26 Automatic adjustment                                  | 38 Cup                  |
| 27 Flat spring   | 39 Return spring        |
| 28 Rubber grommet  | 40 Return spring        |
|  | 41 Collar bolt          |
|  | 42 Washer               |

### Removal:

1. Remove the hand brake caliper (see Job No. 42-25).

2. Pull the cotter (43) which secures the adjustment screw (36) out of the outer lining carrier (18) and unscrew the adjustment screw from the automatic adjustment (Fig. 42-27/3).

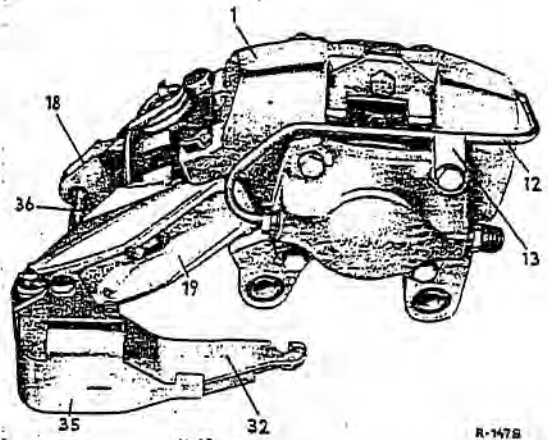


Fig. 42-27/2

- |                         |                         |
|-------------------------|-------------------------|
| 1 Brake caliper         | 18 Inner lining carrier |
| 12 Connecting line      | 32 Tension lever        |
| 13 Pipe clip            | 35 Cover plate          |
| 18 Outer lining carrier | 36 Adjustment screw     |

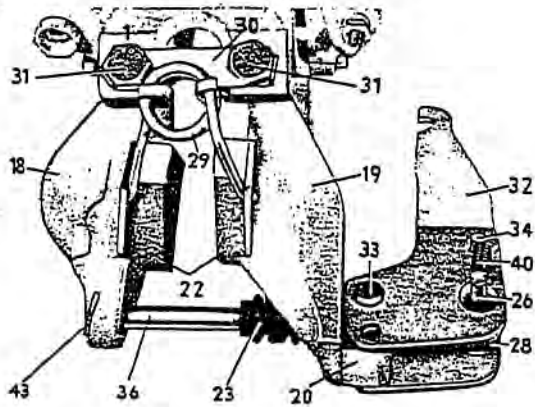


Fig. 42-27/3

- |   |                         |
|---|-------------------------|
| 1 Brake caliper                             | 28 Rubber grommet       |
| 18 Outer lining carrier                     | 29 Leg spring           |
| 19 Inner lining carrier                     | 30 Locking plate        |
| 20 Bearing bracket for tension lever        | 31 Swing bolt           |
| 22 Friction pad with fitting plate          | 32 Tension lever        |
| 23 Rubber grommet                           | 33 Driving block        |
| 26 Adjusting finger on automatic adjustment | 34 Pin on tension lever |
|   | 36 Adjustment screw     |
|   | 40 Return spring        |
|   | 43 Cotter pin           |

42-27/1

3. Remove the rubber grommet (23) together with plastic bushing (24) and pressure spring (25) from the adjustment screw (36) (Figs. 42-27/1 and 42-27/3).
4. Detach the return spring (39) from the inner lining carrier (19) and the cover plate (35) (Fig. 42-27/4).
5. Pull the cotter pin out of the collar bolt. Remove the washer and tap out the collar bolt (Fig. 42-27/2).
6. Take off the tension lever (32) from the inner lining carrier (19) and remove the cover plate (35) from the tension lever (Fig. 42-27/2).
7. Detach the return spring (40) from the adjusting finger of the automatic adjustment (26) and from the pin (34) of the tension lever (32) (Fig. 42-27/3).
8. Remove the automatic adjustment (26) from the tension lever (32). To do this, swivel the automatic adjustment together with the driving block out of the tension lever toward the back so that the leg of the retaining spring (37) jumps out of the bore in the driving block. Turn the driving block back and tilt the automatic adjustment until the adjusting finger can be removed from the bore in the tension lever (Fig. 42-27/1).
9. Remove the rubber grommet (28) from the automatic adjustment (26) (Fig. 42-27/1).
10. Remove the cup (38) and the retaining spring (37) from the shank of the adjusting nut (26) (Fig. 42-27/1).

#### Checking:

11. Check the ratchet arrangement in the automatic adjustment (26). The adjusting nut in the automatic adjustment, when turned toward the left, should make an audible ratchet noise whereas it should lock when turned toward the right.
12. Check the flat spring (27) on the automatic adjustment (26). If the spring should be partly broken, the complete adjustment system should be replaced (Fig. 42-27/1).
13. Check the retaining spring (37) on the collar of the adjusting nut of the automatic adjustment (26) (Fig. 42-27/1).

**Note:** The retaining spring prevents the adjusting nut from turning when the adjustment screw is backed out. It is for this reason that the retaining spring must not slip when it is turned clockwise on the collar of the adjusting nut. If the retaining spring should slip, it should be replaced by a spring with a smaller inside diameter.

14. Check the driving block (33) in the tension lever (32) for ease of movement (Fig. 42-27/1).

#### Installation:

15. Carefully clean the automatic adjustment (26) and coat the adjusting nut and the adjusting sleeve with a water-resistant grease. Pull a new rubber grommet (28) over the automatic adjustment (Fig. 42-27/1).
16. Install the retaining spring (37) in the cup (38) (Fig. 42-27/1).
17. Put the cup together with the retaining spring on the driving block (33) of the tension lever (32) making sure that the leg of the retaining spring engages the hole in the driving block (Fig. 42-27/1).
18. Insert the automatic adjustment (26) in the tension lever (32) in such a way that the collar of the adjusting nut completely engages the retaining spring. Then guide the adjusting finger of the automatic adjustment through the tension lever (Fig. 42-27/1).

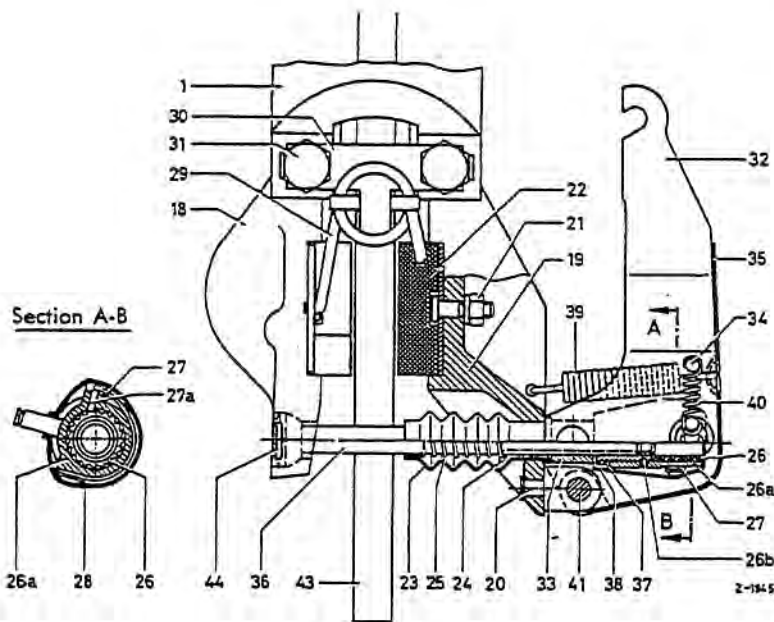
**Note:** The finger must be guided through the tension lever on the side on which the pin is located.

19. Clean the thread of the adjustment screw (36), coat it with Molycote Paste and slide it through the outer lining carrier (18). Install a new rubber grommet (23) together with the plastic bushing (24) and the pressure spring (25) on the adjustment screw. Then insert the adjustment screw in the inner lining carrier (19) (Fig. 42-27/1).
20. Put the tension lever (32) on the bearing bracket (20) of the inner lining carrier (19) and screw the adjustment screw (36) several turns into the automatic adjustment (26) (Fig. 42-27/1).

21. Push the rubber grommet (23) together with the plastic bushing (24) through the bore in the inner lining carrier (19) as far as it will go (Fig. 42-27/4).
22. Attach the leg spring (29) to both friction pads (22).
23. Attach the return spring (40) to the finger (26) of the automatic adjustment and the pin (34) of the tension lever (32) (Fig. 42-27/3).

25. Attach the return spring (39) to the cover plate (35). Push the tension lever (32) toward the inner lining carrier (19) and attach the return spring to the lining carrier (Fig. 42-27/4).
26. Back out the adjustment screw (36) until there is a distance of approx. 0.5 mm between the brake disk and the friction pads. Then cotter the adjustment screw (Fig. 42-27/3).

Fig. 42-27/4



- 1 Brake caliper
- 18 Outer lining carrier
- 19 Inner lining carrier
- 30 Bearing bracket
- 21 Cheese-head screw with hexagon nut and toothed washer
- 22 Friction pad with filling plate
- 23 Rubber grommet
- 24 Plastic housing
- 25 Pressure spring
- 26 Adjusting nut
- 26a Adjusting sleeve
- 26b Snap ring
- 27 Flat spring
- 27a Pin
- 28 Rubber grommet
- 29 Leg spring
- 30 Locking plate
- 31 Swing bolt
- 32 Tension lever
- 33 Driving block
- 34 Pin on tension lever
- 35 Cover plate
- 36 Adjustment screw
- 37 Retaining spring
- 38 Cup
- 39 Return spring
- 40 Return spring
- 41 Collar bolt
- 43 Brake disk
- 44 Cotter pin

24. Slide the cover plate (35) over the tension lever (32). Coat the collar bolt (41) with Molycote Paste. Rest the tension lever with collar bolt against the inner lining carrier (19), put on the washer (42) and cotter the collar bolt (Fig. 42-27/1).

**Note:** The cotter pin (43) prevents the adjustment screw (36) from turning during the adjusting process (Fig. 42-27/3).

27. Install the hand brake caliper (see Job No. 42-25).

28. Check the function of the hand brake.

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Main body of faint text, possibly a detailed list or report content.

Final block of faint text at the bottom of the main content area.



# Removal and Installation of Duo-Servo Parking Brake

Job No.
42-28

Modification: 2nd version added.

### Removal:

1. Remove the brake caliper (see Job No. 42-7).
2. Remove the brake disk. It is advisable to mark the relative position of brake disk and rear axle shaft in order to ensure that the brake disk is reinstalled in the same position.

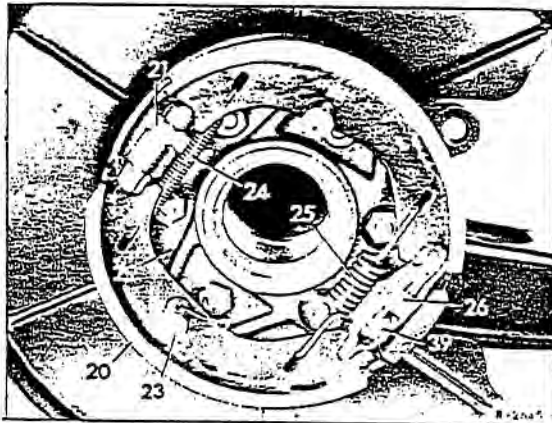


Fig. 42-28/1

1st version

- |                        |                        |
|------------------------|------------------------|
| 20 Brake shoe          | 25 Lower return spring |
| 21 Readjustment device | 26 Expansion lock      |
| 22 Pressure spring     | 29 Brake plate         |
| 23 Retaining pin       | 39 Brake cable         |
| 24 Upper return spring | 50 Cover plate         |

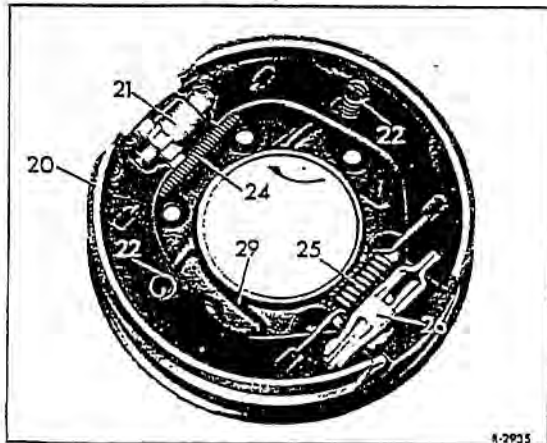


Fig. 42-28/2

2nd version

- |                        |                             |
|------------------------|-----------------------------|
| 20 Brake shoe          | 25 Lower return spring      |
| 21 Readjustment device | 26 Expansion lock           |
| 22 Spring              | 29 Back plate (sheet steel) |
| 24 Upper return spring |                             |

3. Unhook the lower spring (25 by means of the brake spring pliers (52) (Fig. 42-28/3).

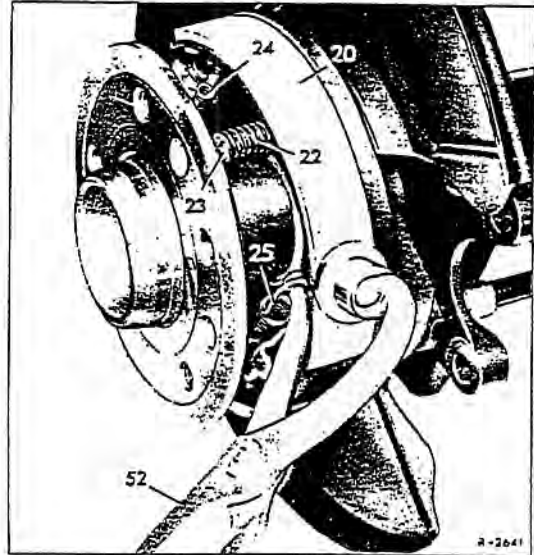


Fig. 42-28/3

- |                    |                        |
|--------------------|------------------------|
| 20 Brake shoe      | 24 Upper return spring |
| 22 Pressure spring | 25 Lower return spring |
| 23 Retaining pin   | 52 Brake spring pliers |

4. Turn the rear axle shaft (40) until the large assembly hole (40a) in the rear axle shaft points toward one of the retaining pins (33) (Fig. 42-28/4).
5. On the first version slightly compress the pressure spring (22) with a hexagon socket wrench, turn the retaining pin 90° and remove the spring together with the pin through the assembly hole in the rear axle shaft (Fig. 42-28/4).

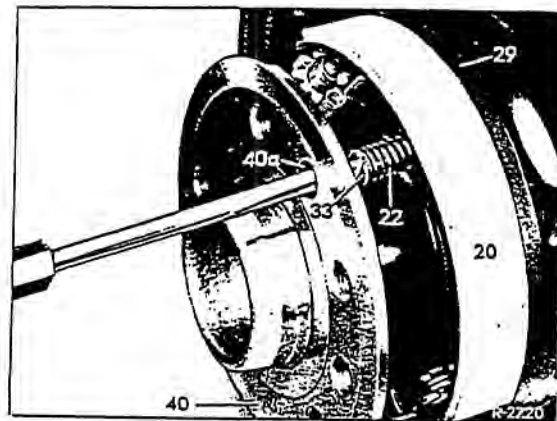


Fig. 42-28/4

- |                    |                                       |
|--------------------|---------------------------------------|
| 20 Brake shoe      | 40 Rear axle shaft                    |
| 22 Pressure spring | 40 a Assembly hole in rear axle shaft |
| 29 Back plate      |                                       |
| 33 Retaining pin   |                                       |

6. On the 2<sup>nd</sup> version use Installing Tool 112 589 09 61 00 (30) and slightly depress the spring (22), turn it 90° and remove it (Fig. 42-28/5).

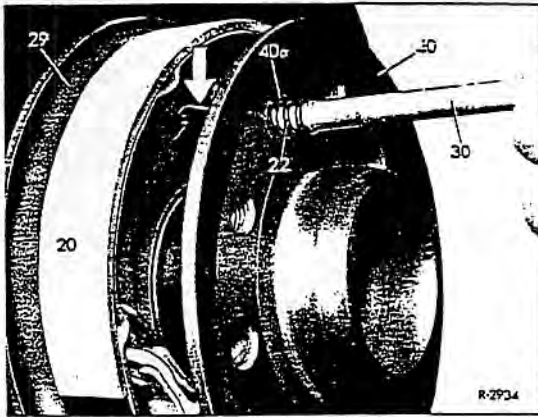


Fig. 42-28/5

- |                    |                                       |
|--------------------|---------------------------------------|
| 20 Brake shoe      | 40 Rear axle shaft                    |
| 22 Spring          | 40 a Assembly hole in rear axle shaft |
| 29 Back plate      |                                       |
| 30 Installing Tool |                                       |

7. Remove the pressure spring and the retaining pin from the second brake shoe.

**Note:** On the 1st version the retaining pin was slotted, on later versions it was provided a hexagon socket SW 6 mm.

8. Pull the two brake shoes (20) apart at their lower end so that they can be removed over the rear axle shaft (40) (Fig. 42-28/10).
9. Unhook the upper return spring (24) from the brake shoe (20) and remove the readjustment device (21) (Fig. 42-28/6).
10. Unhook the return spring (2) from the equaliser (3), turn the wing nut (8) back as far as it will go and detach both brake cables (1) from the equaliser (see Fig. 42-19/2).
11. Press the pin (33) out of the expansion lock (36) and remove the expansion lock from the brake cable (39) (Fig. 42-28/9).

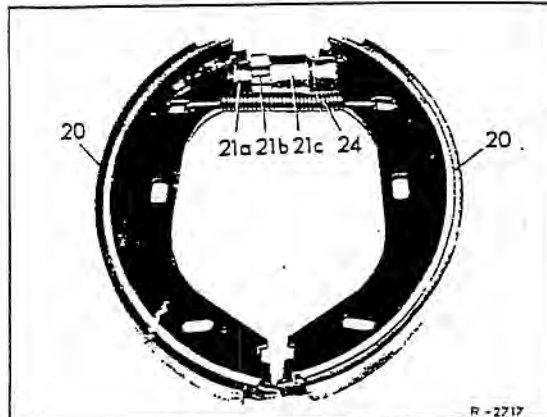


Fig. 42-28/6

- |                               |                        |
|-------------------------------|------------------------|
| 20 Brake shoes                | 21 c Pressure sleeve   |
| 21 a Pressure block           | 24 Upper return spring |
| 21 b Toothed adjustment wheel |                        |

#### Installation:

12. Rub all bearing and sliding surfaces of the expansion lock with a permanent lubricant (zinc sulfide paste, Molykote paste, Liqui-Moly Paste). Attach the brake cable (39) to the expansion lock (26) by means of the pin (33). Press the expansion lock into the back plate (29) (Figs. 42-28/7 to 9).

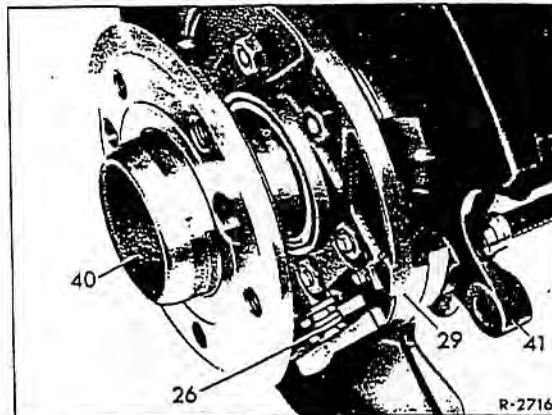


Fig. 42-28/7

- |                   |                    |
|-------------------|--------------------|
| 26 Expansion lock | 40 Rear axle shaft |
| 29 Back plate     | 41 Bearer tube     |

13. Attach the brake cables and return spring to the equaliser.
14. Disassemble the adjustment device and coat the thread and the shaft of the toothed adjustment wheel with a permanent lubricant. Then turn the readjustment device back as far as it will go taking care to ensure that the toothed adjustment wheel moves freely on the pressure block (Fig. 42-28/6).

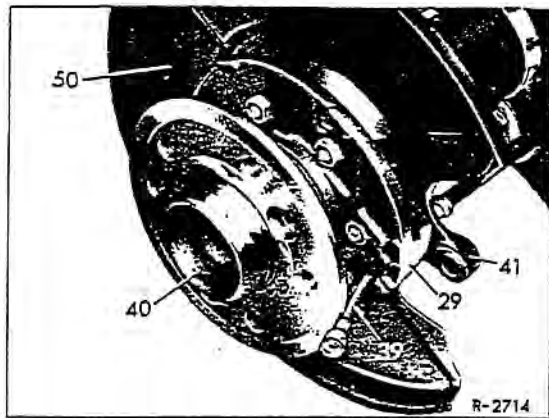


Fig. 42-28/8

29 Back plate	41 Bearer tube
39 Brake cable	50 Cover plate
40 Rear axle shaft	

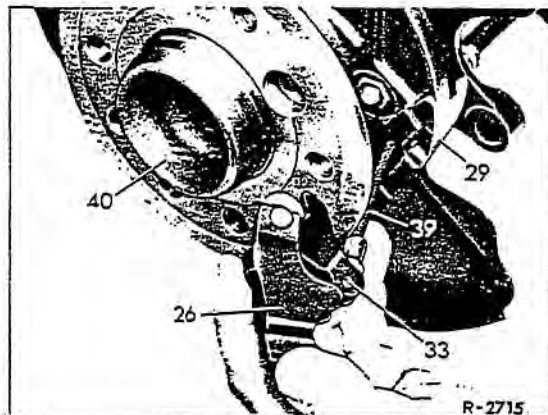


Fig. 42-28/9

26 Expansion lock	39 Brake cable
29 Back plate	40 Rear axle shaft
33 Brake cable pin	

17. On the 1st version install the two pressure springs (22) and the retaining pins (23) in the back plate (29) through the assembly hole in the rear axle shaft (40). Turn the retaining pins 90°, taking care to ensure that the retaining pins become properly seated in the spring retainer (29a) of the back plate (29) (Figs. 42-28/11 und 12).

On the 2nd version put the springs (22) on the installing tool (30) and insert them in the brake shoe (20) and the back plate (29) through the assembly hole of the rear axle shaft (40a). Turn the springs 90° and make sure that they are properly seated in the back plate (Fig. 42-28/3).

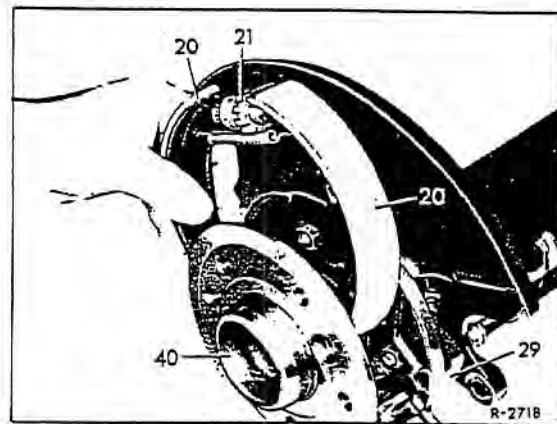


Fig. 42-28/10

20 Brake shoe	29 Back plate
21 Readjustment device	40 Rear axle shaft

15. Install the readjustment device (21) in the two brake shoes in such a way that the toothed adjustment wheel points forward. Attach the upper return spring (24) to the brake shoes (20) from the rear (Fig. 42-28/6).

**Note:** When installing new brake shoes take care to ensure that the left and the right brake are provided with brake shoes of the same lining type and quality.

Brake shoes with the Part No. 000 420 06 20 have Pagid linings.  
Brake shoes with the Part No. 108 420 01 20 have Energit linings.

16. Pull the brake shoes (20) apart at their lower end, slide them in over the rear axle shaft (40) and install them in the expansion lock (Fig. 42-28/8).

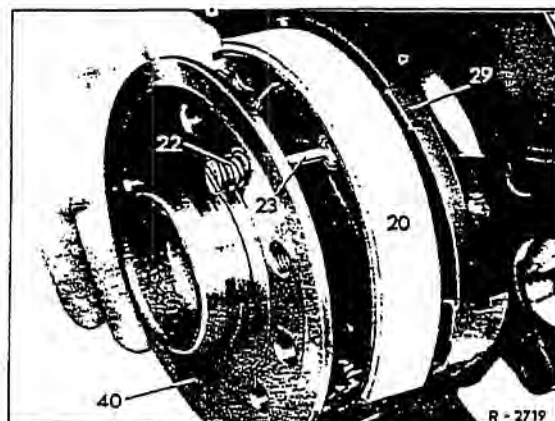


Fig. 42-28/11

20 Brake shoe	29 Back plate
22 Pressure spring	40 Rear axle shaft
23 Retaining pin	

18. Attach the lower return spring (25) to the rear brake shoe (20) with the small eye and use the brake spring pliers (52) to attach it to the front brake shoe (Fig. 42-28/3).

**Note:** The return spring Part No. 000 423 06 92, free length 74 mm, should only be installed together with brake shoes Part No. 000 420 06 20. Brake shoes Part No. 108 420 01 20 can be used with the spring Part No. 000 420 07 92, free length 80 mm, or with the above spring.

To facilitate installation the small eye of the lower return spring can be attached to one

of the brake shoes. Hold the spring when installing the brake shoe set over the rear axle shaft.

19. Coat the recess of the brake disk with a dry lubricant (zinc sulfide paste, Molycote Paste "U", Liqui-Moly 36), slide it on the rear axle shaft and install the brake caliper. Check the brake system for leaks.

20. Adjust the parking brake (see Job No. 42-20, Section F).

Schnitt C-D = Section C-D    Schnitt A-B = Section A-B    Schnitt E-F = Section E-F

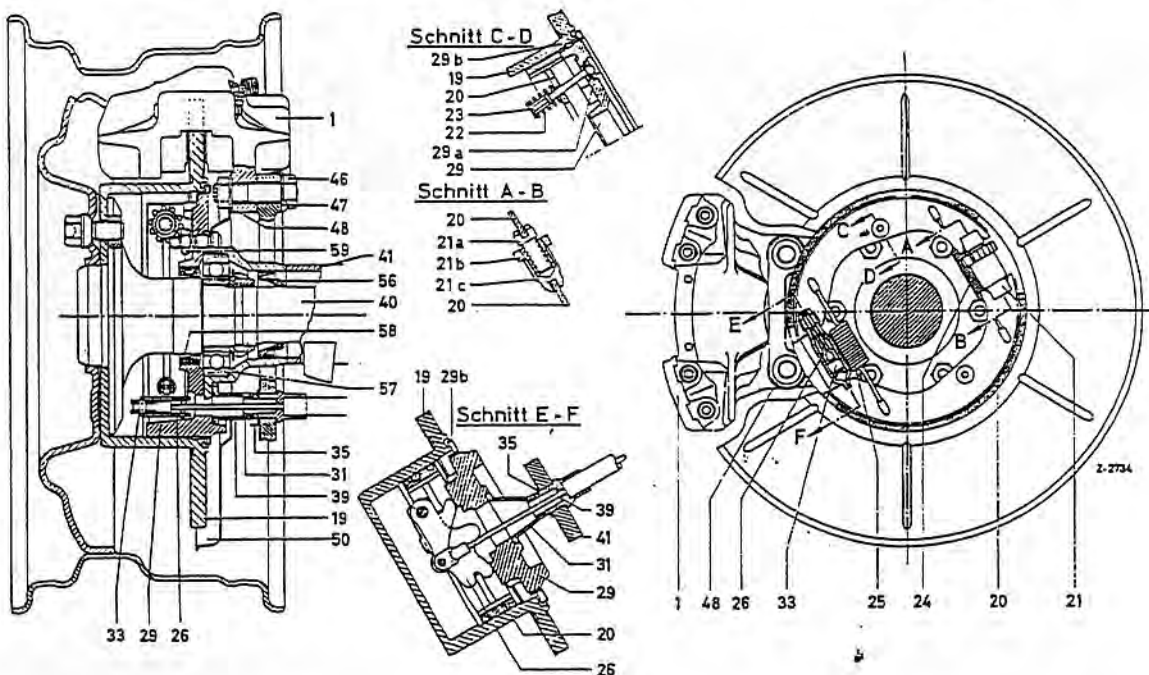


Fig. 42-28/12

- |                               |                        |                            |   |
|-------------------------------|------------------------|----------------------------|---|
| 1 Brake caliper               | 22 Pressure spring     | 31 Rubber cuff             | 48 Bracket with weld-on nut                       |
| 19 Brake disk                 | 23 Retaining pin       | 33 Brake cable pin         | 50 Cover plate                                    |
| 20 Brake shoe                 | 24 Upper return spring | 35 KL lock for brake cable | 56 Sealing ring                                   |
| 21 Readjustment device        | 25 Lower return spring | 39 Brake cable             | 57 Grooved annular bearing                        |
| 21 a Pressure block           | 26 Expansion lock      | 40 Rear axle shaft         | 58 Sealing ring                                   |
| 21 b Toothed adjustment wheel | 29 Back plate          | 41 Bearer tube             | 59 Fitting screw with lock washer and hexagon nut |
| 21 c Pressure sleeve          | 29 a Spring retainer   | 46 Hexagon fitting screw   |   |
|                               | 29 b Screening plate   | 47 Locking plate           |   |



# Trouble Shooting Hints for the Brake System

Job No.

42-30

*Modification: various details added*

## A. Service Brake

Fault	Source of trouble	Remedy
Brake pedal meets with no resistance, and is soft and spongy	<ul style="list-style-type: none"> <li>a) Air in the brake system</li> <li>b) Not enough brake fluid in the fluid reservoir</li> </ul>	<ul style="list-style-type: none"> <li>a) Bleed brake system</li> <li>b) Top up brake fluid and bleed the system</li> </ul>
Brake system is bled, but brake pedal goes right down to the toeboard without producing any braking action	<ul style="list-style-type: none"> <li>a) Leaky line</li> <li>b) Damaged or unserviceable cup in master, wheel, or pressure cylinder</li> <li>c) Check valve damaged on cars with drum brakes</li> </ul>	<ul style="list-style-type: none"> <li>a) Seal or replace brake line</li> <li>b) Replace unserviceable cup or piston seal</li> <li>c) Replace check valve</li> </ul>
Brake pedal is soft and spongy after long down gradient travel	Brake fluid too hot	Give brake system time to cool and, if necessary, bleed
Brakes heat up when car is traveling or fail to release	<ul style="list-style-type: none"> <li>a) Compensating port in brake master cylinder clogged</li> <li>b) Clearance between push rod and piston of brake master cylinder too small (on cars with one-circuit brakes)</li> <li>c) Piston of one of the brake wheel or pressure cylinders sticking</li> <li>d) Rubber parts swollen by use of unsuitable liquids</li> <li>e) Brake cable sticking</li> </ul> <p style="text-align: center;">Cars with drum brakes</p> <ul style="list-style-type: none"> <li>f) Brake shoe return springs too weak or overtensioned</li> <li>g) Brake shoes sticking on anchor pin</li> <li>h) Clearance too small (on models with drum brakes and automatic adjustment)</li> </ul>	<ul style="list-style-type: none"> <li>a) Clean compensating port</li> <li>b) Readjust brake pedal free play (see Job No. 42-20, Section B)</li> <li>c) Repair pressure or brake wheel cylinder</li> <li>d) Drain the brake system, dismantle and clean the whole brake system as specified. Replace all rubber parts including the brake hoses and the stop light switch. Fill brake system with ATE original brake fluid</li> <li>e) Replace brake cable</li> <li>f) Replace return springs</li> <li>g) Free up brake shoes on anchor pin</li> <li>h) Bolt of automatic adjustment is bent. Replace bolt. Measure clearance of the brake shoes.</li> </ul>

42-30/1

Fault	Source of trouble	Remedy
	<p>i) No play of push rod in case of light metal brake shoe rear wheel brake</p> <p style="text-align: center;">Cars with disk brakes</p> <p>j) Special check valve keeps up residual pressure</p> <p>k) Lining carriers of the parking brake have scored the swing bolt</p> <p style="text-align: center;">Cars with power brake T 50</p> <p>l) Vacuum piston of power brake fails to return to its end position or sticks</p> <p>m) Ball valve in slave cylinder piston is not lifted from its seat</p> <p style="text-align: center;">Cars with power brake T 51</p> <p>n) Excessive force-fit between the push rod of the power brake and the piston of the tandem master cylinder</p>	<p>i) Adjust the play of the push rod</p> <p>j) Replace special check valve</p> <p>k) Free up the lining carrier</p> <p>l) Check cup, spring, piston rod, and vacuum cylinder and replace damaged parts</p> <p>m) Check slave cylinder piston for fluid passage in both directions in released position and, if necessary, replace piston</p> <p>n) Replace power brake</p>
<p>Unsatisfactory braking action despite hard foot pressure</p>	<p>a) Brake shoes or friction pads oily or greasy</p> <p>b) Brake linings or friction pads charred</p> <p>c) Friction pads worn</p> <p style="text-align: center;">Cars with power brake T 50</p> <p>d) Collapsed, restricted, or loose vacuum hose</p> <p>e) Leaking control valve</p> <p>f) Low vacuum, though vacuum system is in order</p> <p>g) Leaky ball valve in slave cylinder of power brake</p> <p>h) Vacuum piston sticking</p> <p style="text-align: center;">Cars with power brake T 51</p> <p>i) Vacuum seals in tandem master cylinder damaged</p>	<p>a) Seal rear axle shaft or front wheel hub. Replace brake shoes or friction pads</p> <p>b) Replace brake shoes or friction pads</p> <p>c) Replace friction pads</p> <p>d) Check vacuum hose and, if necessary, replace. Tighten hollow screw</p> <p>e) Replace power brake</p> <p>f) Check engine and if necessary recondition valves</p> <p>g) Replace power brake</p> <p>h) Replace power brake</p> <p>i) Replace vacuum seals and lubricate piston shank with silicone</p>
<p>Brakes dragging on one side</p>	<p style="text-align: center;">Cars with disk brakes</p> <p>a) Friction pads oily or greasy</p> <p>b) Friction pads in one brake caliper excessively worn</p> <p>c) Brake caliper not parallel to brake disk</p> <p>d) Difference in friction value of pads (charred lining surface)</p> <p>e) Clearance in one brake caliper insufficient</p>	<p>a) Seal front wheel hub or rear axle shaft</p> <p>b) Replace friction pads</p> <p>c) Check seat of brake caliper and adjust</p> <p>d) Replace friction pads</p> <p>e) On Dunlop brake caliper check clearance. If necessary, replace pressure cylinder. On Girling and Teves brake calipers check piston in brake caliper for ease of movement</p>

Fault	Source of trouble	Remedy
Brakes dragging on one side	<p style="text-align: center;">Cars with drum brakes</p> <ul style="list-style-type: none"> <li>f) Wear pattern of brake linings bad and unequal</li> <li>g) Brake shoes too large in diameter on one brake</li> <li>h) Brake drums out-of-round or scored</li> <li>i) Excessive difference in diameter of brake drums</li> <li>j) Brake linings oily or greasy</li> <li>k) One brake shoe sticking on anchor pin</li> <li>l) Wheel cylinder pistons sticking</li> <li>m) Moisture in one brake</li> <li>n) Automatic adjustment not functioning properly</li> </ul>	<ul style="list-style-type: none"> <li>f) Recondition brake shoes</li> <li>g) Recondition brake shoes</li> <li>h) Recondition brake drums or, if necessary, replace them. Interchange of brake drums of individual wheels may help, too.</li> <li>i) Equalize internal diameter of brake drums. If necessary, replace</li> <li>j) Seal rear axle shaft or front wheel hub. Replace brake shoes</li> <li>k) Free up brake shoe on anchor pin and correct axial play</li> <li>l) Check wheel cylinders and, if necessary, repair</li> <li>m) Brake hard several times</li> <li>n) Check automatic adjustment and repair</li> </ul>
Squeaking brakes	<p style="text-align: center;">Cars with disk brakes</p> <ul style="list-style-type: none"> <li>a) Friction pad loose on guide bolt of piston (only in case of Dunlop disk brake)</li> <li>b) Friction pad has insufficient lateral play in the brake caliper gap</li> </ul> <p style="text-align: center;">Cars with drum brakes</p> <ul style="list-style-type: none"> <li>c) Faulty contact of front brake shoes with contact plate of brake anchor plate</li> <li>d) Excessive clearance between brake shoe eye and anchor pin</li> <li>e) Bad wear pattern of the linings or charred lining surface</li> <li>f) Much abrasive dust in the brake</li> </ul>	<ul style="list-style-type: none"> <li>a) Use 12 mm <math>\varnothing</math> pressure piece and lightly push in fitting plate on friction plate</li> <li>b) Replace friction pad (lightly grease guide surfaces in caliper gap with graphite grease or Molykote Paste "U").</li> <li>c) Straighten contact plates</li> <li>d) Adjust clearance Note: The front wheel brakes are more liable to squeak than the rear wheel brakes. Particular care should therefore be given to this operation on the front wheel brakes.</li> <li>e) Recondition brake linings. If necessary exchange brake shoes</li> <li>f) Thoroughly clean brake with compressed air</li> </ul>

Fault	Source of trouble	Remedy
Rattling of brakes	<p>a) Rear shock-absorbers unequal in effect</p> <p>b) Rear axle suspension defective</p> <p>c) Excessive disk wheel wobble</p> <p style="text-align: center;">Cars with disk brakes</p> <p>d) Run-out of brake disk</p> <p>e) Unsatisfactory wear pattern of friction pads</p> <p>f) Difference in overall thickness of brake disk</p> <p>g) Coating on braking areas of brake disks</p> <p style="text-align: center;">Cars with drum brakes</p> <p>h) Excessive out-of-roundness of rear brake drums</p> <p>i) Excessive variation in wall thickness of brake drums</p> <p>j) Bad wear pattern of brake linings</p>	<p>a) Replace rear shock-absorbers</p> <p>b) Check rear axle suspension and, if necessary, repair</p> <p>c) Check disk wheels and, if necessary, replace</p> <p>d) Check and correct run-out of brake disk</p> <p>e) Run in friction pads</p> <p>f) Install new brake disks with a thickness difference below 0.03 mm</p> <p>g) Clean brake disks with emery paper or abrasive pads (not grinding pads)</p> <p>h) Check out-of-roundness of the brake drums by means of a dial gage. Out-of-roundness must not be in excess of 0.02 mm. If necessary, recondition the brake drums.</p> <p>i) Replace brake drums. The maximum permissible variation in wall thickness is 1 mm</p> <p>j) Recondition brake linings</p>
Leaky pressure cylinder	<p>a) Piston seal shrunk</p> <p>b) Scores in cylinder wall</p> <p>c) Formation of rust on cylinder wall</p>	<p>a) Replace piston seal. (O. D. of piston seal must exceed piston <math>\phi</math> by 1 mm).</p> <p>b) Replace pressure cylinder</p> <p>c) Remove light rust patches. If necessary, replace brake caliper or pressure cylinder. Replace damaged dust caps.</p>
Fluid reservoir needs frequent replenishing with brake fluid	<p>a) Leak in hydraulic system</p> <p>b) Brake master cylinder leaking</p> <p>c) Brake wheel cylinder or pressure cylinder leaking</p> <p>d) Brake fluid escaping from leak port</p>	<p>a) Check all lines, hoses, and unions for leaks. When doing this, press down brake pedal firmly and hold in position with pedal jack.</p> <p>b) Check brake master cylinder and, if necessary, replace secondary cup.</p> <p>c) Check wheel or pressure cylinder and, if necessary, replace cup or piston seal.</p> <p>d) Replace power brake</p>

Fault	Source of Trouble	Remedy
No or insufficient power assist	<p>Cars with two-circuit brake system</p> <p>a) Insufficient vacuum b) Vacuum line clogged</p> <p>c) Damaged diaphragm in vacuum pump d) Control housing in power brake damaged</p>	<p>a) Measure the vacuum b) Check connection on check valve (plastic plug in front of valve) c) Replace diaphragm d) Replace power brake</p>
Power brake hissing in partly applied position	<p>a) Leak in poppet assembly b) Control housing broken</p>	<p>a) Replace power brake b) Replace power brake</p>
Power brake run-out too early (brake pedal drops on slightest touch, brake action out of control)	Excessive travel of control piston	Replace power brake
Brake pedal can be depressed down to the cowl with moderate foot pressure	Damaged sleeve in suspended circuit of tandem master cylinder	Replace tandem master cylinder

### B. Hand Brake

Fault	Source of Trouble	Remedy
Hand brake ineffective	<p>Cars with disk brake</p> <p>a) Excessive gap between friction pads and brake disk b) Worn friction pads c) Friction pads worn more on one side d) Excessive run-out of brake disk</p>	<p>a) Check automatic adjustment b) Replace friction pads c) Check position of leg spring, if necessary replace d) Measure run-out and correct disk</p>

### C Power Brake T 51

Fault	Source of Trouble	Remedy
Power brake snarls or knocks if applied quickly	Excessive distance between control piston and reaction disk	Replace power brake



# Steering Assembly - Group 46

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Removal and Installation of Steering Wheel	46-2
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B. Pressure Block Assembly for Steering Shaft	
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Removal and Installation of Steering Linkage	46-9
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B. Cars with 2nd Version Front Axle	
Removal and Installation of Steering Shock-Absorber	46-10
Removal and Installation of Steering Relay Arm	46-11
Removal and Installation of Steering Gear Arm	46-12
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Job No.
46-0

# Steering

General Data, Dimensions and Tolerances

*Modification: New Models added  
Other modifications marked \**

## A. Mechanical Steering

### Oil Capacity of Steering

Models 190 c, 190 Dc, 220 b, 220 SEb, 230 SL, 200 D, 230, 230 S, 250 S, 250 SE

Hypoid transmission oil SAE 90	0.3 liter
Oil Level Check	
<p>Turn the steering worm in such a way that the steering nut is in the lower part of the housing. To do this, turn the steering wheel completely to the left on left-hand drive models, and completely to the right on righthand drive models. Then unscrew the screw plug from the steering housing cover and measure the oil level with a depth gage. The oil level should be appr. 40 mm below the bore in the steering housing cover.</p>	

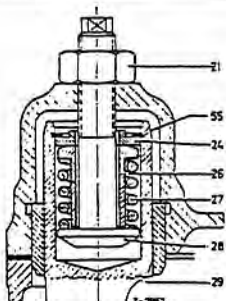
### Bearings of Steering Worm

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 230 SL, 200, 200 D, 230, 230 S, 250 S, 250 SE

Play of angular contact bearings	
End play of steering worm (adjustable by adjusting ring)	0.00 mm to 0.01 mm (practically no play)
<p>Before tightening the hexagon nut, coat the contact surface of the nut and the thread of the adjusting ring with sealing compound.</p>	

### Pressure Block Assembly for Steering Shaft

Models 190 c, 190 Dc, 220 b, 220 SEb, 230 SL, 200, 200 D, 230, 230 S, 250 S, 250 SE

Adjustment of pressure block assembly (Only with the steering removed from the vehicle)	
<p>★ With the steering in center position back out the adjusting screw several times and tighten it firmly with 1 mkp. Then back out the screw about <math>\frac{1}{4}</math> turn and tighten it up to a torque of 0.5 mkp. Put a dial gage on the adjusting screw and set to 0. Then turn in the screw 0.1 to 0.15 mm (about <math>\frac{1}{8}</math> turn) and tighten the hexagon nut (21) with 2.5 to 3 mkp. — the dial gage must move back to 0.03—0. This adjustment corresponds to a torque of 175 to 225 cmkp required to turn the steering shaft beyond the center position. Before tightening the hexagon nut, coat the contact surface of the nut and the thread of the adjusting ring with sealing compound.</p>	



## B. DB Power Steering

Modification: Table of tightening torques enlarged

### Steering Power Assistance

Beginning of power assistance with a force acting on steering wheel circumference of kp	Beginning of manual power limitation	
	with a force acting on steering wheel circumference of kp	corresponds to an oil pressure of atm.
approx. 0.7	approx. 2.8	approx. 12.0

### Oil Capacity of Power Steering

For type of oil see fuel and oil chart	approx. 1.5 litres
Oil level check	
With the engine running, the oil level should reach the level mark stamped in the reservoir (approx. 12 mm below the reservoir edge). Use absolutely clean oil for topping up since even the smallest impurities may cause trouble in the hydraulic system.	

### Steering Gear Arm Position

Models 190 c to 300 SEL

Distance "a" from outer face of the steering housing to center bore for ball stud in steering gear arm with center position check screw screwed in	76±3
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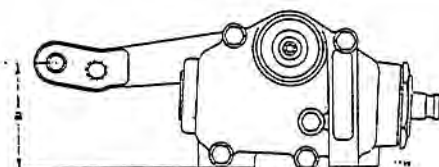


Fig. 43-0/3

### Adjustment of Steering Relay Arm

Models 190 c to 300 SEL

Distance 'a' between steering relay arm and trunnion bearing (see Fig. 46-11/2) (Steering in center position or lever in straight-ahead position)	
Standard distance	Minimum distance
2.5 mm	1.0 mm

### Tightening Torques

Models 190 c to 300 SL

Hexagon screws for fastening the steering to the chassis base panel	appr. 5 mkp
Hexagon castle nut for fastening the steering gear arm to the steering shaft	appr. 20 mkp
Hexagon nut for fastening the steering wheel to the steering tube	appr. 8 mkp
Hexagon socket screws for fastening the steering coupling to the steering tube or steering worm	appr. 2.5 mkp
Hexagon nut for fastening steering column shock-absorber to steering tube	appr. 5 mkp
Hexagon nut for fastening steering wheel to steering column shock-absorber	appr. 1.2 — 1.5 mkp

46-0/2

Date	Description	Amount
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2050	...	...

# Removal and Installation of Steering Assembly

Job No.
46-1

## Removal:

1. Unscrew the hexagon socket screw (clamping screw) (8) from the lower flange (4) of the steering coupling (Fig. 46-1/1).
2. Detach the center tie-rod from the steering gear arm (see Job No. 46-9).
3. Unscrew the three hexagon screws (5) for fastening the steering assembly to the chassis base panel from the outside. Then pull the steering worm off the steer-

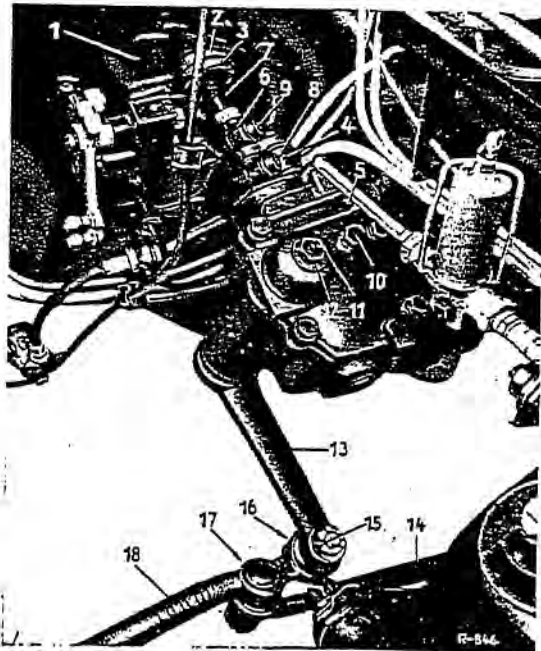


Fig. 46-1/1

- 1 Cover plate
- 2 Steering column jacket
- 3 Rubber cuff
- 4 Lower flange of steering coupling
- 5 Hexagon screws for fastening the steering assembly to the chassis base panel
- 6 Upper flange of steering coupling
- 7 Steering tube
- 8 Hexagon socket screw (lower clamping screw)
- 9 Hexagon socket screw (upper clamping screw)
- 10 Screw plug in steering housing cover
- 11 Adjusting screw for pressure block assembly of steering shaft
- 12 Hexagon nut (lock nut for adjusting screw)
- 13 Steering gear arm
- 14 Tie-rod
- 15 Castle nut with cotter pin
- 16 Ball joint for center tie-rod
- 17 Ball joint for tie-rod
- 18 Center tie-rod

ing coupling and take out the steering assembly downward (Fig. 46-1/1).

4. Remove the steering gear arm (see Job No. 46-12).

## Installation:

5. Check the steering coupling. If necessary, remove the coupling and reinstall after repair (see Job No. 46-13).
6. Attach the steering gear arm to the steering shaft, paying attention to the position markings (see Job No. 46-12).
7. Unscrew the screw plug (10) from the housing cover and fill up the steering assembly with the specified oil (for quantity and type of oil see Job No. 46-0).
8. Put the steering in center position and fix the position of the steering nut (4) by screwing Center Position Check Screw 111 589 00 23 (1) into the threaded bore for the screw plug in the steering housing cover (2) (Fig. 46-1/2).

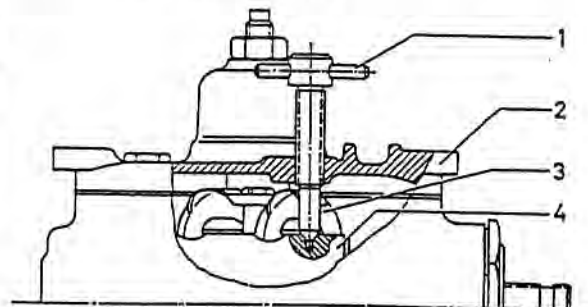


Fig. 46-1/2

- 1 Center Position Check Screw 111 589 00 23
- 2 Steering housing cover
- 3 Ball guide tube of the steering nut
- 4 Steering nut

## Note:

- a) Before screwing in the check screw, turn the steering worm until the center of the steering nut is exactly below the threaded bore in the housing cover, using a suitable

inspection lamp for the job. Then screw in the check screw.

b) Only Check Screw 111 589 00 23 should be used for checking the center position of the steering assembly. If a screw with a through-thread is used, the ball guide tube (3) of the steering nut situated beside the center may be damaged (Fig. 46-1/2).

9. Put the steering tube in its center position. In this center position, the canceling cam on the steering tube is opposite the center of the flash signal switch. For inspection purposes remove the rubber cover on the flash signal switch from the steering column jacket.

10. Press the steering worm into the steering coupling, making sure that the splines are not damaged and that the steering tube is in its correct position.

11. Fasten the steering assembly to the chassis base panel by means of the three hexagon screws. Insert the lower hexagon socket screw (clamping screw) into the steering coupling and tighten it (Fig. 46-1/1).

12. Turn out the center position check screw.

13. Attach the center tie-rod to the steering gear arm (see Job No. 46-9).

14. Turn the steering hard over to the left and to the right. In doing this check whether the

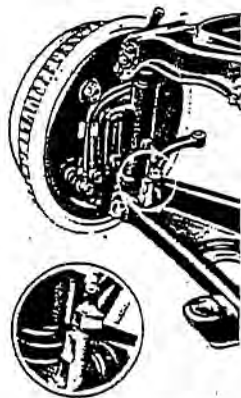


Fig. 46-1/3

steering knuckle arm rests against the steering knuckle assembly stop face (Fig. 46-1/3).

**Note:** The steering must be limited by the steering knuckle assembly. If this is not the case, the cause may be an incorrectly installed steering gear arm or toe-in maladjusted on one side. For this reason, it is important to adjust the toe-in with the steering wheel in the center position, so that the toe-in on the left and on the right wheel is evenly distributed.

The steering nut must not strike against the safety stop faces (a) in the steering housing (Fig. 46-1/3a). The sole purpose of these stop faces is to exclude all possibility of fouling or pressure of the steering nut on the bearings of the steering worm.

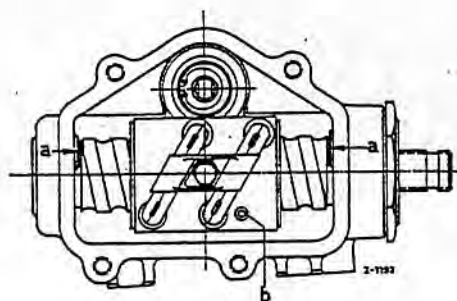


Fig. 45-1/3a

a Safety stop faces for the steering nut on the steering housing.  
b Center for the center position check screw in the steering nut

15. Check the toe-in (see Job No. 40-3).

16. Screw the screw plug (10) into the housing cover (see Fig. 46-1/1).

17. Check the position of the steering wheel during the trial run. When the wheels are in the straight fore and aft position, the steering wheel must also be in the dead center position. If necessary, the position of the steering wheel on the serrations can be corrected toward the right or left (see Job No. 46-2).

18. Check whether the automatic return mechanism of the flash signal switch is working properly.

# Removal and Installation of Steering Wheel

Job Nr.

46-2

## A. 1st Version Steering Wheel

*Modification: 2nd version added*

### Removal:

1. Take off the trademark plate from the steering wheel (Fig. 46-2/1).



Fig. 46-2/1

2. Loosen the hexagon nut fastening the steering wheel to the steering tube and remove (Fig. 46-2/2). Then pull off the steering wheel by hand from the serrations of the steering tube.

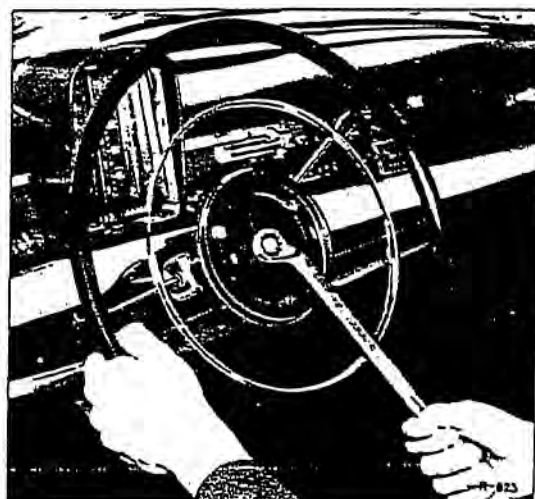


Fig. 46-2/2

**Note:** Before taking off the steering wheel it is advisable to mark the relative positions of the steering wheel and the steering tube.

### Installation:

3. Check the correct position of the retainer (11) for the contact ring (12) of the horns and of the pressure spring (30). Then put the steering wheel on the serrations of the steering tube (19), making sure that the wheel spokes are in their correct position (Fig. 46-2/3). Tighten the hexagon nut and lock washer.

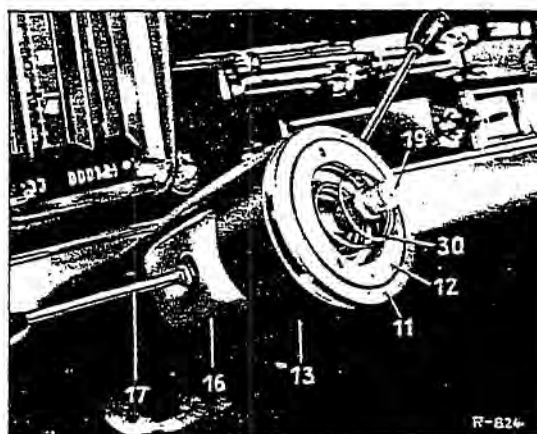


Fig. 46-2/3

- 11 Retainer for contact ring
- 12 Contact ring for horn actuation
- 13 Steering column jacket
- 16 Rubber cover for flash signal switch
- 17 Flash signal switch
- 19 Steering tube
- 30 Pressure spring

**Note:** If a new steering wheel is installed, whose position in relation to the steering tube could not be marked, the steering tube should be put in the center position.

When it is in its center position, the canceling cam on the steering tube is opposite the center of the flash signal switch. For inspection purposes remove the rubber cover at the flash signal switch from the steering column jacket.

46-2/1

4. Check the position of the steering wheel on a trial run. When the wheels are in a straight fore and aft position, the steering wheel must also be in the dead center position. If, when the car is traveling straight ahead, the position of the steering wheel does not correspond to that of the front wheels, check the toe-in, and correct if necessary. If after that the position of the

steering wheel still needs correction, change the position of the steering wheel on the serrations to the right or to the left.

5. Check the horns and check whether the automatic return mechanism of the flash signal switch is working properly.

## B. 2nd Version Steering Wheel (with Steering Column Shock-Absorber)

### Removal:

When the steering wheel is removed procedure should be as follows: In general the steering wheel is removed from the steering column shock-absorber, i. e. the latter remains on the steering tube (paras 3 to 6 below). When work is to be carried out on the steering column jacket, the steering tube or the shift tube, the steering wheel must be removed complete with the steering column shock-absorber (paras 1 and 2).

### Removal of Steering Wheel together with Steering Column Shock-Absorber

1. Take the trademark plate off the steering wheel.
2. Unscrew the hexagon nuts (1) from the steering tube (5) with a socket wrench, then remove the steering wheel complete with steering column shock-absorber (Fig. 46-2/4).

### Removal of Steering Wheel without Steering Column Shock-Absorber

3. Remove the steering wheel from the steering column shock-absorber by unscrewing the 5 hexagon nuts (1) (Fig. 46-2/5).

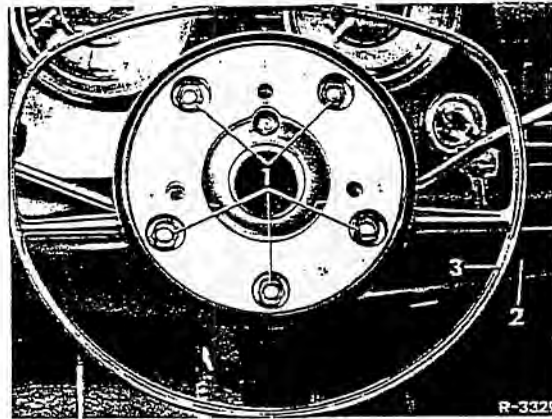
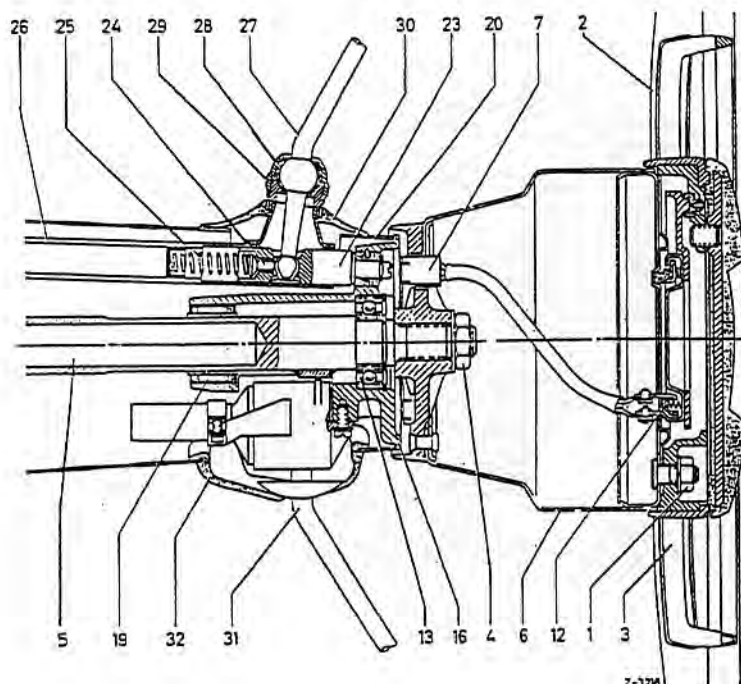


Fig. 46-2/5

- 1 Hexagon nut with spring washer
- 2 Steering wheel
- 3 Horn ring

Fig. 46-2/4

- 1 Hexagon nut with spring washer
- 2 Steering wheel
- 3 Horn ring
- 4 Hexagon nut with spring washer
- 5 Steering tube
- 6 Steering column shock-absorber
- 7 Slip ring with cable
- 12 Contact ring
- 13 Annular grooved bearing
- 16 Mounting plate
- 19 Needle bearing
- 20 Vulkollan ring
- 23 Guide pin
- 24 Spring seat pin
- 25 Pressure spring
- 26 Shift tube
- 27 Shift lever
- 28 Ball socket
- 29 Cap
- 30 Rubber cover
- 31 Combined switch
- 32 Rubber cover



4. Detach cable (7) from the contact ring and remove steering wheel (Fig. 46-2/6).

#### Other Steering Wheel Jobs

5. Unscrew countersunk tapping screws (10) from the steering wheel, then remove centering bottom (11) and contact ring (12) (Fig. 46-2/7).
6. Remove horn ring (3) from steering wheel (Fig. 46-2/7).

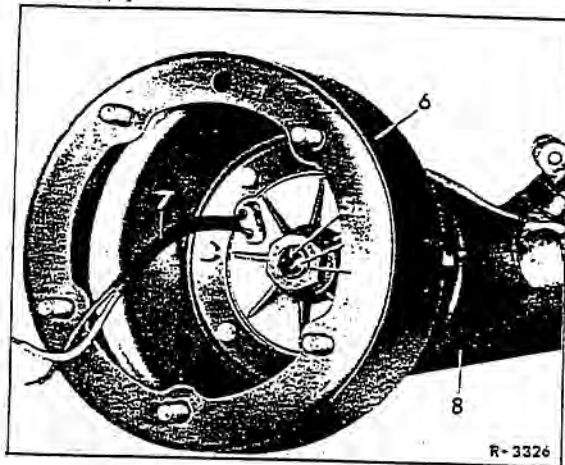


Fig. 46-2/6

- 4 Hexagon nut with spring washer
- 5 Steering tube
- 5a Marking on the steering tube
- 6 Steering column shock-absorber
- 7 Cable for slip ring
- 8 Steering column jacket

7. Remove lock ring (9), then slip ring (7) from the hub of the steering column shock-absorber (6) (Fig. 46-2/8).

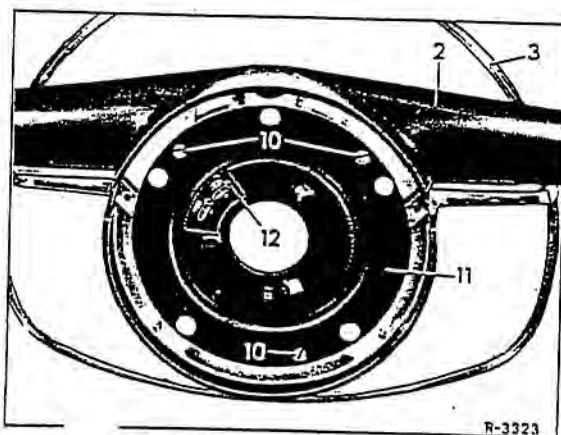


Fig. 46-2/7

- 2 Steering wheel
- 3 Horn ring
- 10 Countersunk tapping screw
- 11 Centering bottom
- 12 Contact ring

#### Installation:

8. Fix slip ring (7) to the steering column shock-absorber (6) with the lock ring (9) (Fig. 46-2/8).
9. Place horn ring (3) in the steering wheel (2) (Fig. 46-2/7).
10. Place the contact ring (12) on the horn ring (3) in such a way that the terminals protrude into the hole in the centering bottom (11). Secure centering bottom to the steering wheel with the countersunk tapping screws (10) (Fig. 46-2/7).
11. Connect the cable (7) for the slip ring to the contact ring (Fig. 46-2/6).
12. Fasten steering wheel to the steering column shock-absorber, tightening the hexagon nuts with the specified torque (see Job No. 46-0).

Note: A bore between two weld-on screws in the steering column shock-absorber should point upward when the steering tube is correctly positioned.

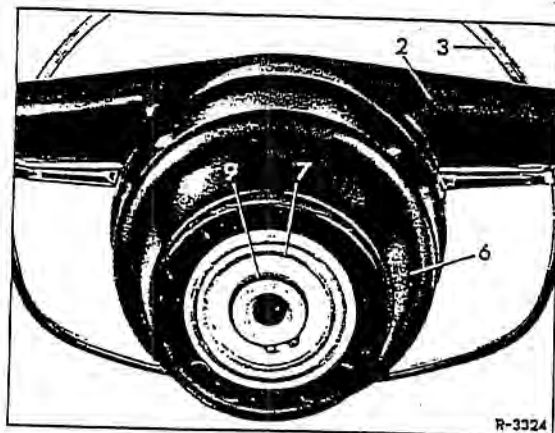


Fig. 46-2/8

- 2 Steering wheel
- 3 Horn ring
- 6 Steering column shock-absorber
- 7 Slip ring
- 9 Lock ring

13. Put steering wheel together with steering column shock-absorber on the serrations of the steering tube, ensuring that the wheel spokes are correctly positioned and the notch on the steering tube is in the 12 o'clock position.

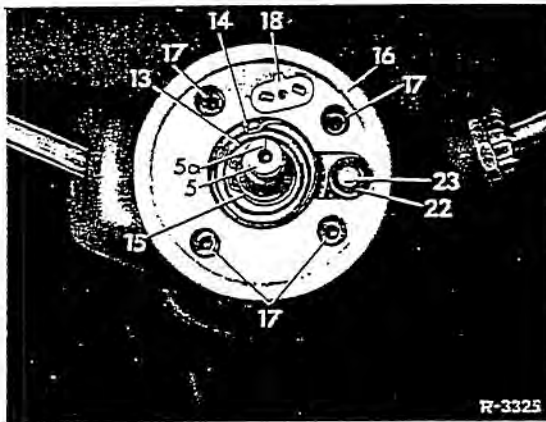


Fig. 46-2/9

- 5 Steering tube
- 5a Mark on steering tube
- 13 Annular grooved bearing
- 14 Snap ring
- 15 Snap ring
- 16 Mounting plate
- 17 Hexagon socket screw with washer
- 18 Carbon brush
- 22 Lock ring
- 23 Guide pin

14. Place the hexagon nut (4) in a socket wrench (50), insert the spring washer (4) and secure both nut and washer to the socket wrench with adhesive tape (50a). Screw the hexagon nut onto the steering tube, at the same time ensuring that the spring washer does not drop out of the wrench. Remove adhesive tape from the socket wrench and tighten the hexagon nut with the specified torque (Fig. 46-2/10).

15. During a trial run check the position of the steering wheel with wheels in the straight-ahead position. If the position of the steering wheel does not agree with the position of the front wheels in the straight-ahead position, check the toe-in and, if necessary, correct it. If correction of the steering wheel is still necessary, the latter can be shifted to the right or left on the serrations (max. 2 serrations).

16. Check the horns and check whether the automatic return mechanism of the combined switch is working properly.

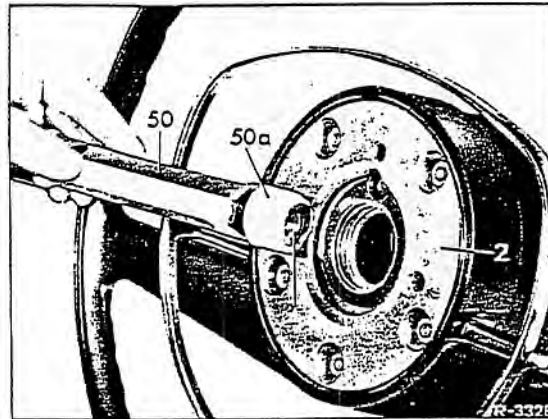


Fig. 46-2/10

- 1 Hexagon nut with spring washer (steering column shock-absorber)
- 2 Steering wheel
- 3 Horn ring
- 4 Hexagon nut with spring washer (steering tube)
- 50 Socket wrench
- 50a Adhesive tape



# Checking the Play of the Steering Assembly Units

Job No.

46-3

1. Check the play at the steering wheel. A maximum play of 25 mm is permissible at the circumference of the steering wheel.

**Note:** When checking the play it is advisable to have an assistant hold the front wheels steady.

2. If the play at the steering wheel exceeds this amount, check the play in the component parts of the whole steering assembly:

a) **Front Wheel Bearings**

If necessary, adjust or replace the annular taper roller bearings.

b) **King Pin**

Check by pushing the front wheels hard from side to side about the longitudinal axis. If necessary, replace the king pins or the bearing bushings (for dimensions see Job No. 33-0).

c) **Steering Linkage**

Check by moving the tie-rods vigorously. If necessary, replace the center tie-rod or the ball heads of the tie-rods (see Job No. 46-9).

d) **Steering Relay Arm**

Check by moving it vigorously up and down. If necessary, replace the steering relay arm and the bushing in the trunnion bearing (see Job No. 46-0 and 46-11).

e) **Steering**

If the steering play is excessive, remove the steering.

Readjust the pressure block assembly for the steering shaft (see Job No. 46-0). If the end play of the steering worm is excessive, readjust the bearings by means of the adjusting ring in the upper part of the steering housing (see Job No. 46-0).

If the radial play of the steering shaft is excessive, replace the shaft and if necessary the bearing bushings (for dimensions see Job No. 46-0).

The pressure block assembly and the steering worm bearings must not be readjusted with the steering installed in the vehicle.



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# Adjustment of Steering

Job No.

46-4

Only with the Steering Removed from the Vehicle

Modification: Paras 4-7 on page 46-4/2

## A. Steering Worm Play

1. Attach the steering to the assembly plate (25) which has been clamped in a vise (Fig. 46-4/2).
2. Completely loosen the pressure block assembly for the steering shaft (see Section B).
3. Check the steering worm for the specified end play (practically no play) (see Table in Job No. 46-0). The steering worm must turn easily, but there must not be any excessive play. If the steering worm does not move easily when the end play is adjusted correctly, disassemble the steering and check the bearing parts of the steering worm (Fig. 46-4/1).

Pin Wrench 000 589 00 05 to tighten the adjusting ring (7) until the specified end play of the steering worm is obtained (Figs. 46-4/1 and 46-4/2). Then tighten the hexagon nut, at the same time holding the adjusting ring steady in order to ensure that the adjustment is not changed. Again check the end play as described in para 3.

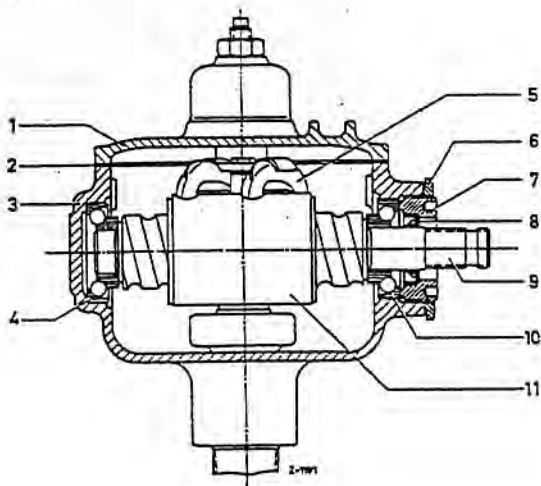


Fig. 46-4/1

- |                           |                            |
|---------------------------|----------------------------|
| 1 Steering housing cover  | 7 Adjusting ring           |
| 2 Gasket                  | 8 Grease seal              |
| 3 Steering housing        | 9 Steering worm            |
| 4 Angular contact bearing | 10 Angular contact bearing |
| 5 Ball guide tube         | 11 Steering nut            |
| 6 Hexagon nut             |                            |

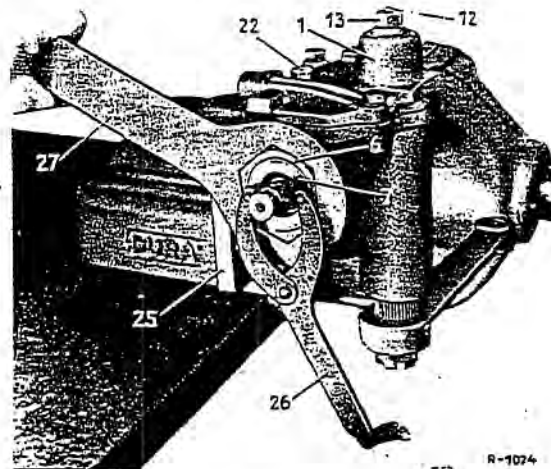


Fig. 46-4/2

- |                                 |
|---------------------------------|
| 1 Steering housing cover        |
| 2 Hexagon nut                   |
| 7 Adjusting ring                |
| 12 Adjusting screw              |
| 13 Hexagon nut (lock nut)       |
| 22 Screw plug                   |
| 25 Assembly plate               |
| 26 Pin Wrench 000 589 00 05     |
| 27 Special Wrench 180 589 00 01 |

**Note:** Before tightening the nut, coat the contact surface of the hexagon nut (6) and the thread of the adjusting ring (7) with sealing compound (Fig. 46-4/2).

4. In order to adjust the end play of the steering worm, use Special Wrench 180 589 00 01 to loosen the hexagon nut (6). Then use

5. Adjust the pressure block assembly for the steering shaft (see Section B).

46-4/1

## B. Pressure Block Assembly for Steering Shaft

1. Check the play of the steering worm and, if necessary, readjust (see Section A).
2. Unscrew the screw plug (22) from the steering housing cover and check the adjustment of the pressure block assembly. As an additional check turn the steering at the steering worm by means of the steering coupling and at the steering shaft by means of the steering gear arm. When the steering shaft passes the center position, it must on no account bind, but the point where there is a slight resistance must be noticeable (Fig. 46-4/3).

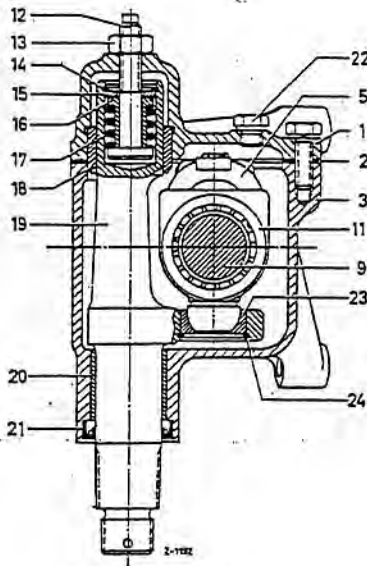


Fig. 46-4/3

- |                          |                          |
|--------------------------|--------------------------|
| 1 Steering housing cover | 16 Pressure sleeve       |
| 2 Gasket                 | 17 Compression spring    |
| 3 Steering housing       | 18 Upper bearing bushing |
| 5 Ball guide tube        | 19 Steering shaft        |
| 9 Steering worm          | 20 Lower bearing bushing |
| 11 Steering nut          | 21 Grease seal           |
| 12 Adjusting screw       | 22 Screw plug            |
| 13 Hexagon nut           | 23 Ball cup              |
| 14 Snap ring             | 24 Snap ring             |
| 15 Thrust washer         |                          |

3. In order to adjust the pressure block assembly of the steering shaft, put the steering in center position. In this position the center of the steering nut must be exactly below the threaded bore for the screw plug in the steering housing cover.

4. Put the steering gear arm on the steering shaft paying attention to the marks and the code number on the steering gear arm. Screw on the castle nut and tighten with a torque of approx. 20 mkg.
5. Use Torque Wrench 000 589 27 21 to measure the torque necessary to turn the steering shaft beyond the center position.

### Note:

- a) The torque should be 1.75-2.25 mkg and this value measured from lock to lock should not be exceeded.

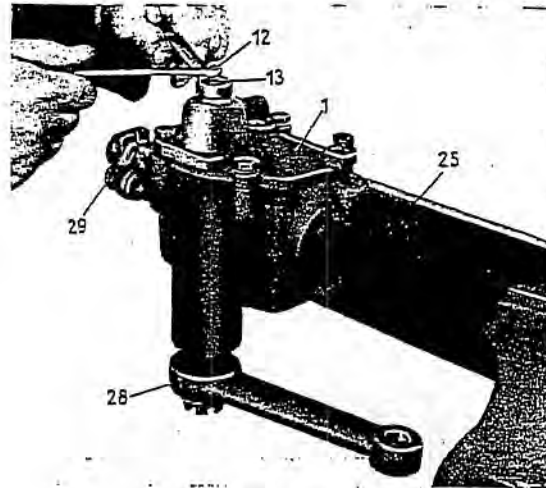


Fig. 46-4/4

- |                           |
|---------------------------|
| 1 Steering housing cover  |
| 12 Adjusting screw        |
| 13 Hexagon nut (lock nut) |
| 25 Assembly plate         |
| 23 Steering gear arm      |
| 29 Steering coupling      |

- b) If the steering does not work properly, check the pressure sleeve (16) and the compression spring (17) of the pressure block assembly for the steering shaft (Fig. 46-4/3, for dimensions see Job No. 46-0).
  - c) Before tightening the hexagon nut (13), coat the contact surface of the nut and the thread of the adjusting screw (12) with sealing compound (Fig. 46-4/3).
6. Check the oil level in the steering (see Job No. 46-0). Screw the screw plug into the steering housing cover.
  7. Cotter the hexagon castle nut.

# Removal and Installation of Steering Lock

Job No.

46-8

Modification: Models 190c, 190Dc and 300SE added

## Removal:

**Note:** The steering lock has been combined with the starter switch so that the same operations are necessary to remove and install the starter switch.

1. Disconnect the ground cable from the battery.
2. Remove the instrument cluster (see Job No. 54-11).
3. Switch the steering lock to Position 1 and take out the ignition key.

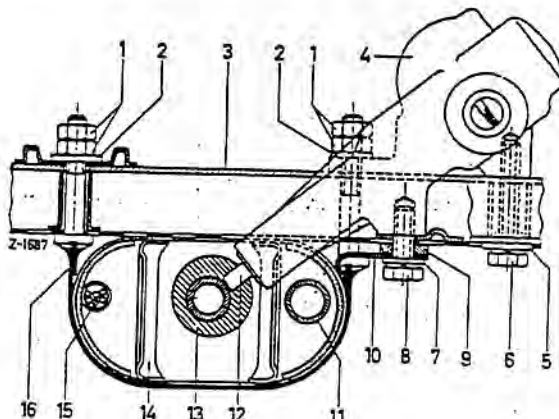


Fig. 46-8/2

Arrangement of steering column jacket and steering lock on Models 190 c, 190 Dc, 300 SE and 220 b, 220 Sb, 220 SEb Sedan, 2nd Version

- |                                  |  |
|----------------------------------|--|
| 1 Hexagon nuts                   | 10 Bracket on steering column jacket for attachment of steering lock |
| 2 Washers                        | 11 Shift tube  |
| 3 Cross member                   | 12 Lock bolt of the steering lock                                    |
| 4 Steering lock                  | 13 Lock ring on steering tube  |
| 5 Washer                         | 14 Steering column jacket  |
| 6 Hexagon screw with lock washer | 15 Wiring harness for flash signal switch and signal horns           |
| 7 Washer                         | 16 Tightening strap  |
| 8 Hexagon screw with lock washer |  |
| 9 Spacer washer                  |  |

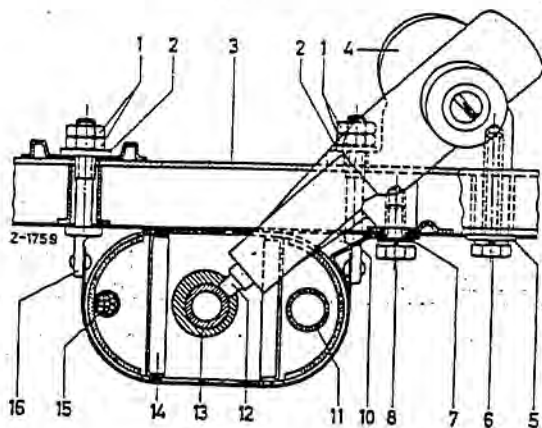


Fig. 46-8/1

Arrangement of steering column jacket and steering lock on Models 220 b, 220 Sb, 220 SEb Sedan, 1st Version

- |  |
|--|
| 1 Hexagon nuts for tightening strap                                  |
| 2 Washer   |
| 3 Cross member   |
| 4 Steering lock  |
| 5 Washer   |
| 6 Hexagon screw and lock washer                                      |
| 7 Washer   |
| 8 Hexagon screw and lock washer                                      |
| 10 Bracket on steering column jacket for attachment of steering lock |
| 11 Shift tube  |
| 12 Lock bolt of the steering lock                                    |
| 13 Lock ring on steering tube  |
| 14 Steering column jacket  |
| 15 Wiring harness for flash signal switch and signal horns           |
| 16 Tightening strap  |

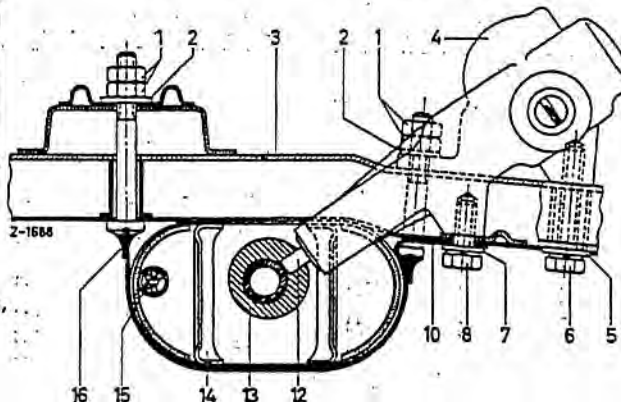
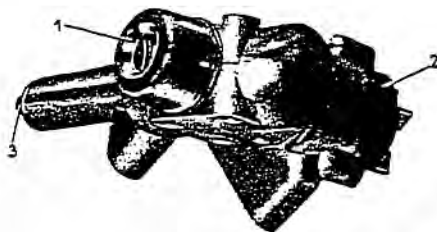


Fig. 46-8/3

Arrangement of steering column jacket and steering lock on Model 220 SEb/Coupé

- |                                  |  |
|----------------------------------|--|
| 1 Hexagon nuts                   | 10 Bracket on steering column jacket for attachment of steering lock |
| 2 Washers                        | 12 Lock bolt of the steering lock                                    |
| 3 Cross member                   | 13 Lock ring on steering tube  |
| 4 Steering lock                  | 14 Steering column jacket  |
| 5 Washer                         | 15 Wiring harness for flash signal switch and signal horns           |
| 6 Hexagon screw with lock washer | 16 Tightening strap  |
| 7 Washer with lock washer        |  |
| 8 Hexagon screw with lock washer |  |

46-8/1



R-970

Fig. 46-8/4

- 1 Cylinder of the steering lock
- 2 Contact plate for the starter switch
- 3 Lock bolt

4. Unscrew the hexagon nuts (1) from the right threaded bolt of the tightening strap (16). Then unscrew the hexagon screws (6) and (8) for fastening the steering lock to the cross member (3) (Fig. 46-8/2).
5. Pull out the steering lock from the cut-out in the steering column jacket upward and at an angle and take it out downward.
6. Disconnect the cables at the contact plate of the steering lock and remove the steering lock (Fig. 46-8/4).

**Installation:**

7. Connect the cables to the contact plate of the steering lock paying attention to the color code. Connect the red cable to terminal 30, the red-black cable to terminal 15/54, the violet cable to terminal 50.
8. Switch the steering lock to Position 1 and take out the ignition key. Put in the lock and insert the hexagon screws (6) and (8) together with lock washer and washer. Screw on the two right hexagon nuts (1) and washers (2) for the tightening strap (16) and lock after tightening. (Figs. 46-8/2 and 3).

Do not omit spacer washer (9) between bracket (10) and cross member (3) in the case of Models 190 c, 190 Dc and 300 SE and the 2nd version of Models 220 b, 220 Sb, 220 SEb Sedan (Fig. 46-8/2).

**Note:** The bracket (10) welded to the right side of the steering column jacket serves to accurately fix the position of the steering column jacket in relation to the steering lock.

The bracket was not installed on the first cars of these models.

9. Connect the ground cable to the battery.
10. Check whether the steering lock and the starter switch work properly in the various positions:

Nose of the key half right:

**Position 0:**

Ignition switched off, key can be removed, steering column locked.

Nose of the key half left:

**Position 1:**

Ignition switched off, steering column free, key can be removed.

Nose of the key full left:

**Position 2:**

Ignition switched on, steering column free, key cannot be removed.

On cars with gasoline engine, key pressed in from position 2 and turned right:

Starter is being operated.

When the engine has started, release the key which must then return to Position 2.

**Note:** When the instrument cluster has been removed, the oil pressure gage line must be plugged before starting the engine.

11. Install the instrument cluster (see Job No. 54-11).

## Steering Lock on Model 230 SL

### Removal:

1. Disconnect the ground cable from the battery.
2. Remove revolution counter, instrument cluster and speedometer (see Job No. 54-11, Section B).
3. Switch the steering lock to position 1 (garage) and pull of the key.
4. On cars with mechanical steering loosen the two hexagon socket screws (9) and (10) on the steering coupling (Fig. 46-8/5). Then remove the pipe clip (4) from the steering column jacket (7) (Fig. 46-8/6).

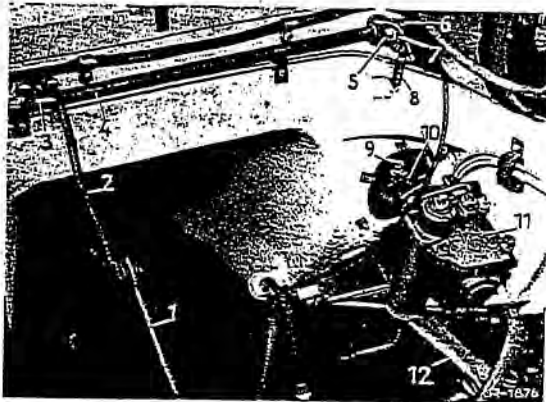


Fig. 46-8/5

- |                    |                         |
|--------------------|-------------------------|
| 1 Regulating rod   | 7 Lever                 |
| 2 Lever            | 8 Return spring         |
| 3 Bearing          | 9 Hexagon socket screw  |
| 4 Control shaft    | 10 Hexagon socket screw |
| 5 Hexagon screw    | 11 Steering             |
| 6 Adjustment lever | 12 Steering gear arm    |

5. On cars with DB power steering remove the pipe clip (4) and the hexagon screws (6) for the cover plate (3). Then push the cover plate upward until the two hexagon socket screws on the steering coupling can be loosened (Fig. 46-8/6).

6. Unscrew the clamping screw on the steering column jacket (6) for the steering lock (9) (Fig. 46-8/7).

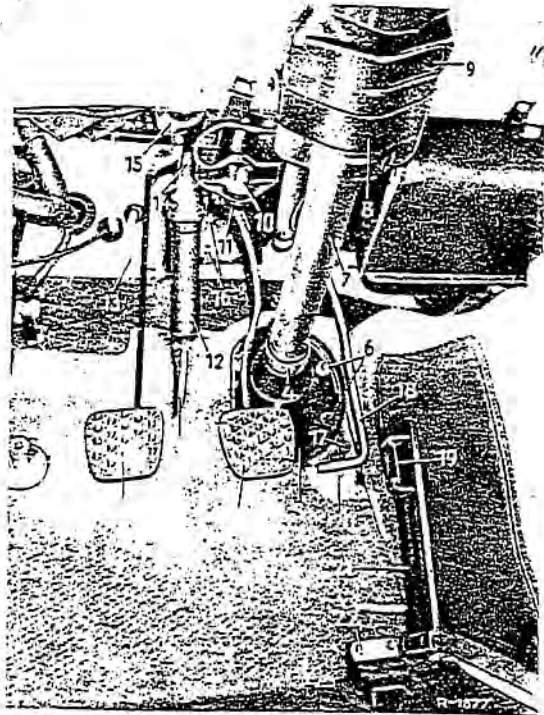


Fig. 46-8/6

- |  |  |
|--|--|
| 1 Clutch pedal   | 12 Supply cylinder                           |
| 2 Brake pedal  | 13 Line from reservoir                       |
| 3 Cover plate  | 14 Piston rod                                |
| 4 Pipe clip  | 15 Pressure spring (dead center spring)      |
| 5 Line to extraction cylinder  | 16 Hexagon screw with lock washer and washer |
| 6 Hexagon screw with lock washer and washer                            | 17 Stop screw                                |
| 7 Steering column jacket   | 18 Adjustment lever                          |
| 8 Tightening strap   | 19 Plastic plate                             |
| 9 Opening in steering column jacket for-slotted screw on clamping ring | 20 Hexagon nut                               |
| 10 Mechanical stop light switch  | 21 Foot plate                                |
| 11 Stop ring   | 22 Mounting plate                            |

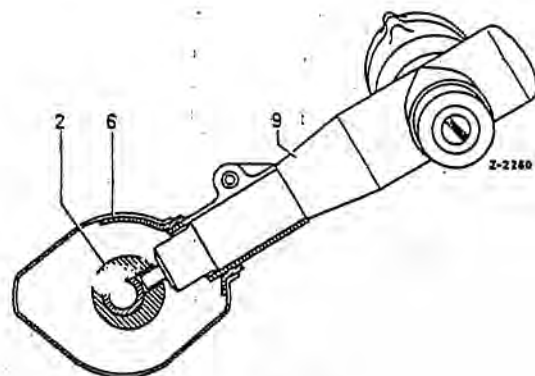


Fig. 46-8/7

- |                          |
|--------------------------|
| 2 Steering tube          |
| 6 Steering column jacket |
| 9 Steering lock          |

7. Unscrew the hexagon nuts (12) from the threaded bolts of the tightening strap (10) and push the steering column jacket (6) forward until the steering lock no longer engages the opening in the instrument panel (Fig. 46-8/8).

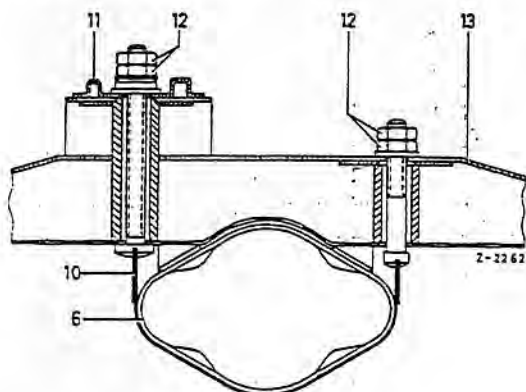


Fig. 46-8/8

- 6 Steering column jacket
- 10 Tightening strap
- 11 Support for the pedal system
- 12 Hexagon nut
- 13 Cross member

8. Turn the steering lock (8) 90° to the left and remove through the steering column jacket bracket, taking care to ensure that the escutcheon (7) is not damaged (Fig. 46-8/9).

**Note:** If it should be necessary the steering column jacket can be pushed slightly toward the left after removing the left cover.

9. Disconnect the cable from the contact plate and remove the steering lock.

#### Installation:

10. Connect the cables to the contact plate of

the steering lock, paying attention to the color code as follows:

- Connect
- red cable to terminal 30
- red/black cable to terminal 15/54
- violet cable to terminal 50

11. Switch the steering lock to position 1 (garage) and pull off the key.

12. Install the steering lock in the steering column jacket bracket and turn 90° to the right so that the steering lock accurately engages the recess in the instrument panel.

13. Pull the steering column jacket upward and on cars with mechanical steering attach the pipe clip and tighten the hexagon socket screws on the steering coupling. On cars with DB power steering first tighten the two hexagon socket screws on the steering coupling, then push the cover plate forward and attach it to the cowl by means of the hexagon screws. Then tighten the hexagon screw on the pipe clip.

14. Attach the tightening strap to the cross member.

15. Screw the clamping screw for the steering lock into the steering column jacket bracket.

16. Attach the ground cable to the battery.

17. Check to see whether the steering lock and the starter switch are working properly (see Section A, No. 10).

18. Install the speedometer, instrument cluster and revolution counter (see Job No. 54-11).

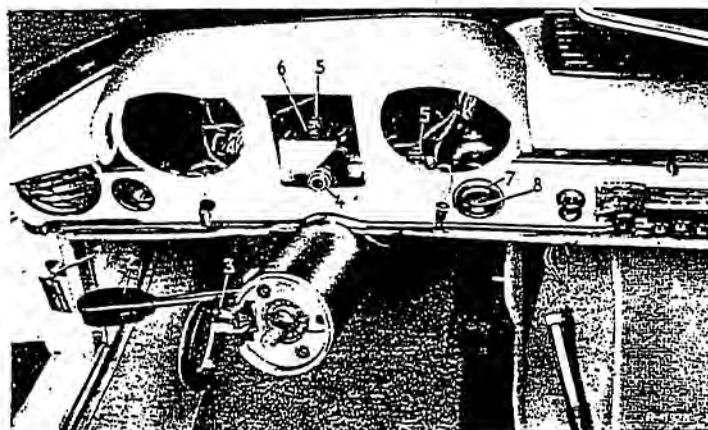


Fig. 46-8/9

- 1 Door contact switch
- 2 Combination switch
- 3 Contact ring
- 4 Flexible drive shaft
- 5 Hexagon nut
- 6 Washer
- 7 Escutcheon
- 8 Steering lock



# Removal and Installation of Steering Linkage

Job No.

46-9

Modification: Fitting sleeve (Fig. 46-9/3a) and ball pin (Fig. 46-9/4c) added

## A. Cars with 1st Version Front Axle

### Removal:

Note: The operations with regard to the steering linkage described below refer to the two tie-rods and the center tie-rod.

1. Loosen and remove the hexagon screw fastening the steering shock-absorber (7) to the bracket (6) at the center tie-rod (5) (Fig. 46-9/1).

2. After removing the cotter pins, unscrew the castle nuts at the outside joints (4) of the tie-rods and at the joints (3) and (8) of the center tie-rod (Fig. 46-9/1).

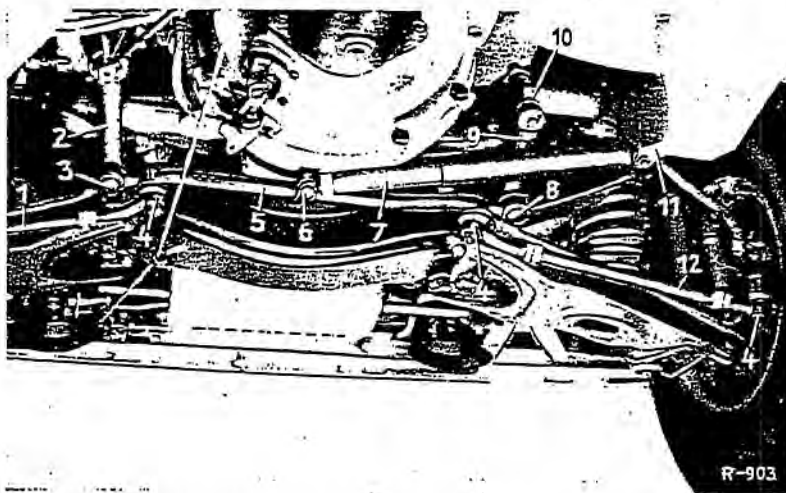


Fig. 46-9/1

- 1 Left tie-rod
- 2 Steering gear arm
- 3 Ball joint 25 mm  $\Phi$  for center tie-rod
- 4 Ball joints 22 mm  $\Phi$  for tie-rods
- 5 Center tie-rod
- 6 Bracket for steering shock-absorber on the center tie-rod
- 7 Steering shock-absorber
- 8 Pivotal joint for center tie-rod
- 9 Steering relay arm
- 10 Trunnion bearing for steering relay arm
- 11 Bracket for steering shock-absorber on chassis base panel
- 12 Right tie-rod

3. Press out the tie-rods at the left and at the right from the steering knuckle arm and press out the center tie-rod from the steering gear arm and the steering relay arm, using Fixture 136 589 12 33 (Fig. 46-9/2 and 46-9/3). Remove the steering linkage.

Note: For all these joints which require no maintenance only a fixture with a base of 4.5 mm can be used. The modern version of Fixture 136 589 12 33 has a base of 4.5 mm. Older versions of this fixture with a 7 mm base can be subsequently turned down or ground down provided that a minimum thickness of 4 mm is left.

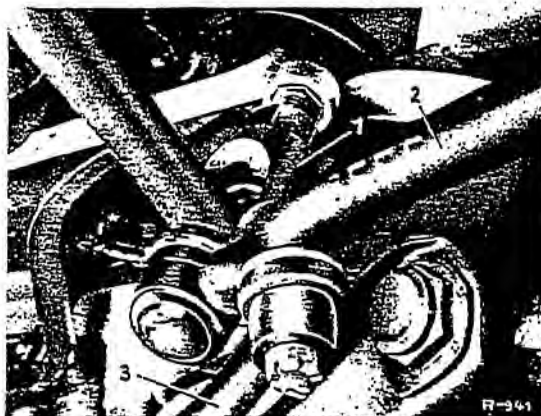


Fig. 46-9/2

- 1 Fixture 136 589 12 33
- 2 Center tie-rod
- 3 Tie-rod

### Installation:

4. Check the joints of the tie-rods and of the center tie-rod. The two tie-rods have ball joints with a diameter of 22 mm, whereas the center tie-rod has a ball joint of 25 mm diameter at the left on the steering gear arm and a flexible pivot joint at the right on the steering relay arm (Fig. 46-9/4 a, b, c). The internal ball joint for the tie-rod is fitted in the center tie-rod (Fig. 46-9/1). If one of the joints is defective, the tie-rod end or the center tie-rod must be replaced. Fixture 136 589 12 33 should also be used to press the tie-rods off the ball pins in the center tie-rod.

46-9/1

5. Check the rubber cuffs (2) for the joints. Damaged cuffs should always be replaced. To do this, remove the clamping ring (3) and pull off the cuff. Before installing a new rubber cuff, fill the space between the cuff and the joint with the specified grease (see Job No. 46-0).

On recent cars the rubber cuff (2) is attached to the tie-rod and center tie-rod by means of a flat wire clamping ring (3) and to the ball pin (1) by means of a plastic ring (10) (Fig. 46-9/4c). The two clamping rings should be installed with the aid of two fitting sleeves made according to the dimensions given in Fig. 46-9/3a. Without these fitting sleeves, assembly is extremely difficult, particularly assembly of the flat wire clamping ring (Fig. 46-9/3b).

**Note:** The two tie-rods and the center tie-rod are equipped with joints which require no maintenance, i. e. the grease reserve is sufficient for their service life and for that reason

they have no grease fittings. In the case of joints of this type, sealing against the entrance of dirt and sand is extremely important for the service life of the joints. This is the reason why damaged rubber cuffs should be replaced immediately since any dirt penetrating into the joint will make the joint unserviceable. For this reason it is very important that the joints should carefully be checked at regular intervals.

6. Check the hexagon nuts (9) and the locking plates (10) of the tie-rods and replace if necessary (Fig. 46-9/4c).

**Note:** The left-hand threads of the left and right tie-rod tubes are inside at the center tie-rod side.

7. Make sure that all traces of grease are removed from the ball pins and the conical seats in the steering knuckle arms, the steering gear arm and the steering relay arm. Install the steering linkage, and tighten and cotter the castle nuts.

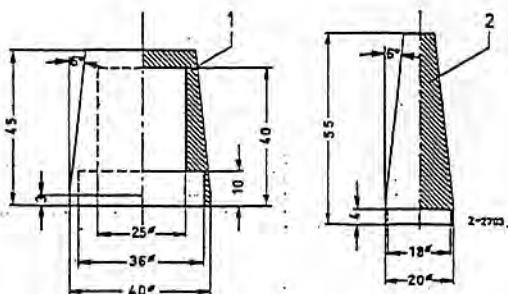


Fig. 46-9/3a  
Fitting sleeve

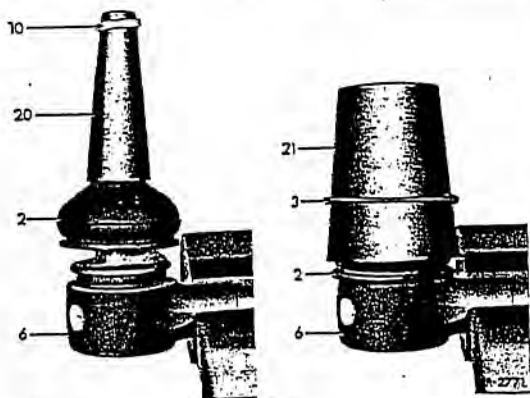


Fig. 46-9/3b

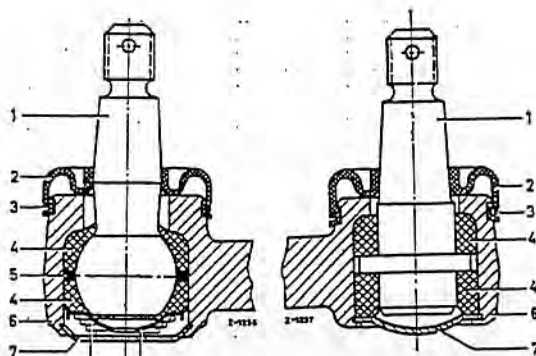


Fig. 46-9/4a

Fig. 46-9/4b

Ball joint on steering gear arm

Pivot joint on steering relay arm

#### Center tie-rod

- |                             |                             |
|-----------------------------|-----------------------------|
| 1 Ball pin                  | 1 Pivot                     |
| 2 Rubber cuff               | 2 Rubber cuff               |
| 3 Clamping ring             | 3 Clamping ring             |
| 4 Vulkollan bearing bushing | 4 Vulkollan bearing bushing |
| 5 Spacer ring               | 6 Center tie-rod            |
| 6 Center tie-rod            | 7 Cover                     |
| 7 Cover                     |                             |
| 8 Pressure spring           |                             |
| 9 Retainer                  |                             |

8. Install the steering shock-absorber on the center tie-rod (see Job No. 46-10).

9. Adjust the toe-in (for dimensions see Job No. 40-0).

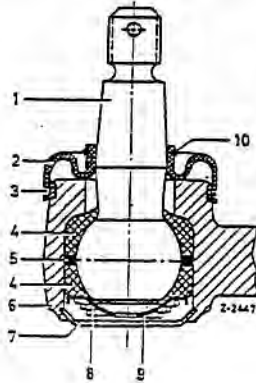


Fig. 46-9/4c

- 1 Ball pin
- 2 Rubber cuff
- 3 Flat wire damping ring
- 4 Plastic bearing bushing
- 5 Spacer ring
- 6 Center tie-rod
- 7 Cover
- 8 Pressure spring
- 9 Retainer
- 10 Plastic clamping ring

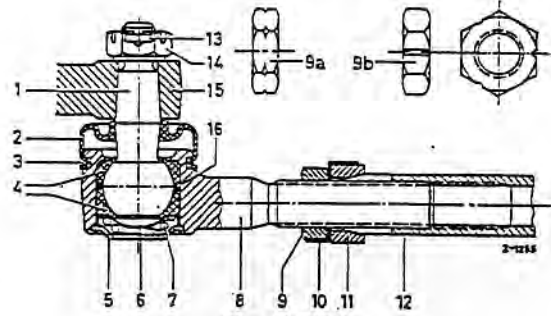


Fig. 46-9/4d

Tie-rod

- 1 Ball pin
- 2 Rubber cuff
- 3 Clamping ring
- 4 Vulkollan bearing bushing
- 5 Cover
- 6 Retainer
- 7 Compression spring
- 8 Tie-rod
- 9 Hexagon nut
- 10 Locking plate
- 11 Clamping ring
- 12 Tie-rod tube
- 13 Cotter pin
- 14 Castle nut
- 15 Steering knuckle arm
- 16 Spacer ring

## B. Cars with 2nd Version Front Axle

### a) Removal and Installation of Tie-Rod

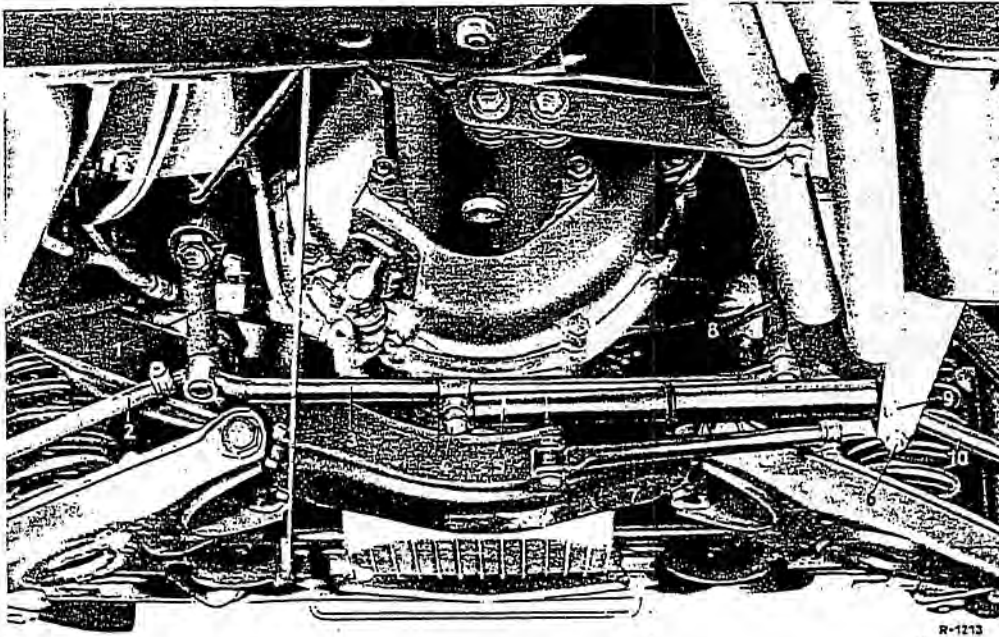


Fig. 46-9/5

- 1 Steering gear arm
- 2 Left tie-rod
- 3 Center tie-rod
- 4 Hexagon screw with lock washer
- 5 Steering shock-absorber
- 6 Hexagon screw with nut and lock washer
- 7 Strut for front axle lateral support
- 8 Steering relay arm
- 9 Hexagon screw with nut and lock washer
- 10 Right tie-rod

#### Removal:

1. After removing the cotter pins, unscrew the castle nuts from the joints (Fig. 46-9/5).
2. Press out the tie-rod from the steering knuckle arm, using Fixture 136 589 12 33 (Fig. 46-9/6).

3. Press out the tie-rod from the steering gear arm, using Fixture 186 589 10 33 (Fig. 46-9/7).

**Note:** a) If the center tie-rod has already been removed, Fixtures 136 589 12 33 or 111 589 08 33 can be used to press the tie-rod joints off the steering gear arm. When the center tie-rod

has not been removed, the puller rests against the center tie-rod joint.

b) To press the tie-rod joint off the steering relay arm (4) the strut (1) for the front axle lateral support must be removed (Fig. 46-9/8).

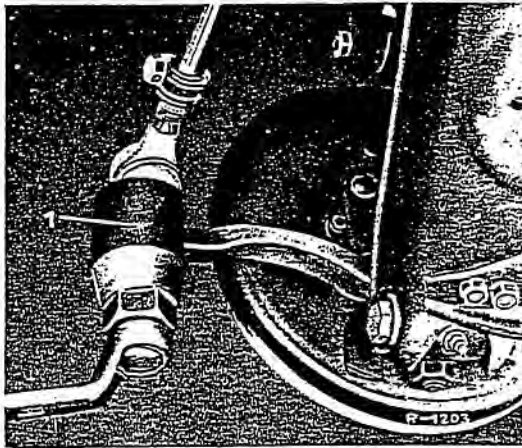


Fig. 46-9/6

1 Fixture 136 589 12 33

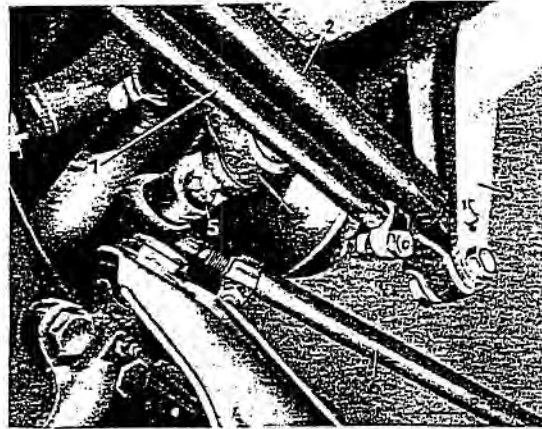


Fig. 46-9/8

- |  |                              |
|--|------------------------------|
| 1 Strut for front axle lateral support | 4 Steering relay arm         |
| 2 Steering shock-absorber              | 5 Castle nut with cotter pin |
| 3 Bracket on chassis base panel        | 6 Right tie-rod              |

nance, i. e. the grease reserve is sufficient for their service life and for that reason they have no grease fittings. In the case of joints of this type, sealing against the penetration of dirt and sand is extremely important for the service life of the joints. This is the reason why damaged rubber cuffs should be replaced immediately since any dirt penetrating into the joint will make the joint unserviceable. For this reason it is very important that the joints should be checked carefully at regular intervals.

6. Make sure that all traces of grease are removed from the ball pins and the conical seats in the steering knuckle arms, the steering gear arm and the steering relay arm. Install the tie-rod, tighten and cotter the castle nuts.

**Note:** The tie-rods must be fitted so that the tie-rod end with left-hand thread is positioned on the left side seen in the direction of travel.



Fig. 46-9/7

1 Fixture 136 589 10 33

#### Installation:

4. Check the joints of the tie-rods. The tie-rods have ball joints with a diameter of 22 mm. If one of the joints is defective, the tie-rod end must be replaced.

5. Check the rubber cuffs (10) for the joints. Damaged cuffs should always be replaced (see Section A, Item 5).

To do this, remove the clamping wire (9) and pull off the cuff (Fig. 46-9/9). Before installing a new rubber cuff, fill the space between the cuff and the joint with the prescribed type of grease (see Job No. 46-0).

**Note:** The two tie-rods and the center tie-rod are equipped with joints which require no mainte-

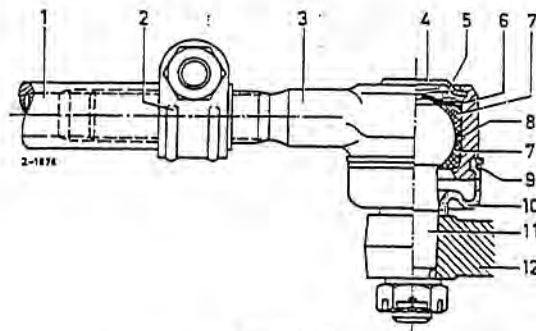


Fig. 46-9/9

- |                   |                             |
|-------------------|-----------------------------|
| 1 Tie-rod tube    | 7 Vulkollon bearing bushing |
| 2 Clamp           | 8 Spacer ring               |
| 3 Tie-rod end     | 9 Clamping wire             |
| 4 Cover           | 10 Rubber cuff              |
| 5 Pressure spring | 11 Ball pin                 |
| 6 Retainer        | 12 Steering knuckle arm     |

## b) Removal and Installation of Center Tie-Rod

### Removal:

1. After removing the cotter pins, unscrew the castle nuts from the joints.
2. Unscrew the hexagon screw fastening the steering shock-absorber and press the steering shock-absorber out of the bracket.
3. Press out the center tie-rod by means of Fixture 111 589 08 33 (Fig. 46-9/10).

### Installation:

4. Check the joints in the center tie-rod.
5. Make sure that all traces of grease are removed from the ball pins and the conical seats in the steering gear arm and the steering relay arm. Install the center tie-rod, tighten and cotter the castle nuts.
6. Attach the steering shock-absorber to the center tie-rod.

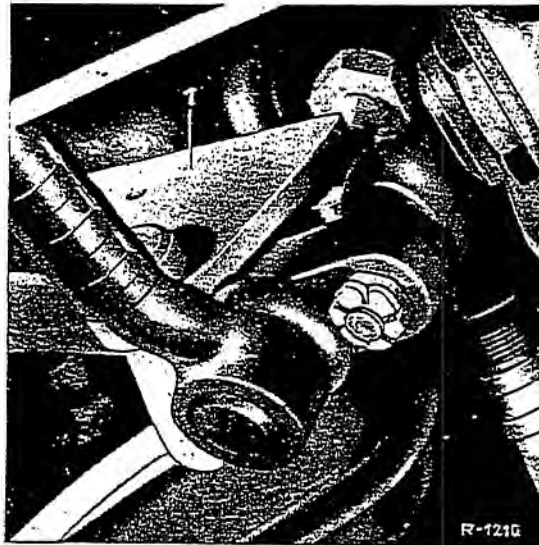


Fig. 46-9/10

1 Fixture 111 589 08 33

Job No.

46-10

## Removal and Installation of Steering Shock-Absorber

*Modification: Dust-protected version with pictures added*

### Removal:

1. Loosen and remove the hexagon screw holding the steering shock-absorber to the bracket (5) on the chassis base panel and also the hexagon screw the steering shock-absorber to fastening the center tie-rod (3) (Fig. 46-10/1).

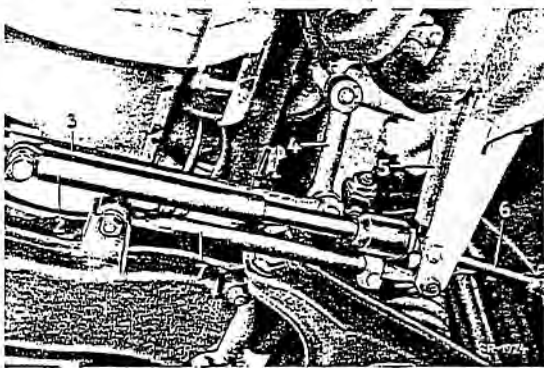


Fig. 46-10/1

- 1 Front axle support
- 2 Steering shock-absorber
- 3 Center tie-rod
- 4 Steering relay arm
- 5 Bracket on the chassis base panel
- 6 Right tie-rod
- 7 Strut for lateral support of front axle

2. Remove the steering shock-absorber.

### Installation:

3. Check the steering shock-absorber (see Job No. 46-0) and the two rubber mountings.

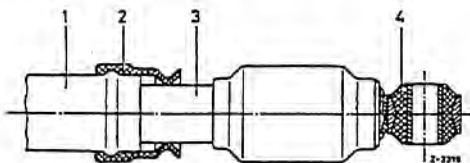


Fig. 46-10/2

Dust-protected version

- 1 Protective sleeve
- 2 Rubber sleeve
- 3 Shock-absorber tube
- 4 Rubber mounting

**Note:** In vehicles which are in use in areas where excessive dust conditions prevail, the shock-absorbers installed at our works are already provided with a rubber sleeve (2) for protection against dust and sand

between the shock-absorber tube and the protective sleeve (Fig. 46-10/2). Replacement shock-absorbers will always be of the dust-protected type. In standard cars, this rubber sleeve is not installed (see Fig. 46-10/1).

4. Install the steering shock-absorber, making sure that the side with the inscription 'Rahmenseite' (chassis side) points toward the bracket on the chassis base panel (Fig. 46-10/3).

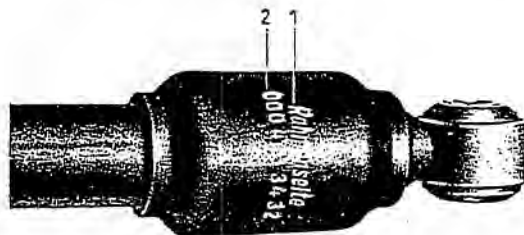


Fig. 46-10/3

- 1 Assembly marking
- 2 Part number

R-1925

5. Insert the hexagon screws and tighten the nuts together with the lock washers.

6. In special cases, e.g. after an accident, check the safety clearance of the steering shock-absorber, which should be at least 5 mm. In order to check the shock-absorber, disconnect the shock-absorber on one side while the wheels are in a right and left lock and compress and extend it as far as it will go.

**Note:** If the safety clearance is found to be inadequate, check whether the steering gear arm or the steering relay arm is bent, the mounting for the steering shock-absorber is in order, the piston rod of the steering shock-absorber is bent, the toe-in is correctly adjusted and distributed evenly a both front wheels.

# Removal and Installation of Steering Relay Arm

Job No.
46-11

Modification: 2nd and 3rd version added

## Removal:

1. On cars with the first version front axle detach the center tie rod and on cars with the second version front axle detach the center and right tie rod from the steering relay arm.
2. Tap up the locking plate (2) for the cover plate (1) on the top of the trunnion bearing (3) of the steering relay arm (4). Then loosen the cover plate and remove together with the pressure spring and the thrust washer. Pull the arm out of the trunnion bearing downward (Fig. 46-11/1).

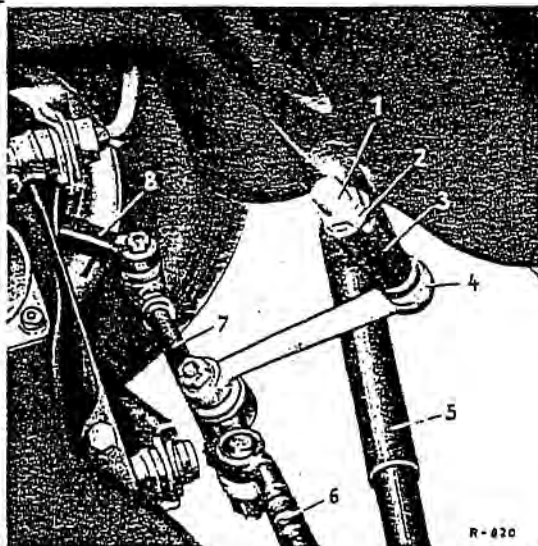


Fig. 46-11/1

- |  |                           |
|--|---------------------------|
| 1 Cover plate                            | 5 Steering shock-absorber |
| 2 Locking plate                          | 6 Center tie-rod          |
| 3 Trunnion bearing on chassis base panel | 7 Right tie-rod           |
| 4 Steering relay arm                     | 8 Steering knuckle arm    |

**Note:** Before unscrewing the cover plate it is advisable to measure and mark the distance 'a' between the steering relay arm and the trunnion bearing in the straight-ahead position (see Fig. 46-11/2 and No. 7).

## Checking and Repairing:

3. Check the steering relay arm (for dimensions and illustrations see Job No. 46-0).

4. Check the pin of the steering relay arm (8) and the bushing (6) in the trunnion bearing (5) for wear (for dimensions see Job No. 46-0). If the pin is worn, replace the arm. If necessary, tap out the bushing including the grease seal (7) from the trunnion bearing (Fig. 46-11/2).

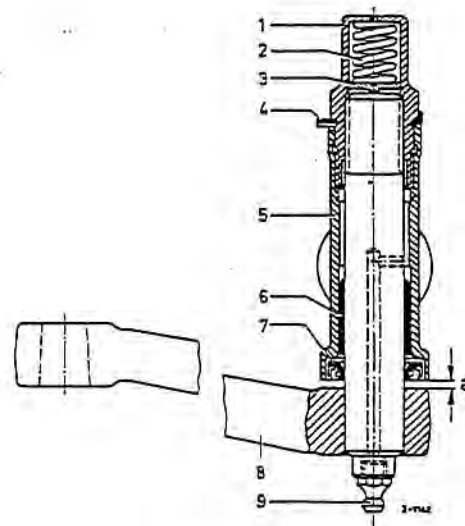


Fig. 46-11/2

1st version

- |                    |                               |
|--------------------|-------------------------------|
| 1 Cover plate      | 6 Bushing                     |
| 2 Pressure spring  | 7 Grease seal                 |
| 3 Thrust washer    | 8 Steering relay arm with pin |
| 4 Locking plate    | 9 Grease fitting              |
| 5 Trunnion bearing |                               |

**Note:** As a replacement part, the steering relay arm is only supplied together with the pin, since under ordinary workshop conditions the pin cannot be pressed into the relay arm.

5. Carefully press the new bushing into the trunnion bearing with the chamfered side upward (Fig. 46-11/2). Then ream out the bushing to the specified final dimension (for dimensions see Job No. 46-0).

## Installation:

6. Press a new grease seal (7) into the trunnion bearing (5) with the sealing lip to the outside (Fig. 46-11/2).

46-11/1

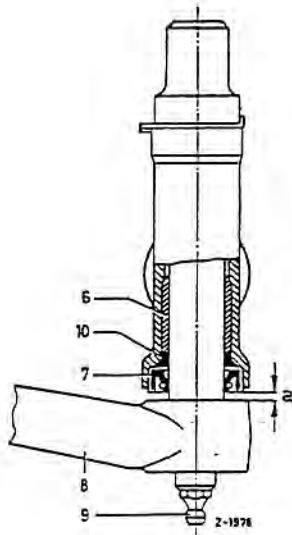


Fig. 46-11/3

2nd version

- 6 Bushing
- 7 Grease seal
- 8 Steering relay arm
- 9 Grease fitting
- 10 Vulkollan ring

**Note:**

a) It is important for the sealing lip of the grease seal to point to the outside so that the pressure developed during lubrication and also any superfluous grease can escape between the sealing lip and the steering relay arm.

If the grease seal is incorrectly installed, it might be pressed out by the pressure created.

- b) On the 2nd version a Vulkollan ring (10) is located between the grease seal (7) and the bushing (6). The Vulkollan ring is intended to prevent rattling noises and can be installed subsequently together with a modified grease seal.
  - c) The 3rd version contains a combined grease seal (8) with a Vulkollan bushing (Fig. 46-11/4).
7. Coat the pin of the steering relay arm (8) and the bushing (6) with antifriction bearing grease. Then insert the steering relay arm. Put on the thrust washer (3) and the pressure spring (2) and screw on the cover plate (1) in such a way that in the straight-ahead position with the cover screwed right in the height of the steering relay arm corresponds to the height of the steering gear arm (pivot point distance) (see also Job No. 40-3).

**Note:**

a) The height of the steering relay arm can be adjusted because the internal thread of the cover plate has a pitch of 2 mm, whereas the external thread has a pitch of 1 mm.

Under normal circumstances the height of the steering gear arm and of the steering relay arm will coincide if in the straight-ahead position the standart distance 'a' (see Job No. 46-0) between steering relay arm and trunnion bearing is maintained.

The prescribed minimum distance between steering relay arm and trunnion bearing in the straight-ahead position should never

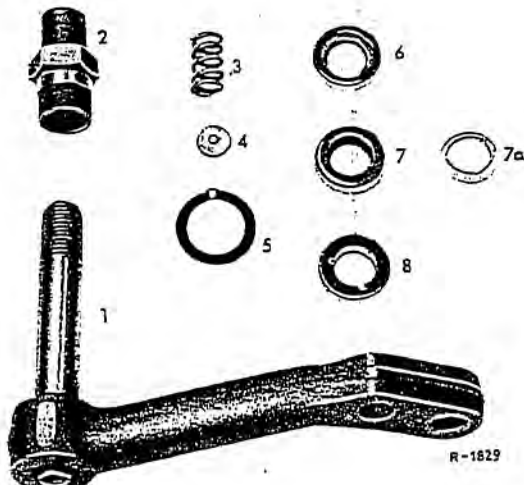


Fig. 46-11/4

- 1 Steering relay arm
- 2 Cover plate
- 3 Pressure spring
- 4 Thrust washer
- 5 Locking plate
- 6 Grease seal
- 7 Grease seal
- 7a Vulkollan ring
- 8 Combined grease seal with Vulkollan bushing



be less than the prescribed distance, since otherwise the relay arm may foul the trunion bearing.

- b) When installing a new steering relay arm make sure that the proper arm suitable for the particular car is installed. In order to avoid confusion between the various types of steering relay arms they are now being provided with code numbers (see Job No. 46-0).

8. When the adjustment of the steering relay arm is correct, tighten the cover plate (1) and lock (Fig. 46-11/2).
9. Attach the center tie-rod or when required center tie-rod and tie-rod to the steering relay arm (see Job No. 46-9).
10. Press grease into the grease fitting (9) on the pin of the steering relay arm (Fig. 46-11/2).
11. Check the toe-in (see Job No. 40-3).

## Removal and Installation of Steering Gear Arm

Job No.
46-12

*Modification: Cars with 2nd Version Front Axle (Addition)*

### A. Cars with 1st Version Front Axle

#### Removal:

1. Detach the center tie-rod (18) from the steering gear arm (13) (Fig. 46-12/1 and Job No. 46-9).

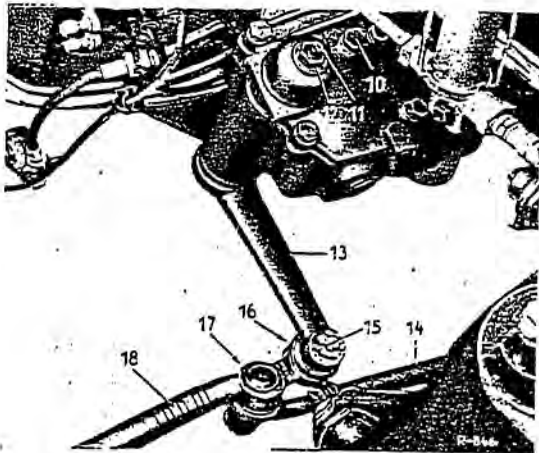


Fig. 46-12/1

- |                      |                                     |
|----------------------|-------------------------------------|
| 10 Screw plug        | 15 Castle nut with cotter pin       |
| 11 Adjusting screw   | 16 Ball joint of the center tie-rod |
| 12 Hexagon nut       | 17 Ball joint of the tie-rod        |
| 13 Steering gear arm | 18 Center tie-rod                   |
| 14 Tie-rod           |                                     |

2. After removing the cotter pin, unscrew the castle nut fastening the steering gear arm (13) to the steering shaft. Then pull off the steering gear arm by means of Fixture 186 589 04 33 (Fig. 46-12/1).

#### Installation:

3. Check the steering gear arm (for dimensions see Job No. 46-0 and Fig. 46-0/1).
4. Clean the serrations on the steering gear arm and on the steering shaft. Screw in the center position check screws, place the steering gear arm on the steering shaft, making sure that the markings on the gear arm correspond to the markings on the shaft. Check the correct positioning of the steering gear arm (see Job No. 40-3, Section D).
5. Screw out the center position check screw, screw on the castle nut and tighten well. After a firm blow on the steering gear arm finally tighten the nut and cotter.
6. Install the center tie-rod (see Job No. 46-9).
7. Check the toe-in (for dimensions see Job No. 40-0).

## B. Cars With 2nd Version Front Axle

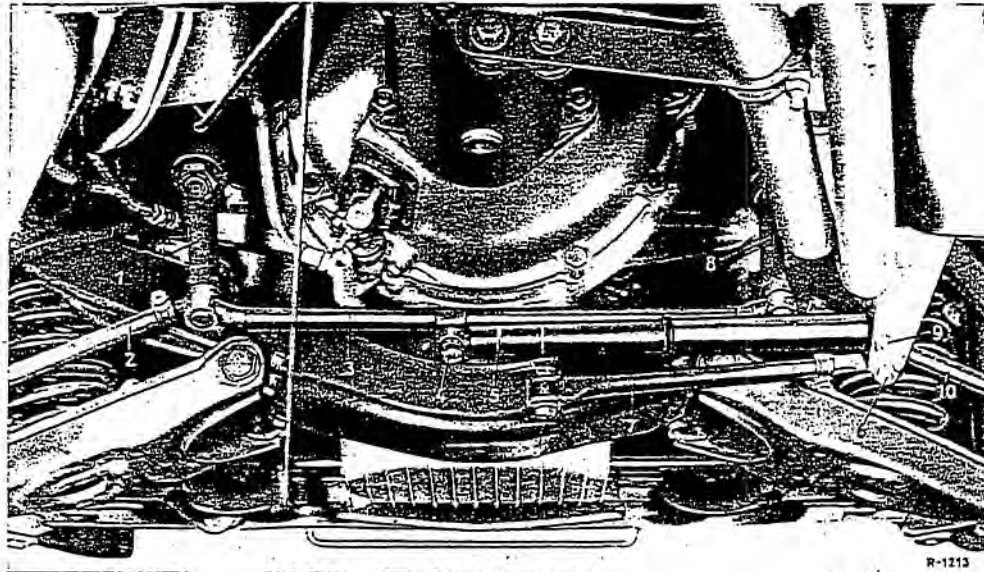


Fig. 46-12/2

- |                                  |  |
|----------------------------------|--|
| 1 Steering gear arm              | 6 Hexagon screw with nut and lock washer |
| 2 Left tie-rod                   | 7 Strut for front axle lateral support   |
| 3 Center tie-rod                 | 8 Steering relay arm                     |
| 4 Hexagon screw with lock washer | 9 Hexagon screw with nut and lock washer |
| 5 Steering shock-absorber        | 10 Right tie-rod                         |

### Removal:

1. Disconnect the tie-rod (2) and the center tie-rod (3) from the steering gear arm (1) (Fig. 46-12/2).
2. After removing the cotter pin, unscrew the castle nut fastening the steering gear arm (1) to the steering shaft. Then pull off the steering gear arm by means of Fixture 186 589 04 33 (Fig. 46-12/2).

### Installation:

3. Check the steering gear arm (for dimensions see Job No. 46-0).

4. Clean the serrations on the steering gear arm and on the steering shaft. Screw in the center position check screw, place the gear arm on the steering shaft, making sure that the markings on the gear arm correspond to the markings on the shaft. Check the correct position of the steering gear arm (see Job No. 40-3, Section D).
5. Unscrew the center position check screw, screw on the castle nut and tighten well. After a firm blow on the steering gear arm finally tighten the nut and cotter.
6. Install the tie-rod and center tie-rod (see Job Nos. 46-9).
7. Check the toe-in.

# Removal and Installation of Steering Coupling

Job No.  
46-13

Modification: Installation Instruction para 7

## Removal:

1. Unscrew the hexagon socket screw (lower clamping screw) (8) from the lower flange (4) of the steering coupling (Fig. 46-13/1).

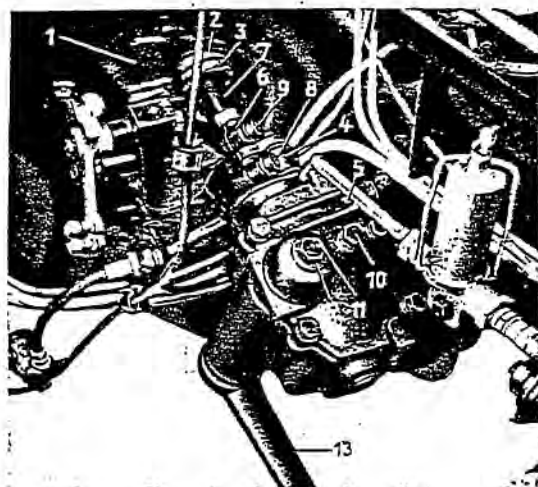


Fig. 46-13/1

- 1 Cover plate
- 2 Steering column jacket
- 3 Rubber cuff
- 4 Lower flange of steering coupling
- 5 Hexagon screws for attaching the steering to the chassis base panel
- 6 Upper flange of steering coupling
- 7 Steering tube
- 8 Hexagon socket screw (lower clamping screw)
- 9 Hexagon socket screw (upper clamping screw)
- 10 Screw plug in steering housing cover
- 11 Adjusting screw for pressure block assembly of steering shaft
- 12 Hexagon nut (lock nut for adjusting screw)
- 13 Steering gear arm

2. Unscrew from the outside the three hexagon screws (5) fastening the steering assembly to the chassis base panel. Press the steering worm off the steering coupling and slightly lower the steering assembly (Fig. 46-13/1).
3. Unscrew the hexagon socket screw (upper clamping screw) (9) from the upper flange (6) of the steering coupling and press the steering coupling off the steering tube (46-13/1).
4. Remove the cotter pins from the two bolts (2) and take off the washers (3) (Fig.

46-13/2). Then pull off the lower flange (4) from the upper flange (6) and remove the two bushings (5).

## Installation:

5. Check the bushing (5) and the washers (3) and, if necessary, replace them. Also check the bolts in the upper flange and the two bores for the bushings in the lower flange (For dimensions see Table in Job No. 46-0).

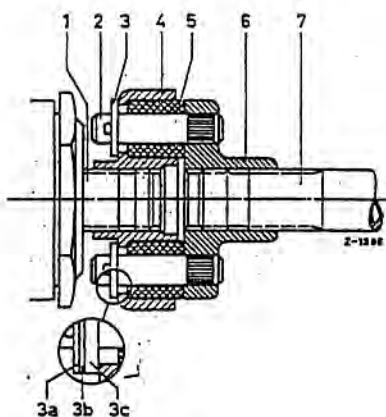
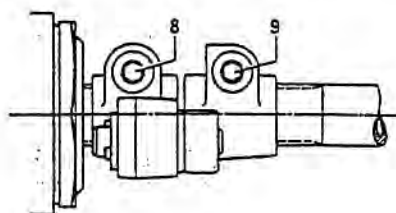


Fig. 46-13/2

- |                   |   |
|-------------------|---|
| 1 Steering worm   | 5 Bushing                                     |
| 2 Bolt            | 6 Upper flange                                |
| 3 Washers         | 7 Steering tube                               |
| 3a Steel washer   | 8 Hexagon socket screw (lower clamping screw) |
| 3b Spring washer  | 9 Hexagon socket screw (upper clamping screw) |
| 3c Plastic washer |   |
| 4 Lower flange    |   |

6. Press the bushings into the lower flange (4) and press the flange onto the bolts (2) in the upper flange. Then slightly compress the two flanges in a vise, push on the washers (3), the inside plastic washers, the spring washers in the middle and the outside steel washers, and cotter (Fig. 46-13/2).

46-13/1

**Note:**

- a) On the first cars of this series the plastic bushings were installed with less force-fit, so that in certain cases the steering coupling may produce a cracking noise because of the play still present (see Job No. 46-0). On such steering couplings an attempt should be made to obtain a sufficient force-fit of the bushings by using plastic bushings with an outside diameter close to the upper tolerance limit. If necessary, the lower flange should be replaced.
- b) On the first cars of this series the steel washers (3a) were not installed. When repairs are carried out, these washers, Part No. 136 990 95 40, should be subsequently

installed (steel washers with an inside diameter of 10 mm, an outside diameter of 17 mm, and a thickness of 1 mm).

- 7. Press the steering coupling onto the serrations of the steering tube, screw in the hexagon socket screw (upper clamping screw) (9) together with the lock washer and tighten with the specified tightening torque (see Fig. 46-13/2 and Job No. 46-0).

**Caution:** The clamping screws (8) and (9) must be carefully tightened in order to prevent the steering tube from sliding out of the steering coupling.

- 8. Install the steering assembly according to Job No. 46-1 from para 8 onward.

# Servicing of Power Steering

Job No.

46-21

## Periodical Maintenance Work

Modification: Para 1

1. After an initial mileage of 500 and 3000 km (Vouchers C, D, E) and subsequently whenever the car is being serviced check the tension of the V-belt driving the high-pressure oil pump. Thumb pressure deflection of the V-belt should be 10-15 mm.

Models 220 b, 220 Sb, and 220 SEb

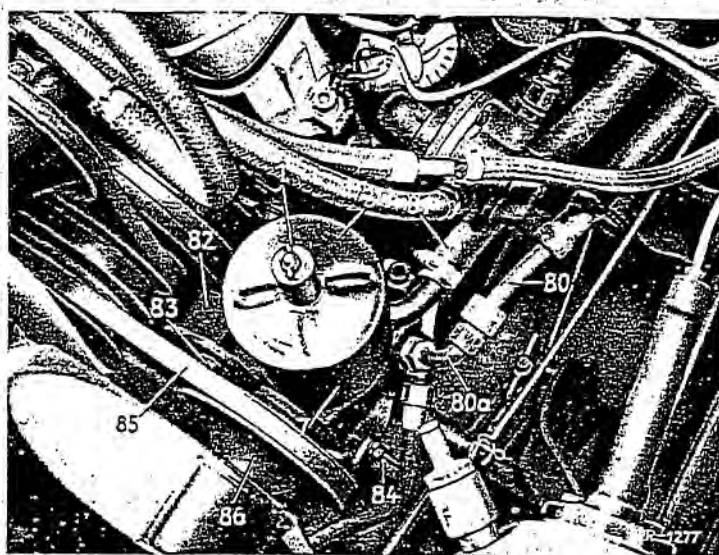


Fig. 46-21/1

Arrangement of high-pressure oil pump on Models 220 b, 220 Sb

- 1 Wing nut
- 3 Cover
- 7 Reservoir
- 80 High-pressure oil hose
- 80a Elbow on high-pressure oil pump
- 81 Oil return hose
- 82 Support for high-pressure oil pump
- 83 Hexagon screw with nut, washer, locking plate, and lock washer
- 84 Clamping screw
- 85 Narrow V-belt
- 86 Pulley

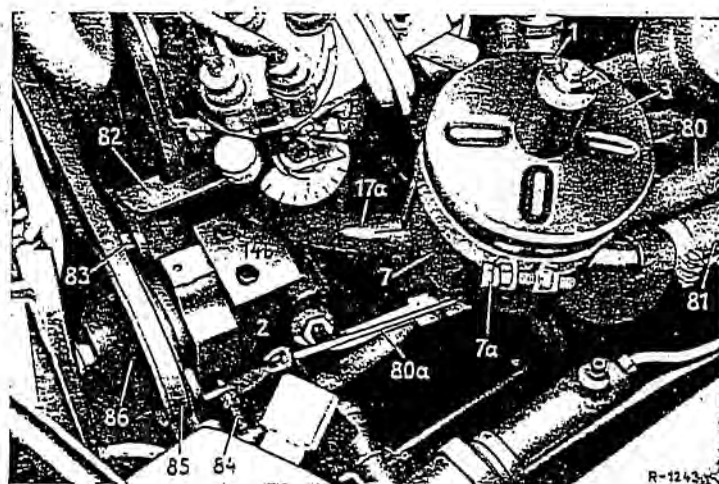


Fig. 46-21/2

Arrangement of high-pressure oil pump on Model 220 SEb

- 1 Wing nut
- 2 High-pressure oil pump
- 3 Cover
- 7 Reservoir
- 7a Hexagon screw on clamp
- 14b Flange plate
- 17a Connecting hose
- 80 High-pressure oil hose
- 80a Elbow on high-pressure oil pump
- 81 Oil return hose
- 82 Support for high-pressure oil pump
- 83 Hexagon screw with nut, washer, locking plate, and lock washer
- 84 Clamping screw
- 85 Narrow V-belt
- 86 Pulley

In order to re-adjust the V-belt (85) loosen the three hexagon screws attaching the high-pressure oil pump to the support, then tighten the hexagon nuts on the clamping screw (84) until the prescribed tension of the V-belt is obtained. Then re-tighten the hexagon screws (Figs. 46-21/1 and 46-21/2).

Model 300 SE

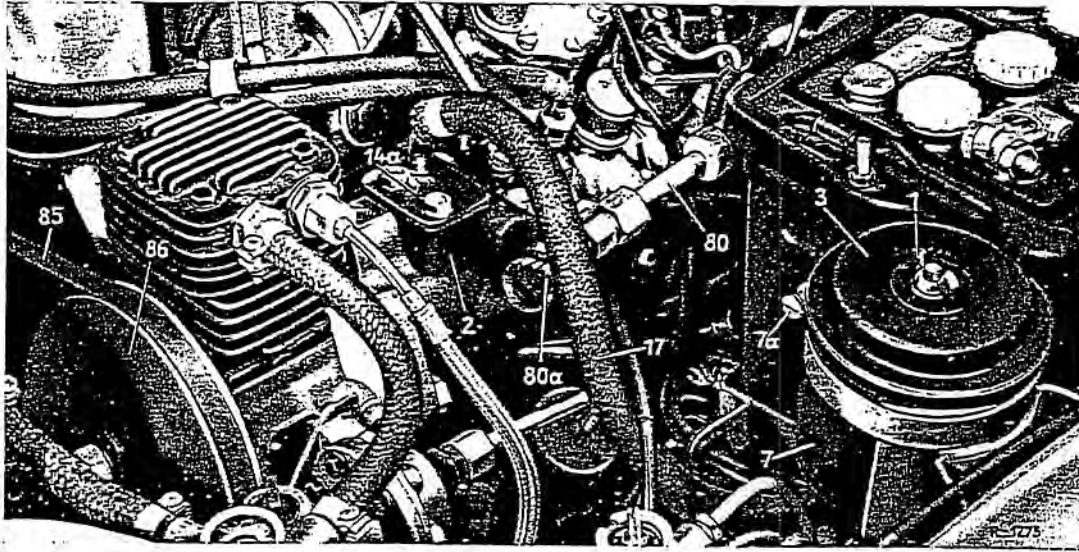


Fig. 46-21/3

Arrangement of high-pressure oil pump on Model 300 SE

- |                           |                                     |
|---------------------------|-------------------------------------|
| 1 Wing nut                | 17 Connecting hose                  |
| 2 High pressure oil pump  | 80 High-pressure oil hose           |
| 3 Cover                   | 80a Elbow on high-pressure oil pump |
| 7 Reservoir               | 85 Narrow V-belt                    |
| 7a Hexagon screw on clamp | 86 Pulley                           |
| 14a Flange plate          |                                     |

In order to re-adjust the V-belt loosen the hexagon nut (97) on the clamping screw (96), then tighten the clamping screw until the prescribed V-belt tension has been obtained. Then re-tighten the hexagon nut (Fig. 46-21/4).

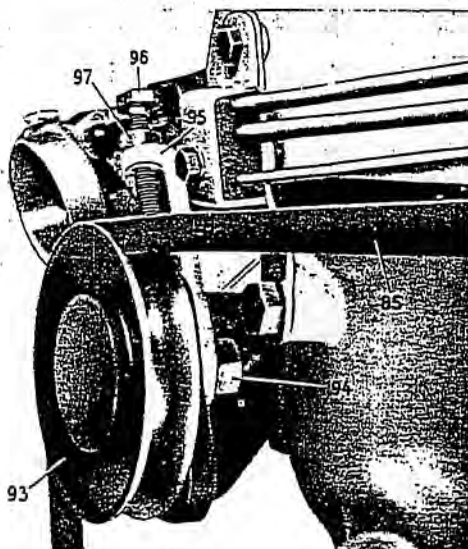


Fig. 46-21/4

- |                    |
|--------------------|
| 85 Narrow V-belt   |
| 93 V-belt pulley   |
| 94 Hexagon nut     |
| 95 Tension bracket |
| 96 Clamping screw  |
| 97 Hexagon nut     |

2. Whenever the car is being serviced check the two hose lines between the steering housing and the high-pressure oil pump and the connections for leaks.
3. Under normal circumstances the oil level in the reservoir of the high-pressure oil pump should be checked after a mileage of 3000 km. The oil level must be checked at operating temperature (approx. 80° C).

To do this loosen the wing nut and remove the screw cover. The oil level should reach the mark stamped in the reservoir (approx. 12 mm below the reservoir edge). For topping up use only the types of oil listed in our fuel and oil tables (maximum reservoir capacity 450 cc).

The oil level check must be made with the engine running.

4. **Caution:** In our works the system is filled with a special oil. When the system is installed subsequently and when the high-pressure oil pump or the power-steering has been repaired, it is imperative that one of the special oils listed in our fuel and oil tables should be used. For ordinary servicing purposes the oil level can be topped up with automatic transmission fluid SAE type A.

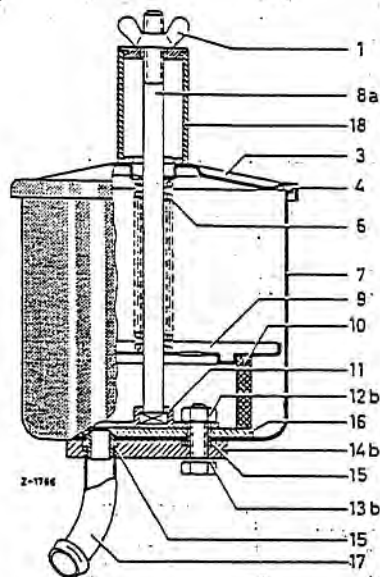


Fig. 46-21/5

- 1 Wing nut
- 3 Cover
- 4 Gasket
- 6 Pressure spring
- 7 Reservoir
- 8a Screw
- 9 Baffle plate
- 10 Filter element
- 11 Supporting bracket
- 12b Hexagon screw with nut
- 13b Sealing ring
- 14b Flange plate
- 15 O-ring
- 16 Reinforcement plate
- 17 Connecting pipe
- 18 Damping dome

5. **After a Mileage of 48 000 km** replace the filter element in the reservoir of the high-pressure oil pump.

To do this remove the cover, the pressure spring, the baffle plate and take out the filter element underneath. Install the new filter element, the baffle plate and the pressure spring. Check the oil level and, if necessary, top up. Fit the cover and tighten by means of the wing nut, using a new paper gasket.

Job No.

46-22

## Bleeding of Power-Steering and High-Pressure Oil Pump

**Note:** Bleeding of the system is only necessary when the steering, the high-pressure oil pump or one of the oil hoses has been replaced or if the high-pressure oil pump has drawn in air because of too low an oil level in the reservoir.

1. Remove the cover of the reservoir (7), check the oil level and, if necessary, top up.

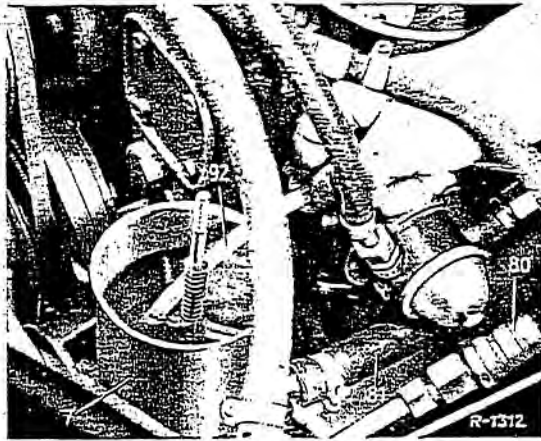


Fig. 46-22/1

- 7 Reservoir
- 80 High-pressure oil hose
- 81 Oil return hose
- 92 Bleeder hose

2. Check all connections between high-pressure oil pump and power steering for leaks.

**Note:** Even small leaks may cause early failure of the hydraulic assistance. Lack of oil may damage the high-pressure oil pump.

3. Push the bleeder hose (92) over the bleed screw of the power steering and insert the end of the hose in the reservoir (7) (Fig. 46-22/1).
4. Open the bleed screw approx. two turns. Run the engine at idle speed. Move the steering wheel several times to both sides no more than  $\frac{1}{4}$  of a turn from the center position.

**Note:** The bleeder hose must be held tightly at the bleed screw and in the reservoir. Otherwise it may twist away and cause large oil losses.



# Checking of Power Steering and High-Pressure Oil Pump

Job No.

46-23

Modification: Para 4 in Section B added

**Note:** Before removing the steering or the high-pressure oil pump when the power steering is not functioning properly always check the system in the car. In most cases this check will show whether the fault is in the steering assembly or in the high-pressure oil pump and in this way unnecessary removal of the units can be avoided. In order to prevent damage to the high-pressure oil pump during checking operations the instructions given in Sections A and B should be followed very carefully.

## A. Checking of Oil Pressure in the High-Pressure Oil Pump

Before checking the steering assembly itself for faults, always check the delivery pressure of the high-pressure oil pump first.

This can be done by connecting a pressure gage with throttle valve to the delivery side of the high-pressure oil pump. The delivery pressure is a safe indication of the functioning of the flow control valve and the pressure relief valve.

**Note:** At a counter pressure of 50 atm and at 500 rpm the minimum delivery of the pump should be 5.7 l/min. However, these values can only be measured on a test stand.

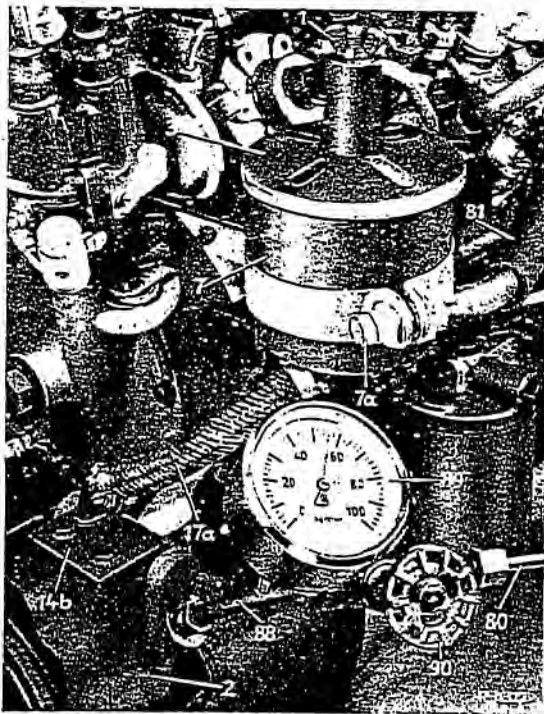


Fig. 46-23/1

- |                           |                           |
|---------------------------|---------------------------|
| 1 Wing nut                | 17a Connecting hose       |
| 2 High-pressure oil pump  | 80 High-pressure oil hose |
| 3 Cover                   | 81 Oil-return hose        |
| 7 Reservoir               | 88 Elbow                  |
| 7a Hexagon screw on clamp | 89 Pressure gage          |
| 14b Flange plate          | 90 Throttle valve         |

1. Empty the reservoir by means of a gun since otherwise oil will run out when the high-pressure oil hose is disconnected.
2. Disconnect the high-pressure oil hose (80) from the elbow. Connect the pressure gage (89). Close the throttle valve (90) on the pressure gage.
3. Fill up the reservoir, using only new oil.
4. Run the engine and measure the pressure at a speed of approx. 700 to 800 rpm. Keep the engine at this speed by working the accelerator.

The minimum delivery pressure should be 55 atm and the maximum 65 atm. **Caution:** Do not run the engine during this checking procedure for too long since otherwise the oil temperature will increase excessively and may damage the high-pressure oil pump.

If the pressure in the oil pump does not reach the prescribed value, it is advisable

46-23/1

to check and, if necessary, replace the flow control and pressure relief valves before removing and disassembling the pump.

5. Remove the pressure gage, connect the high-pressure oil hose and fill up the reservoir. Bleed the system (see Job No. 46-22).

### B. Checking of Beginning of Manual Power Limitation

If the control slide valve works properly the force to be applied at the circumference of the steering wheel is limited to approx. 2.6-2.8 kg. The proper functioning of the manual power limitation can be measured in the car by means of a spring scale or a torque wrench. Since the spring scale can only be hooked over a spoke of the steering wheel the force measured at the spoke must be slightly lower than the force on the circumference of the steering wheel.

1. Run the engine and keep it at a speed of approx. 700 to 800 rpm during the measuring procedure.
2. Hook the spring scale (3) over one of the two steering wheel spokes and turn the wheel while holding the gage at an angle of  $90^\circ$  (Fig. 46-23/2).

**Note:** The spring scale must be hooked over the spoke at a distance of 190 mm measured from the center of the steering wheel. In order to prevent the scale from sliding on the fillet radius of the spoke it is advisable to apply some adhesive tape to this section of the spoke.

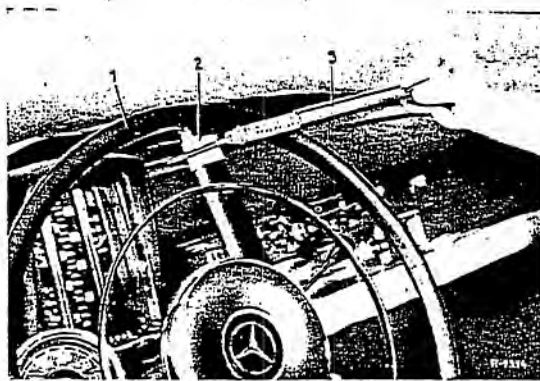


Fig. 46-23/2

3. When the manual power limitation works properly the force necessary to turn the steering wheel should not exceed 3.5 kg.

1 Steering wheel    2 Adhesive tape    3 Spring scale 000 589 02 65

4. When Torque Wrench 000 589 67 21 is used to measure the manual power limitation remove the hub pad from the steering wheel. Then put the torque wrench on the hexagon nut of the steering tube and measure the force necessary to turn the steering tube; this force should not exceed 60-80 cmkg.

# Trouble-Shooting Hints for the Power Steering and the High-Pressure Oil Pump

Job No.

46-24

## A. High-Pressure Oil Pump

Trouble	Causes	Remedy
Tendency of steering wheel to make bumping and jerking movements when turned	V-belt to high-pressure oil pump too loose	Re-tension V-belt
Droning or grunting noise when wheel is turned	Lack of oil which causes the high-pressure oil pump to draw in air	Before topping up the reservoir with new oil find the leak in the hydraulic system. To do this turn the steering for a moment to the left and to the right in order to produce maximum pressure. If the system is heavily oiled up, thoroughly clean the parts with gasoline. Bleed the whole system after sealing the leak.
Foaming in the reservoir of the high-pressure oil pump	High-pressure oil pump draws in air	Replenish the oil <b>Models 220 b, 220 5b</b> Replace the O-ring on the pipe union of the reservoir and the O-rings sealing the reservoir against the pump housing.  <b>Models 220 SEb, 300 SE</b> Replace the O-rings between the flange plate and the pump housing.  Check the hose connection between the reservoir and the high-pressure oil pump for leaks <b>Note:</b> Replace all aluminum sealing rings whenever the hexagon screws have been unscrewed
Oil pressure of high-pressure oil pump too low	Leaks in the hydraulic system	Check all pipe connections and the power steering for leaks
Oil pressure of high-pressure oil pump too low	Flow control valve sticking	<b>Models 220 b, 220 5b, 220 SEb</b> Remove the high-pressure oil pump, remove the flow control valve and free up.  <b>Model 300 SE</b> Drain the oil from the high-pressure oil pump, remove the flow control valve, free it up and, if necessary, replace it
High-pressure oil pump not delivering oil	High-pressure oil pump damaged	Remove high-pressure oil pump and disassemble. If wear is excessive, replace the pump  <b>Note:</b> If the cam ring and the pump vanes show signs of damage, the steering assembly must be disassembled and cleaned and all hoses must be cleaned as well. Abrasive particles in the lines may cause failure of hydraulic assistance
Oil overflow in the reservoir on Model 300 SE	Leak in the sealing ring on the drive shaft which permits engine oil to flow from the air compressor into the high-pressure oil pump	Replace the housing cover of the high-pressure oil pump Remove the steering and drain the old oil by tilting the pipe connection

46-24/1

Trouble	Causes	Remedy
Lack of oil in reservoir	Reservoir cover not seated properly Reservoir shows cracks Models 220b, 220Sb, 220SEb Sealing ring on pump drive shaft leaking	Replace paper gasket and properly mount reservoir cover Replace reservoir Check alignment of pulley from high-pressure oil pump to crankshaft and adjust. Then replace housing cover and drive shaft

## B. Steering

Trouble	Causes	Remedy
Steering too stiff when parking	Beginning of manual power limitation too late High-pressure oil pump not working properly Lack of oil Air-trapped in the system V-belt to high-pressure oil pump loose Control slide valve sticking because of dirt Excessive friction between steering nut and power piston Internal leakage in steering assembly	Check beginning of manual power limitation if necessary, repair steering assembly, replacing control slide valve and bushing Check high-pressure oil pump and, if necessary, replace Fill up oil reserve, if necessary, find leakage and seal Bleed system Re-tension V-belt Remove steering assembly, disassemble and clean, free up control slide valve in the bushing and, if necessary, replace Disassemble, check, and repair steering assembly  <b>Note:</b> If abrasive particles are found, disassemble and check the high-pressure oil pump, if necessary, replace it Remove and disassemble steering assembly, replace all seals (O-rings, Teflon inner sealing ring)
Steering does not return easily to center position after having been turned	Steering shaft adjusted too tightly Control slide valve sticking because of dirt Steering nut sticking because of dirt in power piston Centering spring broken	Remove steering assembly and re-adjust pressure block assembly Remove steering assembly, disassemble and clean Remove steering assembly, disassemble and clean Disassemble steering assembly, replace centering spring
Rattle in the steering	Excessive play between control edge of steering nut and control slide valve	Replace steering nut, steering worm and control slide valve with bushing
Knocking of steering in center position	End play between steering worm and bearing cap End play of steering nut in power piston	Remove steering and replace axial bearings in bearing cap Remove steering and replace axial angular contact bearings
Knocking in the steering when wheel is turned	Steering shaft lifting from power piston	Remove steering, re-adjust pressure block assembly

Trouble	Causes	Remedy
Squeaking of steering when turned	Scoring of ball-head of steering shaft in ball socket of power piston	Remove steering and repair or replace steering assembly
Leak in steering assembly	<p>Leaking sealing ring on steering shaft</p> <p>Leaking sealing ring in bearing insert</p> <p>Leaking O-rings on bearing cap</p> <p>Leaking O-rings in lower housing cover</p> <p>Leaking O-ring on pressure union</p> <p>Leaking O-ring on round nut</p> <p>Leaking brass cone in pressure union</p> <p>Leaking sealing ring below screw plug or return union</p>	<p>Remove steering, remove lower housing cover and replace sealing ring</p> <p>Remove steering and replace ring in bearing insert</p> <p>Remove steering, unscrew bearing cap, turn steering to the right up to the point where bearing cap is pushed out of the steering housing and replace O-rings</p> <p>Remove steering, remove lower housing cover and replace O-rings</p> <p>Unscrew pressure union and replace O-ring</p> <p>Remove steering. Unscrew round nut and replace O-ring. Re-adjust pressure block assembly</p> <p><b>Note:</b> Replace all aluminum sealing rings under hexagon nut and cap nut</p> <p>Replace pressure union</p> <p>Unscrew screw plug or return union and replace sealing ring</p>
Temporary stiffness of steering when wheel is turned quickly	Air trapped in system	Bleed system

## Removal and Installation of Power Steering

## Removal:

1. Draw the oil from the reservoir of the high-pressure oil pump by means of a gun.

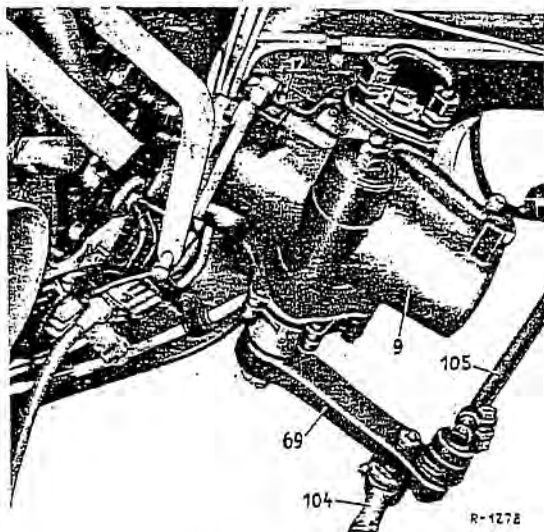


Fig. 46-25/1

9 Steering assembly  
12 Bleed screw  
69 Steering gear arm  
104 Center tie-rod  
105 Left tie-rod

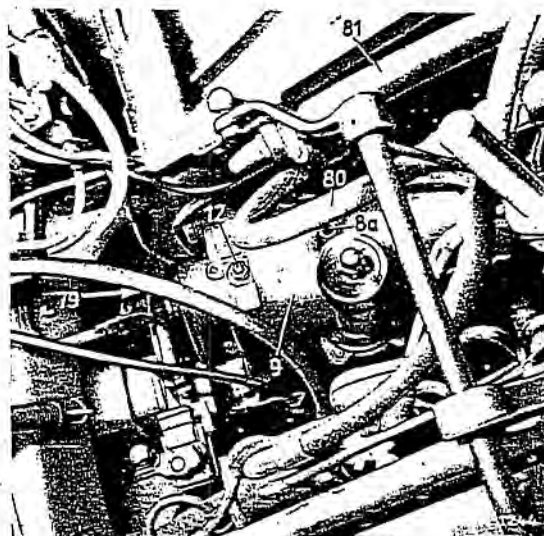


Fig. 46-25/2

8a Center position check screw 111 589 02 23 00  
9 Steering housing  
12 Bleed screw  
79 Hexagon socket screw (clamping screw)  
80 High-pressure oil hose  
81 Oil-return hose

2. Detach the high-pressure oil hose (80) and the oil-return hose (81) from the steering assembly, holding the connectors on the steering assembly steady (Fig. 46-25/2).

3. Cover the oil hoses and the connecting points of the power steering with dust caps to prevent dirt from entering the system.

4. Unscrew the hexagon screw (79) from the lower flange of the steering coupling (Fig. 46-25/2).

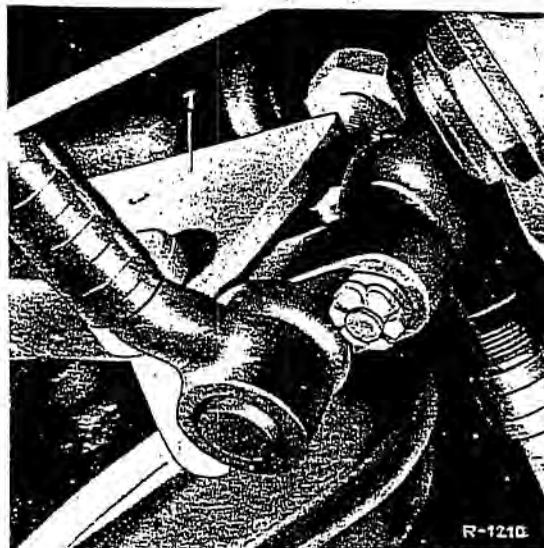


Fig. 46-25/3

1 Fixture 111 589 08 33

5. Press the center tie rod off the steering gear arm using Fixture 111 589 08 33 (Fig. 46-25/3).

6. Press the tie-rod off the steering gear arm using Fixture 186 589 10 33 (Fig. 46-25/4).

**Note:** The tie-rod can also be pressed off by means of Fixture 136 589 12 33.

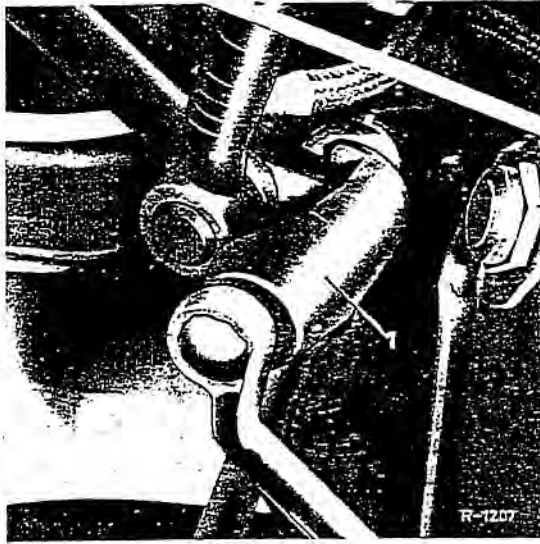


Fig. 46-25/4

1 Fixture 186 589 10 33

7. Unscrew the hexagon screws for fastening the steering assembly to the chassis base panel. Then press the steering worm off the steering coupling and remove the steering assembly downward.
8. Drain the oil from the steering assembly by holding the steering assembly with the oil union downward and by turning it hard over to the left and to the right.

**Installation:**

9. Check the steering coupling. If necessary, remove the coupling from the steering tube and reinstall after repair (see Job No. 46-13).
10. Install the steering gear arm on the steering shaft paying attention to the position markings on the steering gear arm and the steering shaft. Tighten the castle nut with approx. 15 mkg and cotter.
11. Unscrew the screw plug from the steering assembly. Put the steering assembly in center position. Fix the power piston in position in the steering housing by screwing in the center check screw.

**Note:** Before screwing in the check screw, turn the steering worm until the center of the power piston is exactly below the threaded bore in the steering housing.

12. Check dimension 'a', if necessary adjust by changing the position of the steering gear arm (Fig. 46-25/5 and Job No. 46-0).
13. Put the steering tube in its center position. In this center position the canceling cam on the steering tube is opposite the center of the flash signal switch. For inspection purposes remove the rubber cover for the flash signal switch from the steering column jacket.
14. Press in the steering worm into the steering coupling taking care to ensure that the serrations are not damaged and that the steering tube remains in its center position.
15. Attach the steering assembly to the chassis base panel. Insert the lower hexagon socket screw (clamping screw) into the steering coupling and tighten it (Fig. 46-25/1).
16. Unscrew the center check screw and screw the screw plug into the steering housing using a new sealing ring.
17. Attach center tie-rod and tie-rod to the steering gear arm (see Job No. 46-9).
18. Turn the steering hard over to the left and to the right. In doing this check whether the steering knuckle arm rests against the steering knuckle assembly stop face (see Fig. 46-1/3).

**Note:** The steering must be limited by the steering knuckle assembly.

If this is not the case, the cause may be an incorrectly installed steering gear arm or toe-in maladjusted on one side. For this reason it is important to adjust the toe-in with the steering wheel in the center position, so that the toe-in on the left and on the right wheel is evenly distributed.

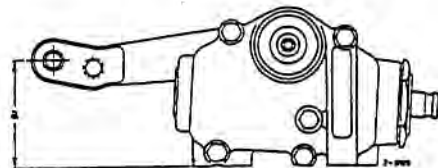


Fig. 46-25/5

19. Remove the dust cap from the pressure and return union. Connect the high-pressure and return hoses to the upper housing cover of the power steering.

**Note:** Make sure that the hoses are properly positioned. Even minor rubbed spots may cause oil loss in a very short time and as a consequence may produce failure of hydraulic assistance.

20. Fill up the reservoir of the high-pressure oil pump with the prescribed type of oil (see fuel and oil tables).

21. Push the bleed hose on to the bleed valve of the power steering. Back off the screw and insert the bleed hose in the reservoir.

22. With the engine running bleed the hydraulic system of the power steering and replenish the oil in the reservoir of the high-pressure oil pump up to the oil level mark (see Job No. 46-22).

**Note:** During the bleeding procedure hold the bleed hose steady. Run the engine only for a short time in order to prevent emptying of the reservoir. Always replenish the oil in the reservoir immediately.

23. Check the hydraulic system and the power steering for leaks.

**Note:** With the engine running turn the steering to right or left lock for a short time in order to ensure that maximum oil pressure is reached. Then check whether all connection points are absolutely leak-proof.

24. Adjust the toe-in.

25. Check the position of the steering wheel during the trial run. When the wheels are in the straight ahead position, the steering wheel must be in the dead center position.

26. Check whether the automatic return mechanism of the flash signal switch is working properly.



# Removal and Installation of High-Pressure Oil Pump

Job No.

46-26

Models 220 b, 220 Sb and 220 SEb

**Note:** On Models 220 b and 220 Sb the reservoir is screwed to the high-pressure oil pump, whereas on Models 220 SEb and 300 SE the reservoir is separated from the high-pressure oil pump.

## Removal:

1. Unscrew the wing nut (1) on the reservoir (7) and remove the cover together with the gasket. Remove the pressure spring, the baffle plate and the filter element from the reservoir (Figs. 46-26/1 and 46-26/3).
2. Empty the reservoir by means of a gun since otherwise it will be difficult to collect the oil when disconnecting the hoses.
3. Unscrew the hexagon nut from the drive shaft of the high-pressure oil pump, holding the pulley (86) steady at the parallel flat (Fig. 46-26/2).
4. Loosen the hexagon nuts fastening the high-pressure oil pump to the support (82) without, however, unscrewing the nuts completely (Figs. 46-26/1 and 46-26/3).

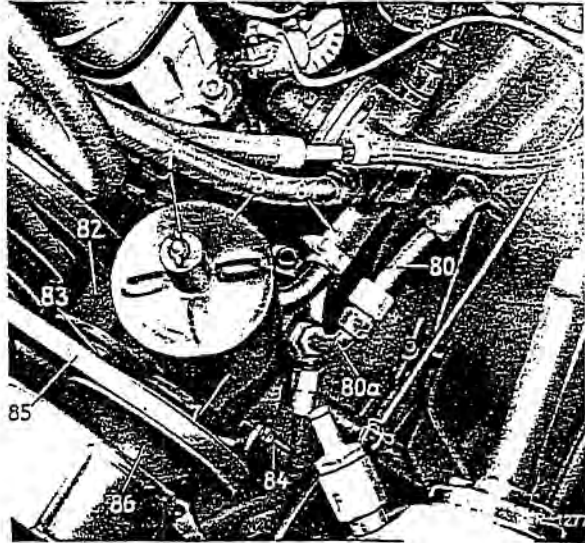


Fig. 46-26/1

Arrangement of high-pressure oil pump and reservoir on Models 220b and 220 Sb

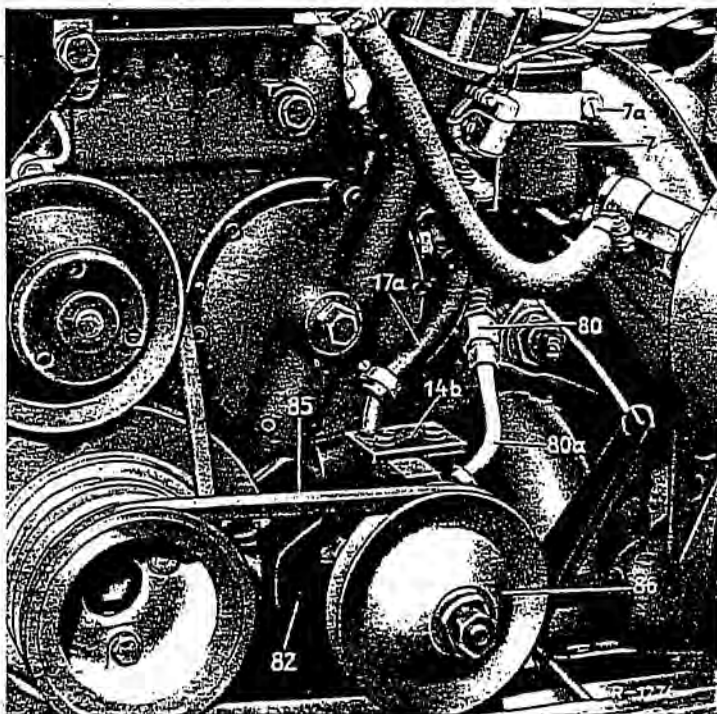


Fig. 46-26/2

Arrangement of high-pressure oil pump and reservoir on Model 220 SEb

- 7 Reservoir
- 7a Hexagon screw on clamp
- 14b Flange plate
- 17a Connecting hose
- 80 High-pressure oil hose
- 80a Elbow on high-pressure oil pump
- 82 Support for high-pressure oil pump
- 85 Narrow V-belt
- 86 Pulley

46-26/1

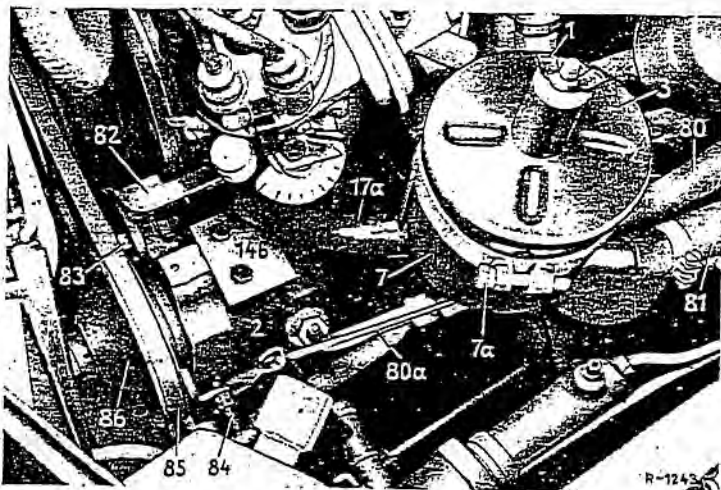


Fig. 46-26/3

Arrangement of high-pressure oil pump and reservoir on Model 220 SEb

- 1 Wing nut
- 2 High-pressure oil pump
- 3 Cover
- 7 Reservoir
- 7a Hexagon screw on clamp
- 14b Flange plate
- 17a Connecting hose
- 80 High-pressure oil hose
- 80a Elbow on high-pressure oil pump
- 82 Support for high-pressure oil pump
- 83 Hexagon screw with nut, washer, locking plate and lock washer
- 84 Clamping screw
- 85 Narrow V-belt
- 86 Pulley

5. Loosen the hexagon nuts on the clamping screw (84) until the V-belt is slack and remove the V-belt from the pulley (Fig. 46-26/2).
6. Disconnect the high-pressure oil hose (80) from the pipe elbow (80a). Carefully plug the hose and the connection on the housing to prevent dirt from entering.
7. On Models 220 b and 220 Sb disconnect the return hose (81) from the reservoir (Fig. 46-26/1). On Model 220 SEb disconnect the connecting hose (17a) (Figs. 46-26/2 and 46-26/3) from the reservoir to the high-pressure oil pump at the pipe elbow on the pump housing. Carefully plug the connecting points to prevent dirt from entering.
8. Unscrew the hexagon screws. Remove hexagon nuts, clamping screw, locking plates and spacer ring. Remove the high-pressure oil pump from the support.

**Installation:**

9. Put the pulley on the drive shaft, then fit the high-pressure oil pump (2) to the support (82) and attach by means of the hexagon screws in such a way that the oil pump can still move easily in the support.

**Note:** a) To begin with attach the high-pressure oil pump by means of the hexagon screws to the front face of the support.

b) The locking plates prevent the hexagon nuts, which are not easily accessible, from turning.

c) Use the lower hexagon screw on the front face to fasten the clamping screw.

d) Do not omit the spacer ring between the support and the high-pressure oil pump at the rear attachment point. The spacer ring prevents undue strain on the high-pressure oil pump in the support and is available in the following thicknesses: 13.5; 13.25; 13.0; 12.75; 12.5 mm.

e) The rear hexagon screw has a standard Witworth thread.

10. Attach the pulley to the drive shaft of the high-pressure oil pump. Put on the narrow V-belt and tension it by means of the tensioning device until the belt can be depressed approx. 10 mm. Tighten the hexagon nuts on the clamping screw.
11. Tighten the hexagon nuts fastening the high-pressure oil pump to the support.
12. Connect the high-pressure oil hose to the pump.
13. On Models 220 b and 220 Sb connect the oil return hose to the reservoir. On Model 220 SEb connect the connecting hose from the reservoir to the high-pressure oil pump.
14. Insert the filter element, the baffle plate and the pressure spring in the reservoir, fill the reservoir with the prescribed type of oil (see fuel and oil tables) and bleed the system (see Job No. 46-22).

**Note:** When filling up with oil it is advisable to top up the oil in the reservoir when the engine is being started in order to ensure that the pump does not draw in air.

15. Put the cover and gasket on the reservoir and screw down by means of the wing nut.
16. Check the high-pressure oil pump and all hose connections for leaks.

**Note:** With the engine running turn the steering to right or left lock for a short time in order to ensure that maximum oil pressure is reached.

#### Model 300 SE

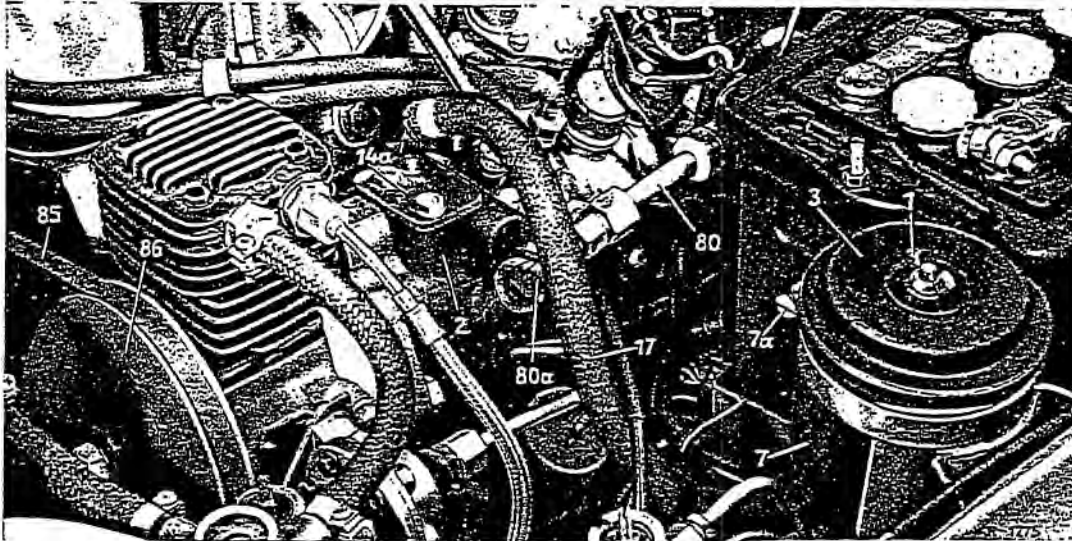


Fig. 46-26/4

#### Arrangement of high-pressure oil pump and reservoir on Model 300 SE

1 Wing nut	7a Hexagon screw on clamp	80a Elbow on high-pressure oil pump
2 High-pressure oil pump	14a Flange plate	85 Narrow V-belt
3 Cover	17 Connecting hose	86 Pulley
7 Reservoir	80 High-pressure oil hose	

#### Removal:

1. Disconnect the high-pressure oil hose (80) and the connecting hose (17) from the high-pressure oil pump (2) (Fig. 46-26/4).
2. Remove the air compressor (see Job No. 32-15).
3. Unscrew the hexagon socket screws attaching the high-pressure oil pump (2) to the air compressor (Fig. 46-26/5).
4. Remove the O-ring (15a) from the pump housing (15) (see Fig. 46-28/11).

#### Installation:

5. Put a new O-ring (15a) in the pump housing (15) (see Fig. 46-28/11).
6. Attach the high-pressure oil pump to the air compressor; the tightening torque of the screw connection is 4-5 mkg.

**Note:** When attaching the pump to the air compressor make sure that the projections

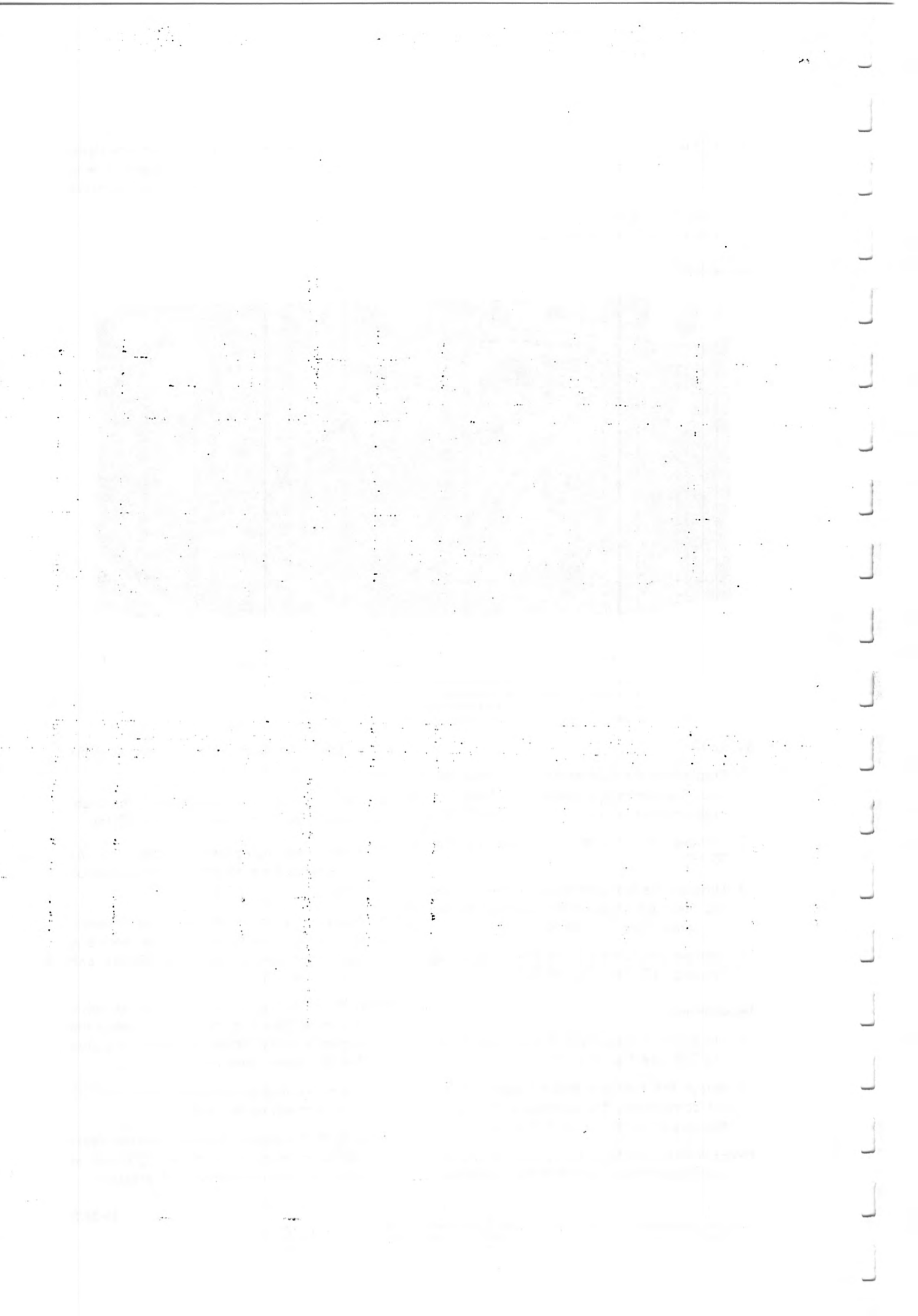
of the drive shaft fit accurately into the slots of the coupling disk.

7. Install the air compressor and the high-pressure oil pump (see Job No. 32-15).
8. Attach the high-pressure hose and the connecting hose to the high-pressure oil pump.
9. Remove the cover (3) from the reservoir (7) and top up with oil up to the mark and bleed the system (see Fig. 46-26/4 and Job No. 46-22).

**Note:** When filling up with oil it is advisable to top up the oil in the reservoir when the engine is being started in order to ensure that the pump does not draw in air.

10. Check the high-pressure oil pump and all hose connections for leaks.

**Note:** With the engine running turn the steering for a moment to left or right lock in order to obtain maximum oil pressure.



## **Fuel System**

## **Group 47**

	Job No.
<b>Fuel System (General Data, Dimensions and Tolerances)</b>	47-0
<b>Removal and Installation of Fuel Tank</b>	47-1
<b>Removal and Installation of Fuel Level Indicator Mechanism</b>	47-2
<b>Screw Plug for the Fuel Tank on Model 220 SEb</b>	47-3

## **Exhaust System**

## **Group 49**

<b>Removal and Installation of Exhaust System</b>	49-1
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## **Cooling System**

## **Group 50**

<b>Removal and Installation of Radiator</b>	50-1
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Job No.
47-0

# Fuel System

## General Data, Dimensions, and Tolerances

Modification: Models 230 SL, 300 SE (2nd Version) added

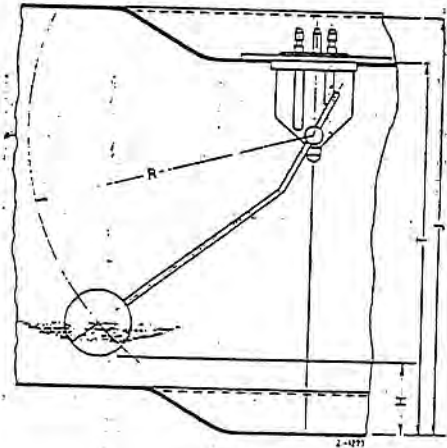


Fig. 47-0/1

### Fuel Tank and Fuel Level Indicator

Model	Installation height 'T' mm	Height of tank 'J' mm	Length of lever 'R' mm	Lever position mm	Resistance ohm	Fuel gage	Tank contents <sup>1)</sup> available <sup>2)</sup>
190 c, 190 Dc  220 b (1st version)	142	164	104	H = 23	10±4	reserve	5
				H <sub>1</sub> = 25	—	warning light	6
				H <sub>2</sub> = 44	50±5	¼	12.8
				H <sub>3</sub> = 74	100,5±5	½	25.5
				H <sub>4</sub> = 102	143±6	¾	38
				H <sub>5</sub> = 129	180 $\begin{smallmatrix} +12 \\ -2 \end{smallmatrix}$	full	51
220 b <sup>3)</sup> (2nd version) 220 Sb 220 SEb 230 SL 300 SE (1st version) 300 SE (2nd vers.) <sup>1)2)</sup>	180	199	132	H = 33	10±4	reserve	7(9) <sup>1)</sup>
				H <sub>1</sub> = 35	—	warning light	8(10)
				H <sub>2</sub> = 58	50±5	¼	16(20)
				H <sub>3</sub> = 95	100,5±5	½	32(40)
				H <sub>4</sub> = 130	143±6	¾	48(60)
				H <sub>5</sub> = 164	180 $\begin{smallmatrix} +12 \\ -2 \end{smallmatrix}$	full	64(80)

<sup>1)</sup> The values in brackets apply to the 82 liter fuel tank of Model 300 SE.

<sup>2)</sup> In the case of Models 190 c, 190 Dc and 220 b 1st version the actual contents of the fuel tank is 52 liters, but a residual amount of 1 liter is not available because of impurity deposition. On Models 220 b 2nd version, 220 Sb, 220 SEb, 230 SL, and 300 SE 1st version with a fuel tank capacity of 65 liters, 1 liter is not available, and on Model 300 SE 2nd version with a fuel tank capacity of 82 liters a residual amount of 2 liters is not available.

<sup>3)</sup> The larger fuel tanks can be installed subsequently.

**Note:** With the float lever in position 'H<sub>1</sub>' the warning light must light up after a switch-on lag of 4—7 minutes. The delay in the lighting up of the warning light is caused by bi-metal springs built into the fuel gage.

# Removal and Installation of Fuel Tank

Job. No.

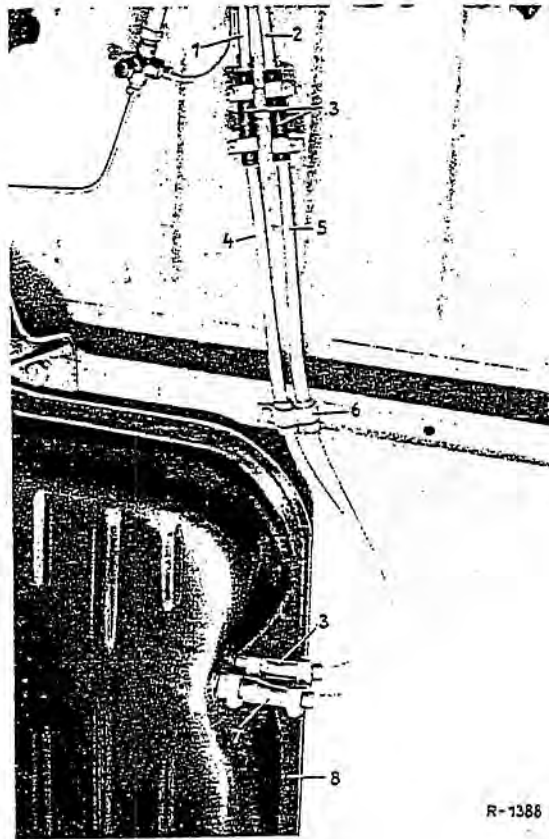
47-1

*Modification: Fuel Tank with Hose Connections (Addition)*

## Removal:

1. Unscrew the screw plug from the fuel tank and empty the tank.
2. Pull out the plug for the electric cable at the fuel level indicator.
3. Take off the filler cap. On cars with fuel tank ventilation remove the vent lines from the filler neck.
4. Remove the fuel lines from the tank.
5. Unscrew the three hexagon nuts and remove the fuel tank.

**Note:** If soldering work has to be carried out on the new fuel tank the openings of the intake and return pipes must be carefully closed in order to ensure that the plastic hose inside the tank does not melt.



R-1388

## Installation:

6. When reinstalling the tank make sure that the felt strips on the upper surface of the tank are well cemented to the tank. If a plastic screw plug is installed in the fuel tank it should be tightened with a torque wrench to 80-90 cmkg (see Job-No. 47-3).

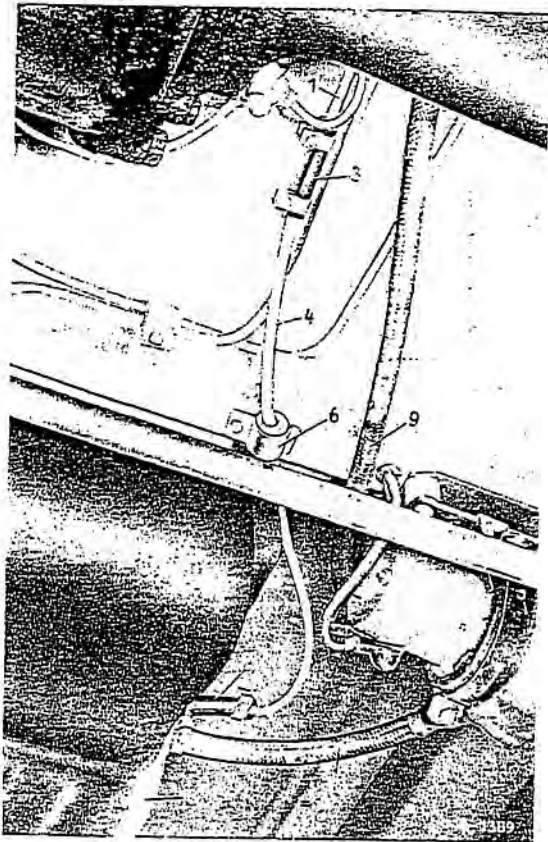
**Note:** On recent cars the fuel tank and the fuel lines have been provided with hose connections to replace the previous screw connections. Since only fuel tanks with hose connections are supplied as replacement parts it is necessary when installing a new fuel tank in an older car to saw off the fuel lines, to debur them, to blow them through from in front and to supplement them with additional lines (see Figs. 47-1/1 and 47-1/2).

Fig. 47-1/1

Models 190 Dc, 220 b, 220 Sb

- 1 Fuel return line
- 2 Fuel intake line
- 3 Fuel hose
- 4 Additional fuel return line
- 5 Additional fuel intake line
- 6 Fixing clip
- 7 Fuel hose
- 8 Fuel tank

The additional fuel lines (4) and (5) are attached to the cross member by means of the fixing clip (6) and they are positioned in such a way that the lines to the pipe unions on the fuel tank and to the fuel lines (1) and (2) are properly aligned. The fuel hoses must not rub anywhere and must on no account be kinked. If necessary the lines must be bent (Figs. 47-1/1 and 47-1/2).



On Model 190 c the connection for the fuel return line on the fuel tank is closed by a cover.

On Model 220 SEb the fuel hose (10) between fuel tank and electric feed pump must be replaced (Fig. 47-1/2).

Fig. 47-1/2

Model 220 SEb

- 1 Fuel return line
- 3 Fuel hose
- 4 Additional fuel return line
- 6 Fixing clip
- 8 Fuel tank
- 9 Fuel hose from feed pump to fuel intake line
- 10 Fuel hose from fuel tank to feed pump

Job. No.

47-2

## Removal and Installation of Fuel Level Indicator

### Removal:

1. Take out the rubber mat in the trunk compartment and remove the rubber cap from the floor of the trunk compartment.
2. Pull out the plug from the fuel level indicator. Unscrew the fixing nuts and remove the fuel level indicator.
3. Remove the gasket from the fuel tank, taking care to ensure that no worn parts of the gasket fall into the fuel tank.

### Installation:

4. Slightly coat a new gasket with Sealing

Compound Teroson LB 1020/1 on one side and put it on the tank in such a way that the coated side lies on the fuel tank. Coat the fuel level indicator slightly with sealing compound and install it, then tighten the fixing nuts crosswise.

**Note:** It is very important that the sealing compound mentioned above should be used because it is resistant to alcohol and gasoline. All other sealing compounds are more or less soluble in gasoline and may therefore clog the filter. The fixing bores in the fuel level indicator are offset so that the fuel level indicator cannot be installed incorrectly.



# Screw Plugs for the Fuel Tank

Job. No.

47-3

Modification: Plastic Screw Plug (Addition)

For the new fuel tanks the screw plugs are made of plastic. The screw plug filter consists of square 0.08 mm mesh on gasoline cars and 0.6 mm mesh on Diesel cars.

The screw plugs can be distinguished by the face inscription "Benzin" (gasoline) and "Diesel".

The plastic screw plugs should be tightened with a maximum torque of 80-90 cmkg. A lower torque will produce leaks and excessive torque may damage the thread of the screw plug.

## Model 220 SEb

On Model 220 SEb the first version filter of the screw plug was made of filter-screen mesh which clogs very easily. When complaints are received about inadequate fuel supply due to the filter in the fuel tank this screw plug must be replaced by a second version screw plug Part No. 111 470 02 86. These two versions of the screw plug can easily be distinguished by holding them up against the light. The first version screw plugs with the filter of filter-screen mesh is opaque, whereas the second version is translucent (Fig. 47-3/2).

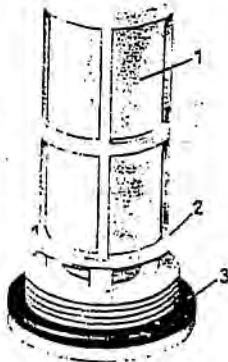
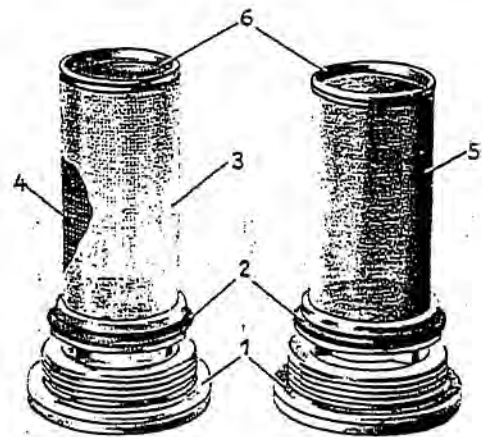


Fig. 47-3/1

Plastic Screw Plug

- 1 Screen jacket
- 2 Sealing lip
- 3 Sealing ring



1st version

2nd version

Fig. 47-3/2

Metal Screw Plug Model 220 SEb

- 1 Sealing ring
- 2 Rubber sealing ring
- 3 Screen jacket (Square-mesh gauze)
- 4 Supporting gauze
- 5 Screen jacket (filter-screen mesh)
- 6 Lid



# Removal and Installation of Exhaust System

Job No.

49-1

*Modification: Revised and extended*

## Removal:

1. Unscrew the exhaust pipe at the front of the exhaust manifold.
2. Unscrew the exhaust bracket (4) from the mounting plate (9) on the rear transmission housing cover (Fig. 49-1/1), and, if installed, detach the rubber rings (10) for fastening the exhaust line to the chassis base panel (Fig. 49-1/2).

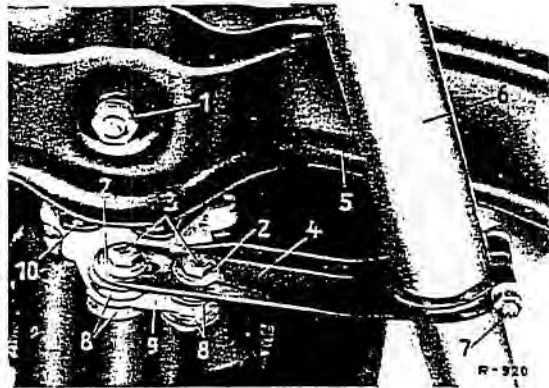


Fig. 49-1/1

- |                        |                                  |
|------------------------|----------------------------------|
| 1 Hexagon nut          | 6 Exhaust pipe                   |
| 2 Washer               | 7 Hexagon screw (clamping screw) |
| 3 Hexagon screw        | 8 Rubber washer                  |
| 4 Exhaust pipe bracket | 9 Mounting plate                 |
| 5 Support              | 10 Engine support                |

3. On cars with air suspension detach the connecting rod for the level adjustment valve from the lever of the torsion bar on the rear axle and after loosening the lower clamp (5) fold down the torsion bar (2) (Fig. 49-1/3).
4. Detach the rubber rings (1) from the main muffler (4) (Fig. 49-1/4), and on cars with dual-pipe exhaust assembly unscrew the hexagon nuts (1) for fastening the main muffler (2) (Fig. 49-1/5).
5. Remove the complete exhaust system, paying attention to the insulating plates (3) between exhaust pipes and the rubber rings whenever installed (Fig. 49-1/5).

**Note:** The exhaust assembly consists of two parts with the exception of Model 230 SL. After loosening the clamping screws on the pipe clips the rear exhaust line can be removed together with the mufflers.

## Installation:

6. Fix the front exhaust line loosely to the exhaust manifold.
7. Attach the rubber rings to the main muffler and on cars with dual-pipe exhaust system fit the insulating plates and screw on the hexagon nuts (Figs. 49-1/4 and 5).

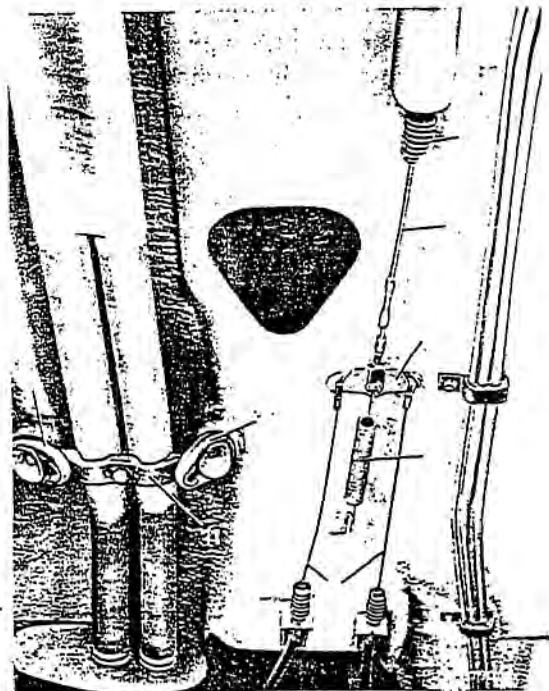


Fig. 49-1/2

- |                     |                  |
|---------------------|------------------|
| 1 Rear brake cable  | 9 Rubber grommet |
| 2 Return spring     | 10 Rubber ring   |
| 3 Equalizer         | 11 Lower bracket |
| 6 Front brake cable |                  |

49-1/1

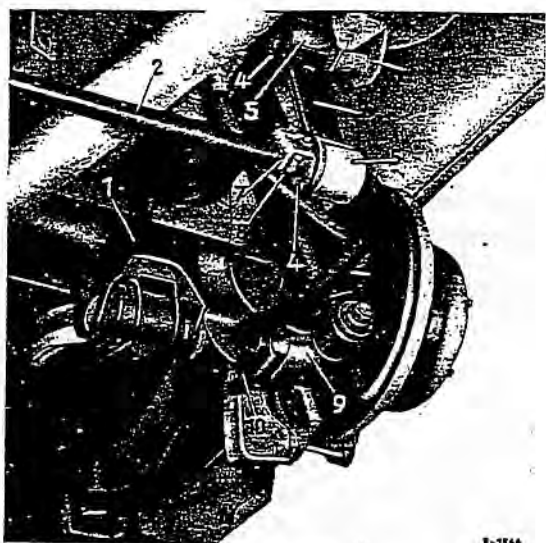


Fig. 49-1/3

- |                              |                    |
|------------------------------|--------------------|
| 1 Rear axle tube             | 6 Bracket          |
| 2 Torsion bar                | 7 Retainer         |
| 3 Chassis base panel bracket | 8 Fixing strap     |
| 4 Rubber mounting            | 9 Bearing bracket  |
| 5 Clamp                      | 10 Connecting link |

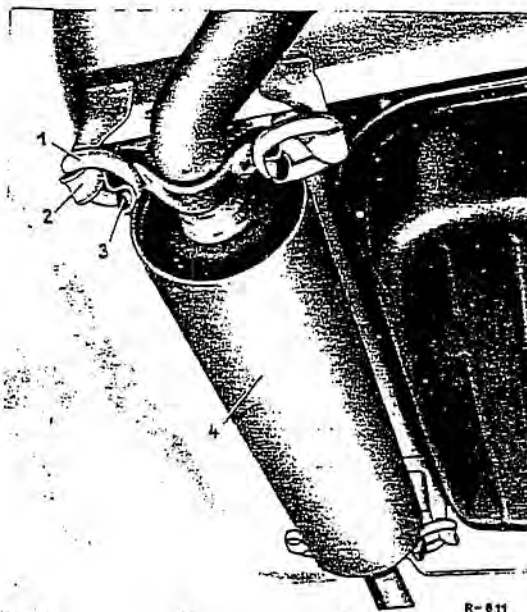


Fig. 49-1/4

- |                              |
|------------------------------|
| 1 Rubber ring                |
| 2 Chassis base panel bracket |
| 3 Main muffler bracket       |
| 4 Main Muffler               |

8. Put new sealing rings on the front exhaust pipe and attach the pipe to the exhaust manifold with self-locking nuts.

9. Screw the exhaust pipe bracket to the mounting plate on the transmission in such a way that the exhaust system is mounted without any tension (Fig. 49-1/1). Where required attach the rubber rings (10) to the chassis base panel (Fig. 49-1/2).

10. On cars with air suspension fold the torsion bar (2) on the rear axle upward and attach the clamp (5) to the bracket (6) (Fig. 49-1/3). Attach the connecting rod for the level-adjustment valve to the lever of the torsion bar.

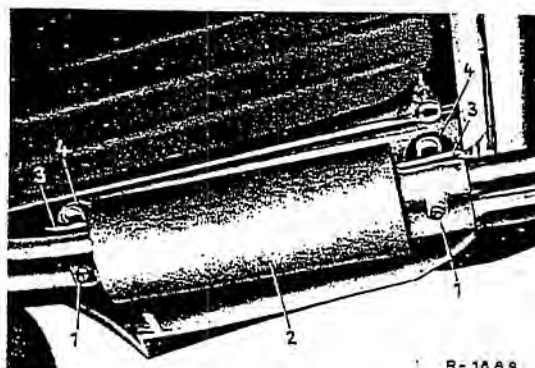


Fig. 49-1/5

- |                    |
|--------------------|
| 1 Hexagon nut      |
| 2 Main muffler     |
| 3 Insulating plate |
| 4 Rubber ring      |

## Removal and Installation of Radiator

Job No.

50-1

*Addition: Various versions of cooling water lines and installation instructions for radiators involved in accidents*

### Removal:

1. Remove the radiator cap.

**Caution:** Overpressure cooling system! The radiator cap must not be unscrewed unless the cooling water temperature is below 90° C. First turn the cap to notch 1 and allow the overpressure to escape. Then continue to unscrew and remove the cap.

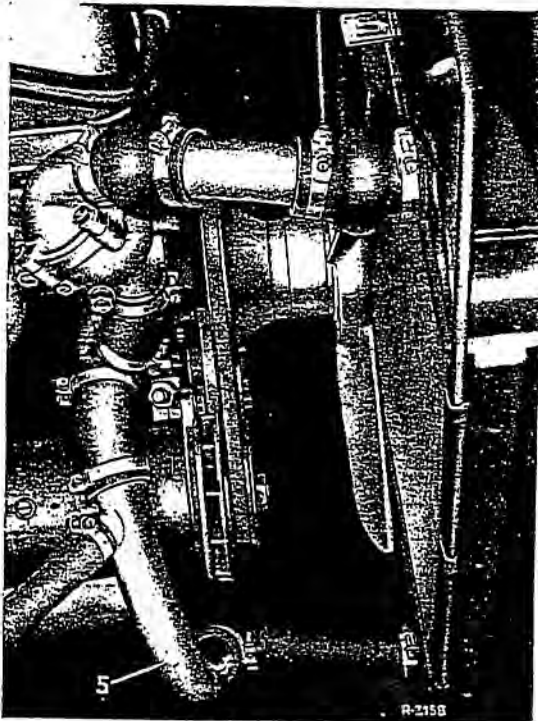


Fig. 50-1/1

Cooling water lines  
1st version 220 b, 220 Sb, 220 SEb  
5 Distributor pipe

2. Drain the cooling water at the radiator drain cock or the screw plug on the radiator and collect it because of such additives as anti-freeze etc.

If the whole cooling water has to be drained, e. g., because pre-mixed anti-freeze has to be filled in, move the heater control levers to "warm" and unscrew the screw plug at the side of the engine block. This is the only way of draining the whole cooling system.

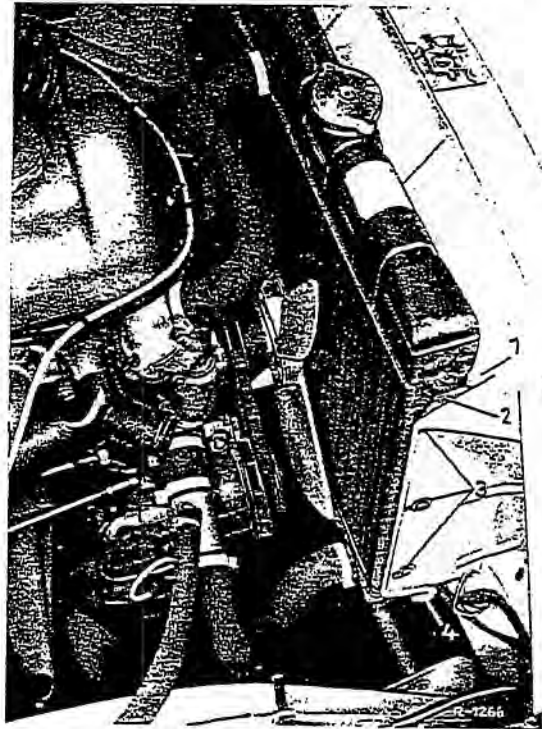


Fig. 50-1/2

Cooling water lines  
1st version 190 c, 190 Dc  
2nd version 220 b, 220 Sb, 220 SEb

- 1 Sealing strip (top)
- 2 Rubber pad
- 3 Hexagon screws
- 4 Sealing strip (bottom)

**Note:** Before screwing in the screw plug, clean the thread of the screw plug for the water tank or the engine block and coat it with graphite paste. Also install a new sealing ring (tightening torque for screw 0.6—0.8 mkg).

3. Unfasten the cooling water hose clamps at the top and at the bottom of the radiator and on Model 230 SL also detach the bleeder hose (5). Remove the water hoses from the pipe unions of the radiator (Figs. 50-1/2 to 5).
4. On cars with automatic DB transmission unscrew any hose connections from the transmission oil cooler (Fig. 50-1/6). Plug the pipe unions on the radiator and hose lines against dust.

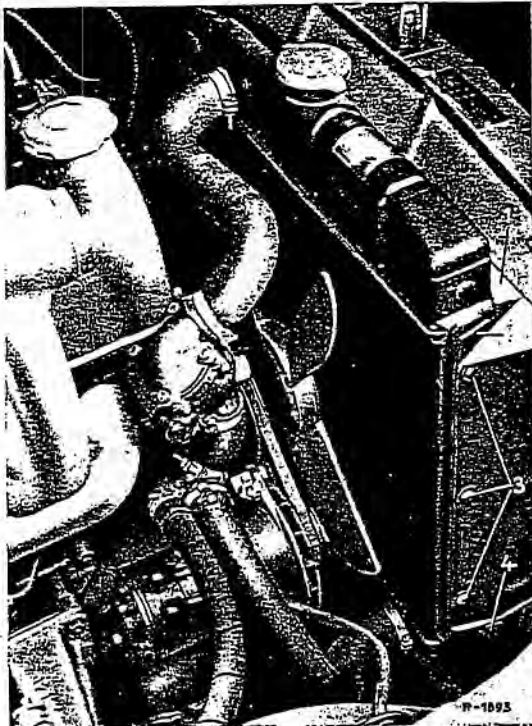


Fig. 50-1/3

Cooling water lines  
 2nd version 190 c, 190 Dc  
 3rd version 220 b, 220 Sb, 220 SEb  
 1 Sealing strip top      3 Hexagon screws  
 2 Rubber pad              4 Sealing strip bottom

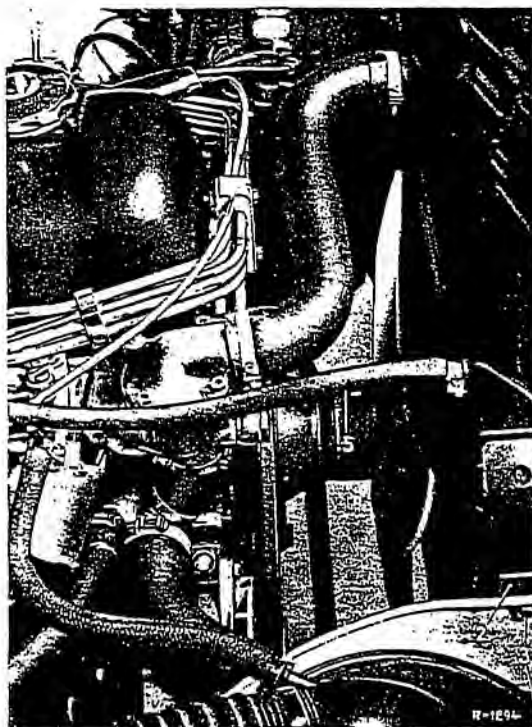


Fig. 50-1/4

Cooling water lines  
 230 SL

2 Rubber pad      3 Hexagon screws      5 Bleeder hose

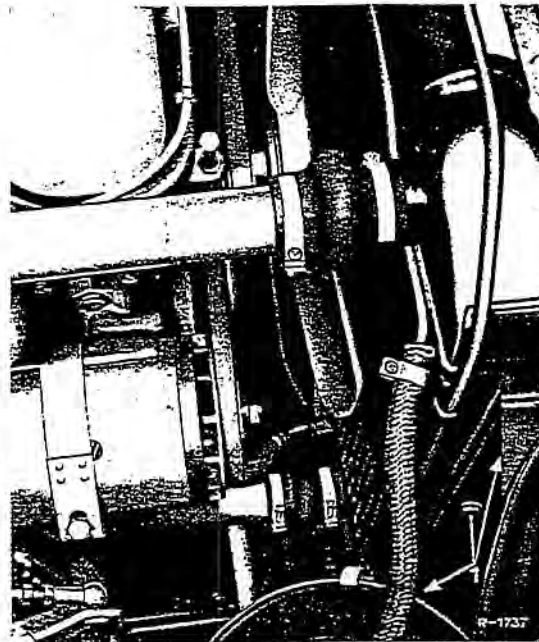


Fig. 50-1/5

Cooling water lines  
 300 SE

1 Fixing screws

5. Unscrew the side fixing screws (Figs. 50-1/2 to 5). On Model 230 SL the engine hood must be removed beforehand and the battery must be removed too. Remove the radiator upward.

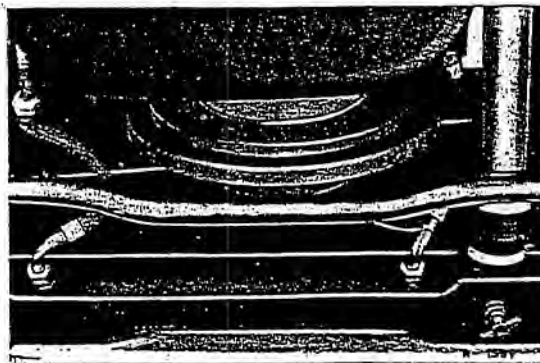


Fig. 50-1/6

Note: When repairs are carried out the 1st version of the lower cooling water line (Fig. 50-1/1) on Models 220 b, Sb, SEb should always be replaced by the 2nd version (Fig. 50-1/2). This makes for a more elastic connection between the engine and the radiator and provides for extra safety. Hardened cooling water hoses or hoses which have become spongy because of contact with oil should always be replaced. Always install hoses from our approved list.

**Installation:**

**Note:** Before installing the radiator, and this is particularly important when carrying out repairs on cars involved in an accident, always measure the inside diameter between the stiffening plates "B 1" at the bores and the width of the radiator "B 2" including the two rubber pads ("a") (Fig. 50-1/7).

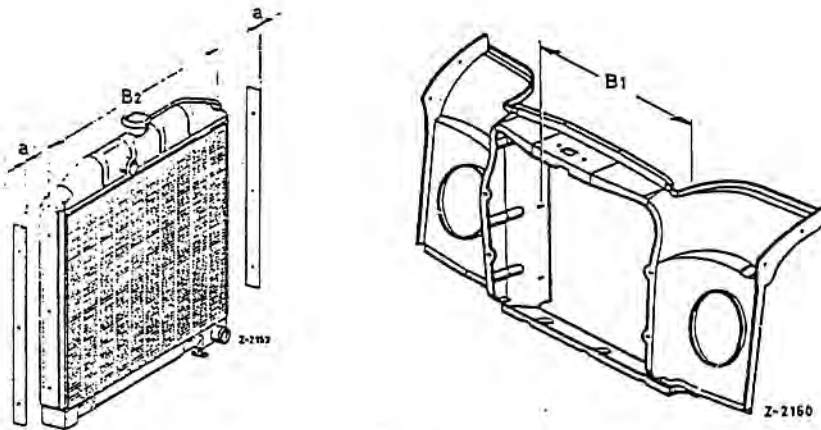
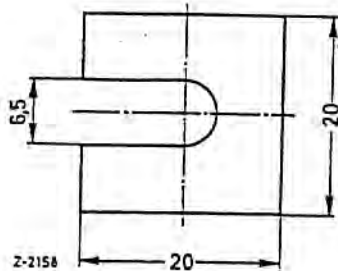


Fig. 50-1/7

If the dimension "B 1" between the stiffening plates is larger than the radiator block "B 2" including the two rubber pads "a", the radiator would be under stress when the hexagon screws are tightened. As a result the side fixing plates of the radiator may become detached at the soldering points which would lead to leaks. To prevent such leaks the difference must be compensated for by shims of the appropriate thickness. These shims can be made in the shop in accordance with the dimensions given in Fig. 50-1/8.



Thickness as required

Fig. 50-1/8

6. Install the radiator from above, at the same time inserting the cooling water hoses in the upper and lower pipe sockets. Care must be taken to ensure that the radiator ribs are not damaged by the fan.
7. Fasten the radiator to the stiffening plate, making sure that the side rubber pads and the upper and lower sealing strips are correctly positioned (Figs. 50-1/2 to 5).

If required insert shims between the rubber pad and the stiffening plate.

8. Check the distance between the fan front edge and the radiator and if necessary adjust (Fig. 50-1/9).

9. On cars with automatic DB transmission attach the hose connections to the transmission oil cooler (Fig. 50-1/6).

Model	Fan distance "a"
190 c 190 Dc 220 b 220 Sb 220 SEb	18 + 2
230 SL 300 SE	20 + 2

**Note:** Absolute cleanliness is of paramount importance whenever jobs are carried out on the transmission oil cooler.

- Attach the hose clamps for the cooling water hoses and on Model 230 SL attach the bleeder hose (5) (Fig. 50-1/4).

**Caution!** It is essential that the cooling water hoses should be bushed on the pipe unions of the radiator as far as they will go. The hose clamps should be attached in such a way that they are seated between the corrugation on the pipe union and the water tank.

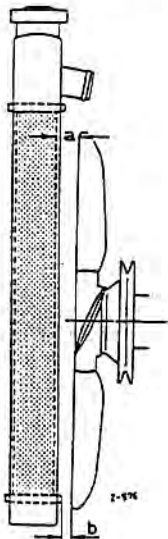


Fig. 50-1/9

- Switch the two heater control levers on the instrument panel to position "warm".
- Fill up slowly so that the air can escape.

The cooling water must be treated with additives as soon as the vehicle is put into operation for the first time. If this is not done scale and rust will form and these gradually decrease the efficiency of the cooling system.

- Run the engine for about 1 minute at a fast idle, leaving the radiator filler neck open.
- Reduce the idle to normal and slowly top up the cooling system as follows:

if the cooling water is cold, up to the marking plate which can be seen in the filler neck,

if the cooling water is hot, about 1 cm higher.

**Caution:** When the engine is hot, cold cooling water should only be poured into the radiator slowly and with the engine running; hot cooling water can be poured into the cold engine without any trouble.

- Make sure to screw on the correct radiator cap.

When screwing on the radiator cap screw it on as far as the stop (notch 2).

**Note:** The correct radiator cap is marked 100 on the top (Fig. 50-1/10), which means that the overpressure valve opens at 1 atm. and the vacuum valve at 0.1 atm. (Fig. 50-1/11).

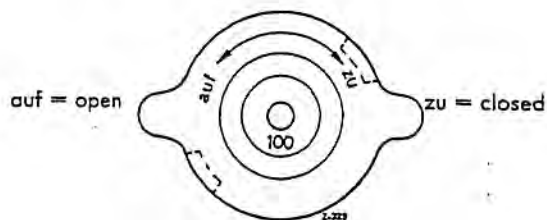


Fig. 50-1/10

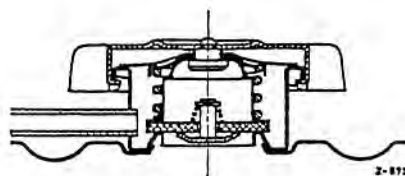


Fig. 50-1/11

- Check the hose connections, the radiator and the transmission oil cooler for leaks.



# Electrical System Groups 15/54/82

	Job No.
Electrical System (Test Values, Measurements and Tolerances)	15-0
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Connections at Fuse Box Model 190 Dc	
Connections at Fuse Box Model 220 b, 220 Sb	
Connections at Fuse Box Model 220 SEb Sedan	
Connections at Fuse Box Model 220 SEb Coupé B	
Circuit Diagram Model 190 c	
Circuit Diagram Model 190 Dc	
Circuit Diagram Models 220 b and 220 Sb, 1st version	
Circuit Diagram Models 220 b and 220 Sb, 2nd version	
Circuit Diagram Model 220 SEb Sedan, 1st version	
Circuit Diagram Model 220 SEb Sedan, 2nd version	
Circuit Diagram Model 220 SEb Coupé B	
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B. Description of the four switch positions	
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A. General	
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<b>Removal and Installation of Rotary Light Switch</b>	82-15
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# Electrical System

Test Values, Measurements and Tolerances

*Modification: Revised and supplemented*

Job No.
---------

15-0
------

## Starter

Model	Starter Bosch designation	Short-Circuit Test		Load Test		Speed rpm
		Current amp.	Voltage volts	Current amp.	Voltage volts	
190 c, 220 b, 220 Sb 230, 230 S	EF (R) 12 V 0, 8 PS 0 001 208 003	250—285	6	165—200	9	1100—1450
190 Dc, 200 Dc	JD (R) 12 V 1, 8 PS 0 001 354 064	670—750		310—350		1250—1450
200	EF(R) 12 V 0, 8 PS 0 001 208 025	250—285		165—200		1100—1450
250 S, 250 SE, 250 SL	EF(R) 12 V 0, 8 PS 0 001 208 026	250—285		165—200		1100—1450
300 SE, 300 SEb 300 SEL	GE(R) 12 V 1, 3 PS 000 130 70 19	500—550	7	270—310		1200—1400
230 SL	EF(R) 12 V 0, 8 PS 0 001 208 009	250—285	6	165—200		1100—1450

Model	Starter Bosch designation Bosch Part No.	Idling Test		Speed rpm	Minimum drawing voltage of solenoid switch	Adjusting dimension "a" (Fig. 15/1) mm
		Current amp.	Voltage volts			
190 c, 220 b, 220 Sb 230, 230 S	EF(R) 12 V 0, 8 PS 0 001 208 003	35—45	12	6400—7900	8	19 ± 0.1
190 Dc, 200 Dc	JD(R) 12 V 1, 8 PS 0 001 354 064	60—80	11.5	6000—7100		49.0 ± 0.2
200	EF(R) 12 V 0, 8 PS 0 001 208 025	35—45	12	6400—7900		19 ± 0.1
250 S, 250 SE, 250 SL	EF(R) 12 V 0, 8 PS 0 001 208 026	35—45	12	6400—7900		19 ± 0.1
300 SE, 300 SEb 300 SEL	EGE(R) 12 V 1, 3 PS 0 001 307 019	40—60	11.5	6500—8000		32.2 ± 0.1
230 SL	EF(R) 12 V 0, 8 PS 0 001 208 009	35—45	12	6400—7900		19 ± 0.1

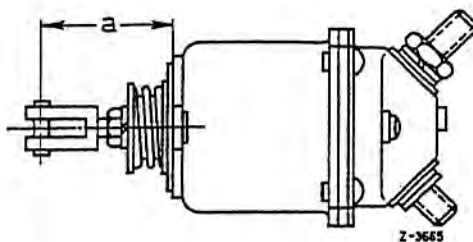


Fig. 15-0/1

\*a\* Adjusting dimension for solenoid switch with the linkage yoke drawn in

15-0/1

## Generator

Standard version	Generator Bosch designation Bosch Part No.	Setting load amp.	Rated voltage 12 volts without load rpm	Speed at performance test		Resistance value of exciter coil ohm	Associated regulator cut-out switch Bosch RS/...
				cold rpm	warm rpm		
190 c, 190 Dc 220 b, 220 Sb 220 SEb	LJ/GG 240/12/2400/AR 8 G 1 14 V 30 A 25 0 101 302 023	30	1700	2300	2500	4.8	UAA 240/12/43 0 190 309 002
300 SE 300 SEb 300 SEL	LJ/GK 300/12/1450/AR 53 K 1 14 V 38 A 15 0 101 402 076	38	1100	1450	1500	5.2	UAA 300/12/43 0 190 309 010
200, 200 D 230, 230 S 250 S, 250 SE 250 SL	K 1 14 V 35 A 20 0 120 400 504	Do not test alternator without regulator					AD 1/14/... ADN 1/14... <sup>1)</sup>
<b>Special Version</b>							
190 c, 190 Dc	LJ/GK 300/12/1450 AR 2 K 1 14 V 38 A 15 0 101 402 071	38	1100	1450	1500	5.2	UA 300/12/43 0 190 300 079

For electrical adjustment values observe the Bosch generator designation.

<sup>1)</sup> Suppressed version

### Three-Phase Generator K 1 $\longleftrightarrow$ 14 V 35 A 20

On the test stand the generator must always be driven via the fan belt pulley and together with the single-element voltage regulator AD 1/14... V or ADN 1/14... V.

#### Terminals:

- D +/61 : energizing diode output, junction for regulator D + and charging lamp
- DF : field winding input, junction for regulator DF
- B + : battery connection
- D- : ground, link to regulator D-

It may be that after a long period of disuse the generator does not automatically energize itself; for this reason a 12 V 2 W charging lamp must be connected between terminal D +/61 and terminal B + (see Fig. 15-0/2). The charging lamp will light up if the system does not function properly. When the engine is running the charging lamp must become completely extinguished.

#### Testing of Generator on Test Stand:

##### a) Checking Rated Voltage Speed

Connect voltmeter to terminal B +. Connect a 12 V 2 W charging lamp between terminals B +/61 and B +; battery not in circuit. Regulator connected the normal way. Increase speed until voltage reaches 14 V. Read off speed: specified value 800—900 rpm.

##### b) Checking Speed under Load

Connect up as under a). Close battery circuit; if necessary connect up load resistance. Increase speed and connect up load uniformly until 35 amps have been reached (at 14 volts). The speed attained must be between 2700 to 3700 rpm.

#### Testing of Regulator

Connect regulator to generator. Connect battery to B +, voltmeter between B + and ground. Increase speed to 4000 rpm. Adjust load current to 28—30 amps. Read off regulator voltage.

For values see table "Regulator" page 15-0/3.

#### Testing of Generator with Regulator in Vehicle:

Connect voltmeter to B + und D-. Connect ammeter to charging cable and load resistance in parallel to battery (Fig. 15-0/3). Start engine and increase speed to a constant 2000—2500 rpm. Use sliding contact of load resistance to adjust load current and read off voltage. For values see table "Regulator" page 15-0/3.

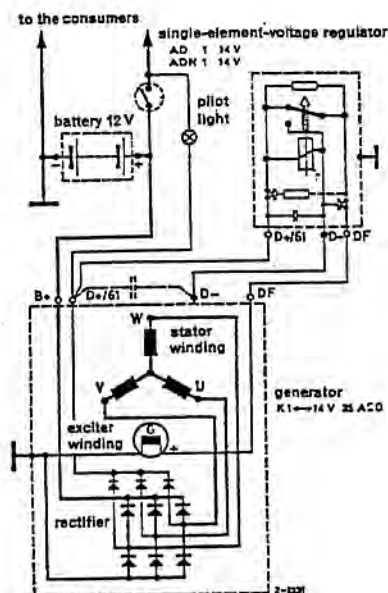


Fig. 15-0/2

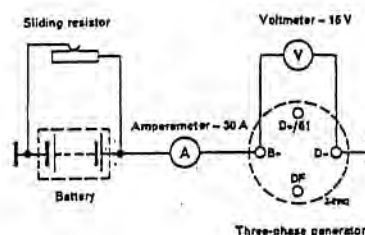


Fig. 15-0/3

## Regulator Cut-Out Switch

Regulator cut-out switch standard version Bosch designation Bosch Part No.	Switch adjustment data		Regulating voltage without load volts	Regulator adjustment data Load at double rated speed of generator Starting of regulator. amp.	
	Cut-in voltage volts	Return current amp.		cold	warm
UAA 240/12/43 0 190 309 002	12.5—13.2	5—11.5	13.5—14.5	29—33	27.5—32
UAA 300/12/43 0 190 309 010	12.5—13.2	5—11.5	13.5—14.5	37—41	35.5—40
<b>Special Version</b>					
UA 300/12/43 0 190 300 079	12.5—13.2	5—11.5	13.5—14.5	37—41	35.5—40
<b>Regulator for Three-Phase Generator</b>					
Bosch designation Bosch Part No.	Regulating voltage volts	Return current amp.	Generator speed rpm	Load current amp.	
AD (N) 1/14 V 0 190 600 001 0 190 601 001 0 190 600 004 0 190 601 006 0 190 601 003 0 190 600 009	13.9—14.8	not applicable	4000	28—30	

## Contact Set

Bosch Part No.	Contact set		Distributor installed in engine types
	MB Part No.	Installed in Bosch distributor	
1237 013 007	000 158 07 90	0231 115 027/029 <sup>1)</sup> /052/053 <sup>1)</sup>	190 c, 190 c <sup>1</sup> , 200, 200 <sup>1)</sup>
		0231 116 034/037/038/040/042/046/048/052 <sup>2)</sup>	220 b, 220 Sb, 220 SEb, 230, 230 <sup>2)</sup> , 230 S, 230 S <sup>2)</sup> , 250 S, 250 S <sup>2)</sup>
1237 013 027	000 158 20 90	0231 115 060 <sup>2)</sup>	200 <sup>2)</sup>
		0231 116 047/051	250 SE, 250 SE <sup>1)</sup> , 250 SE <sup>2)</sup> , 250 SL, 250 SL <sup>2)</sup>
1237 013 038	000 158 19 90	0231 141 001/002	300 SE, 300 SEb, 300 SEL
1237 013 059	000 158 22 90	0231 115 065 <sup>2)</sup>	200 <sup>2)</sup>
1237 013 066	000 158 23 90	0231 115 064	200

<sup>1)</sup> For countries with low-octane fuel

<sup>2)</sup> For vehicles with exhaust gas purification

Note: Distributors with Bosch designation (second set of figures)

115 are installed in 4-cylinder engines  
116 and 141 are installed in 6-cylinder engines  
119 are installed in 8-cylinder engines

## Distributors

Model	Distributor	Contact pressure pond	Contact gap minimum mm	Angle of closure degrees	Automatic timing control range degrees
190 c 200	IFUR 4 0 231 115 052	400—530	0.4	$50^\circ \pm 2^\circ$	16—19
220 b, 220 Sb 230, 230 S 250 S	IFUR 6 0 231 116 048	500—630	0.3	$38^\circ \pm 3^\circ$ $1^\circ$	14.5—17.5
220 SEb	IFUR 6 0 231 116 042	500—630	0.3	$38^\circ \pm 3^\circ$ $1^\circ$	8.5—11.5
230 SL 250 SE, 250 SL	IFUR 6 0 231 116 051	500—630	0.3	$38^\circ \pm 3^\circ$ $1^\circ$	8—11
300 SE, 300 SEb 300 SEL	PFUR 6 0 231 141 002	400—500	0.3	$49^\circ \pm 2^\circ$	9—12

## Distributor

Model	Automatic timing control				Automatic vacuum control			
	Cut-in rpm	Speed at distributor shaft with timing angle			Cut-out rpm	Adjust- ment range degrees	Cut-in mm Hg	Cut-out mm Hg
		5° rpm	10° rpm	15° rpm				
190 c, 200	180—350	400—550	600—900	1550—2050	2250	6—9	60—145	310
220 b, 220 Sb 230, 230 S 250 S	200—350	350—550	600—900	1900—2400	2400	3.5—6.5	80—180	350
220 SEb	300—450	550—750	900—1150		800—1250	4.5—7.5	85—155	200—420
230 SL, 250 SE 250 SL	400—600	700—950	—1100	1200	1200	4—7	80—125	300
300 SE, 300 SEb 300 SEL	200—350	270—550	—580		700—800	4—7	60—150	270

## Ignition Coil

Model	Bosch Part No.	Spark length mm	Primary current amp. at spark length	Series resistance ohm
190 c, 200	K 12 V 0 221 102 001	14	1.4	3.1—3.6
220 SEb, 230 SL	KW 12 V 0 221 102 004	14	2.1	1.8—1.9
220 b, 220 Sb 300 SE	KW 12 V 0 221 102 006	14	1.7	2.0—2.35
230, 230 S, 250 S, 250 SE 250 SL, 300 SEb, 300 SEL	KW 12 V 0 221 102 033			

## Battery

Model	220 b, 220 Sb 200, 230, 230 S 250 S	190 c, 220 b 220 Sb	220 SEb 230 SL, 250 SE 250 SL	190 Dc, 200 D 300 SE, 300 SEb 300 SEL	
Battery	Voltage volts	12			
	Capacity Ah	44	52	55—56	66
Acid level above top edge of separator or above acid level mark		5 mm			
Specific gravity of acid at 20° C or acid density	fully charged	1.28 (tropics 1.23)			
	semi-charged	1.21 (tropics 1.16)			
	discharged	1.14 (tropics 1.09)			
Charging current in amp.	initial charging	max. 5 %			
	ordinary recharging	max. 10 % of battery capacity			
	quick charging	up to 75 %			
Maximum temperature		40° C (tropics 50° C)			
Freezing point	fully charged	—68° C (tropics —40° C)			
	semi-charged	—40° C (tropics —13° C)			
	discharged	—12° C (tropics —6° C)			

Note: The separators are approx. 10 mm higher than the plates

## Bulbs

Model		all models
Operating voltage	volts	12
Main headlights	watts	45/40
Fog lights	watts	35
Parking light	watts	4
Reversing light	watts	15
Tail light	watts	5
Brake light	watts	15
Flash signal	watts	18
License plate light	watts	10
Instrument and pilot lights	watts	2
Clearance light	watts	3 <sup>1)</sup>
Interior lighting	watts	10

<sup>1)</sup> On Models 190 c and 190 Dc the front clearance lights are 2 watts.

### Connections at Fuse Box, Model 190 c

Fuse No.	Fuse element amp.	Lead	Consumer units	Remarks
1	8	30	Reading lights, clearance lights electric clock (socket)	Permanently live circuit
2	25	54	Wipers 1st horn, cigar lighter (2nd and 3rd horn, horn relay)	Can be switched off by ignition starter switch in steering lock
3	8	54	Free for optional extra	
4	8	54	Flash signal system, stop light, reversing light, fuel level indicator mechanism, fuel reserve gage, pilot light for choke control	
5	8	54	Defroster blower	
6	8	54	Upper beam flash signal	
7	8	58	Tail light right, parking light right, license plate light right, instrument lighting	
8	8	58	Tail light left, parking light left, license plate light left (fog lights)	
9	8	56a	Upper beam right, upper beam pilot light	Can be switched off by foot dimmer switch
10	8	56a	Upper beam left	
11	8	56b	Lower beam right	
12	8	56b	Lower beam left	

The consumer units in brackets are optional and are installed only if ordered specially.



### Connections at Fuse Box, Model 190 Dc

Fuse No.	Fuse element amp.	Lead	Consumer units	Remarks
1	8	30	Reading lights, clearance lights, electric clock (socket)	Permanently live circuit
2	25	54	Wipers, 1st horn, cigar lighter (2nd and 3rd horn, horn relay)	Can be switched off by ignition starter switch in steering lock
3	8	54	Free for optional extra	
4	8	54	Flash signal system, stop light, reversing light, fuel level indicator mechanism, fuel reserve gage	
5	8	54	Defroster blower	
6	8	54	Upper beam flash signal	
7	8	58	Tail light right, parking light right, license plate light right, instrument lighting	
8	8	58	Tail light left, parking light left, license plate light left (fog lights)	
9	8	56a	Upper beam right, upper beam pilot light	Can be switched off by foot dimmer switch
10	8	56a	Upper beam left	
11	8	56b	Lower beam right	
12	8	56b	Lower beam left	

The consumer units in brackets are optional and are installed only if ordered specially.

### Connections at Fuse Box, Models 220 b, 220 Sb

Fuse No.	Fuse element amp.	Lead	Consumer units	Remarks
1	8	30	Roof light, reading light, clearance lights, electric clock, socket	Permanently live circuit
2	25	54	Wipers, windshield washer, 1st and 2nd horn, cigar lighter (3rd horn and horn relay)	Can be switched off by ignition starter switch in steering lock
3	8	54	Free for optional extra	
4	8	54	Flash signal system, stop light, reversing light, fuel level indicator mechanism, fuel reserve gage, pilot light for choke control	
5	8	54	Defroster blower	
6	8	54	Upper beam flash signal	
7	8	58	Tail light right, parking light right, license plate light right, instrument lighting	
8	8	58	Tail light left, parking light left, license plate light left, fog lights left and right	
9	8	56a	Upper beam right, upper beam pilot light	Can be switched off by foot dimmer switch
10	8	56a	Upper beam left	
11	8	56b	Lower beam right	
12	8	56b	Lower beam left	

The consumer units in brackets are optional and are installed only if ordered specially.

### Connections at Fuse Box, Model 220 SEb Sedan

Fuse No.	Fuse element amp.	Lead	Consumer units	Remarks
1	8	30	Roof light, reading light, clearance lights, electric clock, socket	Permanently live circuit
2	25	54	Wipers, windshield washer, 1st and 2nd horn, cigar lighter (3rd horn and horn relay)	Can be switched off by ignition starter switch in steering lock
3	8	54	Free for optional extra	
4	8	54	Fuel feed pump	
5	8	54	Flash signal system, stop light, reversing light, fuel level indicator mechanism, fuel reserve gage, idle increase	
6	25	54	Automatic starter aid, electro-magnet starter valve, upper beam flash signal, defroster blower	
7	8	58	Tail light right, parking light right, license plate light right, instrument lighting	Can be switched off by rotary light switch
8	8	58	Tail light left, parking light left, license plate light left, fog lights left and right	
9	8	56a	Upper beam right, upper beam pilot light	Can be switched off by foot dimmer switch
10	8	56a	Upper beam left	
11	8	56b	Lower beam right	
12	8	56b	Lower beam left	

The consumer units in brackets are optional and are installed only if ordered specially.

### Connections at Fuse Box, Model 220 SEb Coupé B

Fuse No.	Fuse element amp.	Lead	Consumer units	Remarks
1	8	30	Roof light, reading light, clearance lights, electric clock, socket, glove compartment light	Permanently live circuit
2	25	54	Wipers, windshield washer, 1st and 2nd horn, cigar lighter (3rd horn and horn relay)	Can be switched off by ignition starter switch in steering lock
3	8	54	Free for optional extra	
4	8	54	Fuel feed pump	
5	8	54	Flash signal system, stop light, reversing light, fuel level indicator mechanism, fuel reserve gage (idle increase, automatic DB transmission)	
6	25	54	Automatic starter aid, electro-magnetic starting valve, upper beam flash signal, defroster blower	
7	8	58	Tail light right, parking light right, license plate light right, instrument lighting	Can be switched off by rotary light switch
8	8	58	light left, fog lights left and right Tail light left, parking light left, license plate	
9	8	56a	Upper beam right, upper beam pilot light	Can be switched off by foot dimmer switch
10	8	56a	Upper beam left	
11	8	56b	Lower beam right	
12	8	56b	Lower beam left	

The consumer units in brackets are optional and are installed only if ordered specially.

## Circuit Diagram 190 c

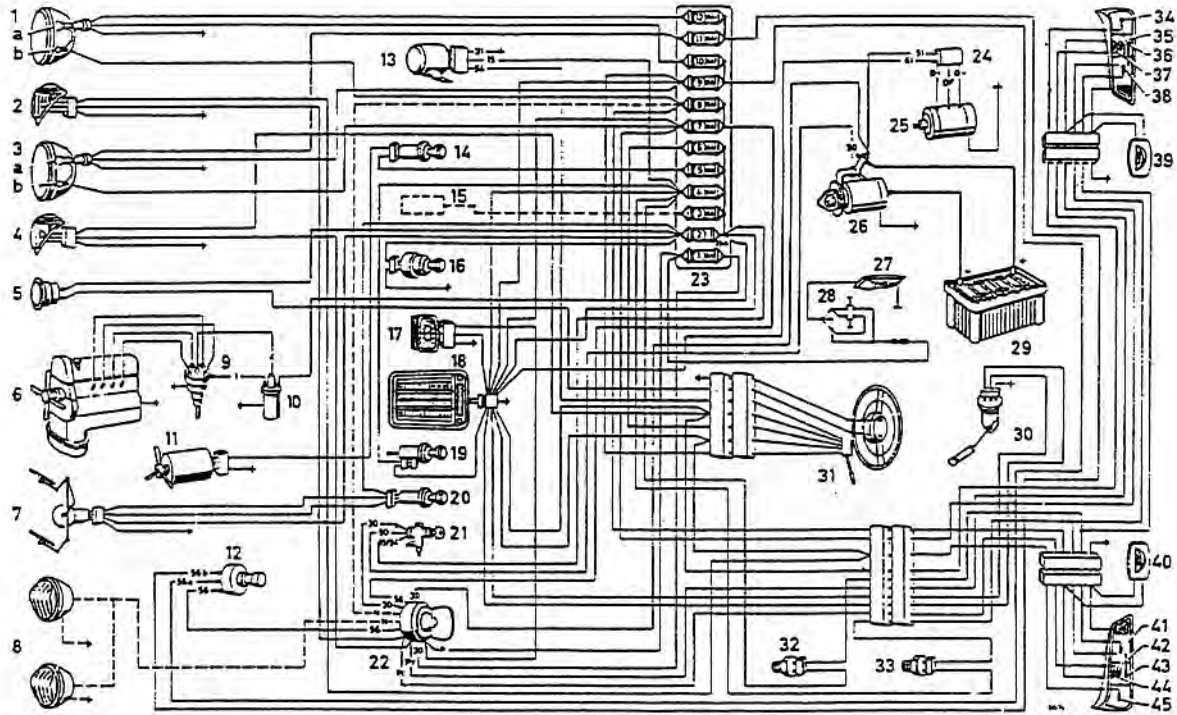


Fig. 15-0/1a

- |   |   |   |
|---|---|---|
| <p>1 a Headlight left, upper beam and lower beam</p> <p>1 b Headlight left, parking light</p> <p>2 Clearance and flash signal lights left</p> <p>3 a Headlight right, upper beam and lower beam</p> <p>3 b Headlight right, parking light</p> <p>4 Clearance and flash signal lights right</p> <p>5 Horn</p> <p>6 Engine</p> <p>7 Windshield wiper</p> <p>8 Fog light (optional extra)</p> <p>9 Distributor</p> <p>10 Ignition coil</p> <p>11 Heater blower motor</p> <p>12 Foot dimmer switch</p> <p>13 Flash signal mechanism</p> | <p>14 Heater blower switch</p> <p>15 Free for optional extra</p> <p>16 Cigar lighter</p> <p>17 Clock</p> <p>18 Instrument cluster</p> <p>19 Choke control</p> <p>20 Windshield wiper switch</p> <p>21 Ignition starter switch</p> <p>22 Light switch with additional positions for clearance light and pull switch for fog lights</p> <p>23 Fuses</p> <p>24 Regulator</p> <p>25 Generator</p> <p>26 Starter</p> <p>27 Reading light</p> <p>28 Door contact switch</p> <p>29 Battery</p> | <p>30 Fuel level indicator</p> <p>31 Flash signal switch with upper beam flash signal switch</p> <p>32 Stop light switch</p> <p>33 Reversing light switch</p> <p>34 Flash signal right</p> <p>35 Clearance light right</p> <p>36 Reversing light right</p> <p>37 Tail light right</p> <p>38 Stop light right</p> <p>39 License plate light right</p> <p>40 License plate light left</p> <p>41 Stop light left</p> <p>42 Tail light left</p> <p>43 Reversing light left</p> <p>44 Clearance light left</p> <p>45 Flash signal left</p> |
|---|---|---|

## Circuit Diagram 190 Dc

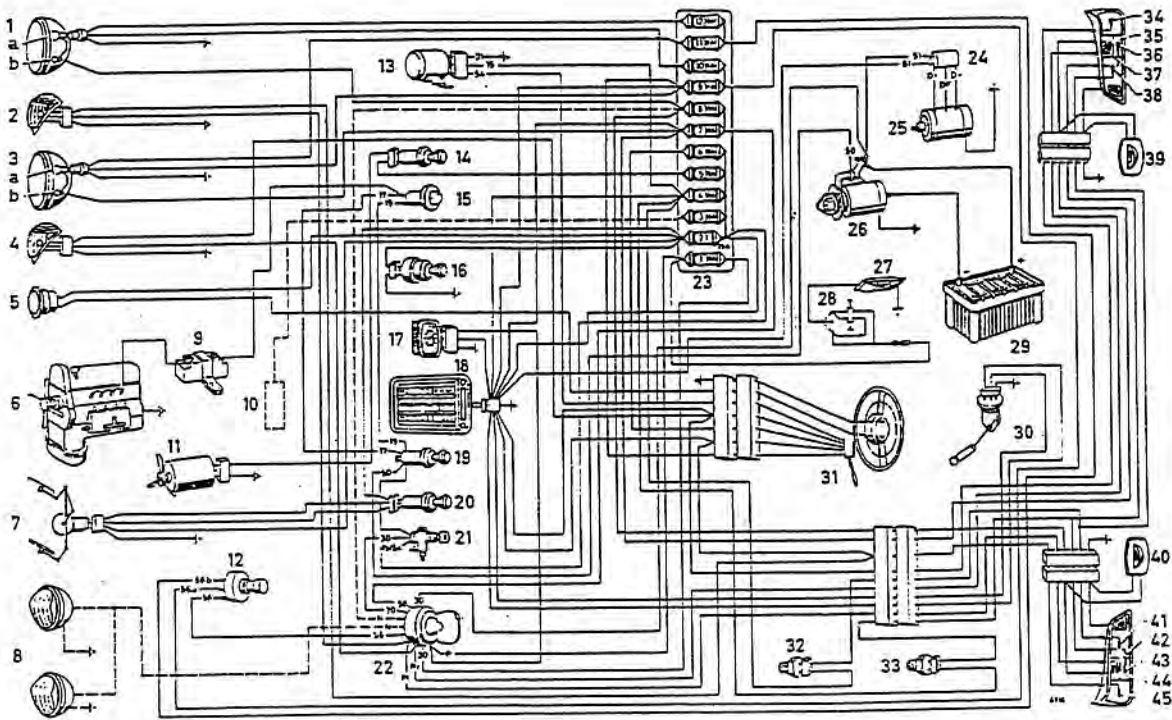


Fig. 15-0/1b

- |  |  |   |
|--|--|---|
| <p>1a Headlight left, upper beam and lower beam</p> <p>1b Head light left, parking light</p> <p>2 Clearance and flash signal lights left</p> <p>3a Headlight right, upper beam and lower beam</p> <p>3b Headlight right, parking light</p> <p>4 Clearance and flash signal lights right</p> <p>5 Horn</p> <p>6 Engine</p> <p>7 Windshield wiper</p> <p>8 Fog light (optional extra)</p> <p>9 Glow plug resistance</p> <p>10 Free for optional extra</p> <p>11 Heater blower motor</p> <p>12 Foot dimmer switch</p> | <p>13 Flash signal mechanism</p> <p>14 Heater blower switch</p> <p>15 Glow plug indicator resistor</p> <p>16 Cigar lighter</p> <p>17 Clock</p> <p>18 Instrument cluster</p> <p>19 Glow plug starter switch</p> <p>20 Windshield wiper switch</p> <p>21 Steering lock</p> <p>22 Light switch with additional positions for clearance light and pull switch for fog lights</p> <p>23 Fuses</p> <p>24 Regulator</p> <p>25 Generator</p> <p>26 Starter</p> <p>27 Reading light</p> <p>28 Door contact switch</p> | <p>29 Battery</p> <p>30 Fuel level indicator</p> <p>31 Flash signal switch with upper beam flash signal switch</p> <p>32 Stop light switch</p> <p>33 Reversing light switch</p> <p>34 Flash signal right</p> <p>35 Clearance light right</p> <p>36 Reversing light right</p> <p>37 Tail light right</p> <p>38 Stop light right</p> <p>39 License plate light right</p> <p>40 License plate light left</p> <p>41 Stop light left</p> <p>42 Tail light left</p> <p>43 Reversing light left</p> <p>44 Clearance light left</p> <p>45 Flash signal left</p> |
|--|--|---|

# Circuit Diagram 220 b and 220 Sb

1st version

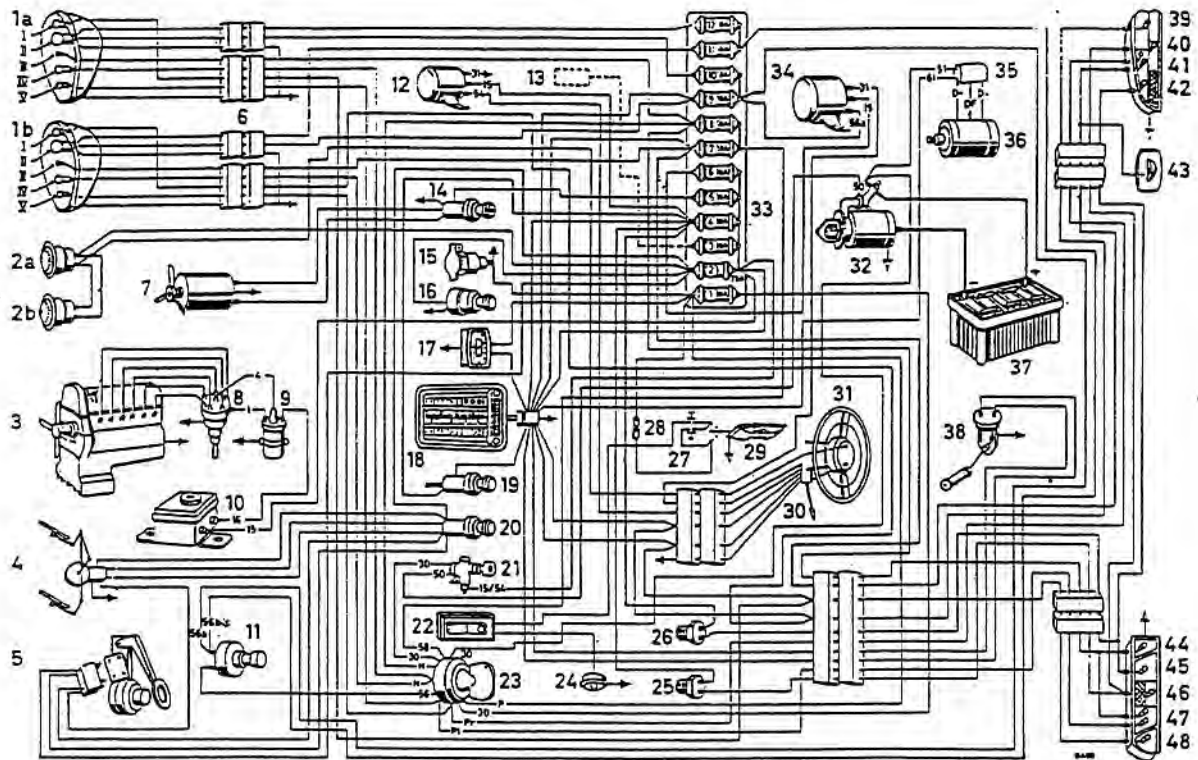


Fig. 15-0/2

- |   |   |   |
|---|---|---|
| 1 a Lighting unit left                        | 9 Ignition coil   | 29 Reading light                                    |
| I Flash signal light                          | 10 Series resistance  | 30 Flash signal switch and upper beam signal switch |
| II Upper beam and lower beam                  | 11 Foot dimmer switch   | 31 Steering wheel with horn ring                    |
| III Parking light                             | 12 Flash signal mechanism   | 32 Starter  |
| IV Fog light                                  | 13 Automatic clutch (optional)  | 33 Fuses  |
| V Clearance light                             | 14 Heater blower switch   | 34 Upper beam flash mechanism                       |
| 1 b Lighting unit right                       | 15 Socket   | 35 Regulator  |
| I Flash signal light                          | 16 Cigar lighter  | 36 Generator  |
| II Upper beam and lower beam                  | 17 Clock  | 37 Battery  |
| III Parking light                             | 18 Instrument cluster   | 38 Fuel level indicator                             |
| IV Fog light                                  | 19 Choke control  | 39 Flash signal right                               |
| V Clearance light                             | 20 Windshield wiper switch  | 40 Reversing light right                            |
| 2 a Horn right                                | 21 Ignition starter switch  | 41 Clearance light and tail light right             |
| 2 b Horn left                                 | 22 Roof light switch (220 Sb)   | 42 Stop light right                                 |
| 3 Engine                                      | 23 Rotary light switch with positions for clearance light left and right and pull switch for fog lights | 43 License plate light right                        |
| 4 Windshield wiper, two-stage                 | 24 Roof light   | 44 License plate light left                         |
| 5 Foot pump with switch for windshield washer | 25 Reversing light switch   | 45 Stop light left                                  |
| 6 Plug connections                            | 26 Stop light switch  | 46 Reversing light left                             |
| 7 Heater blower motor                         | 27 Door contact switch  | 47 Tail and clearance light left                    |
| 8 Distributor                                 | 28 Plug connections   | 48 Flash signal left                                |

# Circuit Diagram for Models 220 b and 220 Sb

2nd Version\*

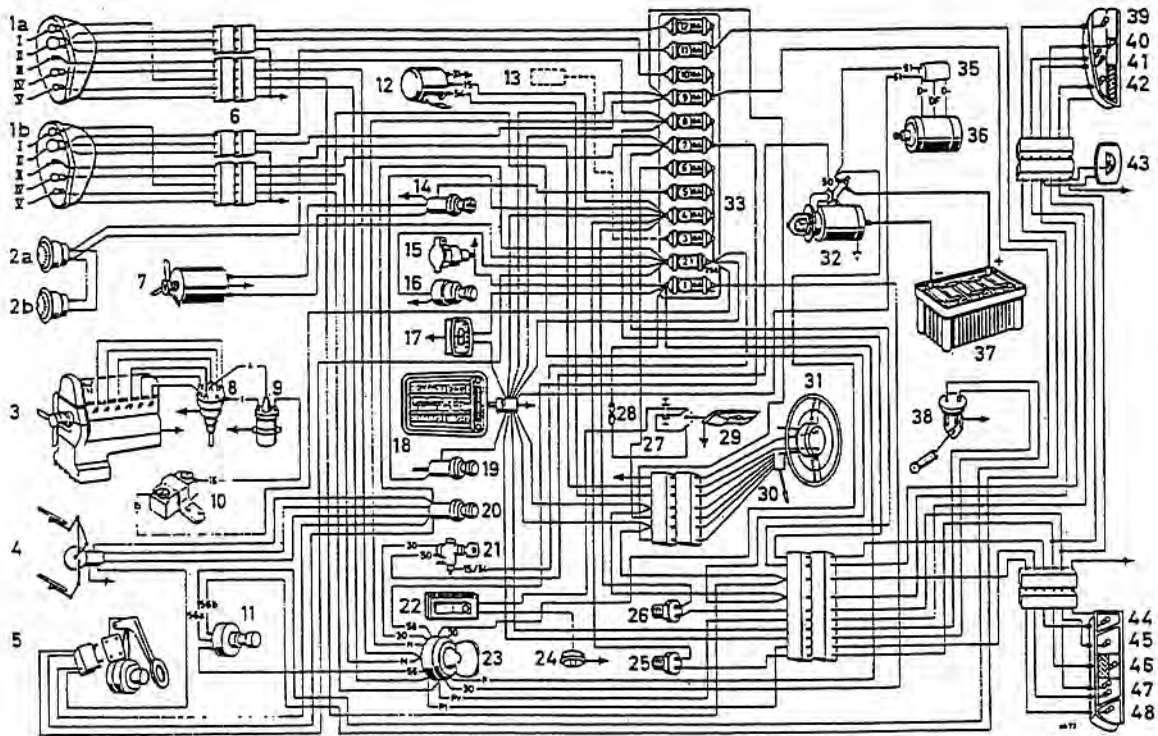


Fig. 15-0/3

- 1a Lighting unit left
  - I Flash signal light
  - II Upper beam and lower beam
  - III Parking light
  - IV Fog light
  - V Clearance light
- 1b Lighting unit right
  - I Flash signal light
  - II Upper beam and lower beam
  - III Parking light
  - IV Fog light
  - V Clearance light
- 2a Horn right
- 2b Horn left
- 3 Engine
- 4 Windshield wiper (two-stage in 220 S)
- 5 Fuel pump for windshield washer with switch for windshield wiper
- 6 Plug connections
- 7 Heater blower motor
- 8 Distributor

- 9 Ignition coil
- 10 Series resistance
- 11 Foot dimmer switch
- 12 Flash signal mechanism
- 13 Free for optional extra
- 14 Heater blower switch
- 15 Socket
- 16 Cigar lighter
- 17 Clock
- 18 Instrument cluster
- 19 Choke control
- 20 Windshield wiper switch
- 21 Steering lock
- 22 Roof light switch (only Model 220 S)
- 23 Light switch with additional positions for clearance light and pull switch for fog lights
- 24 Roof light (only Model 220 S)
- 25 Reversing light switch
- 26 Stop light switch
- 27 Door contact switch

- 28 Plug connection
  - 29 Reading light
  - 30 Flash signal switch and upper beam flash signal switch
  - 31 Steering wheel with horn ring
  - 32 Starter 12 volts
  - 33 Fuses
  - 35 Regulator
  - 36 Generator 12 volts
  - 37 Battery 12 volts
  - 38 Fuel level indicator
- Arrangement
- Model 220
    - 39 Flash signal right
    - 40 Reversing light right
    - 41 Clearance light and tail light right
    - 42 Stop light right
    - 43 License plate light right
  - Model 220 S
    - 44 License plate light left
    - 45 Stop light left
    - 46 Reversing light left
    - 47 Tail and clearance light left
    - 48 Flash signal left



# Circuit Diagram for Models 220 b and 220 Sb

1st Version\*

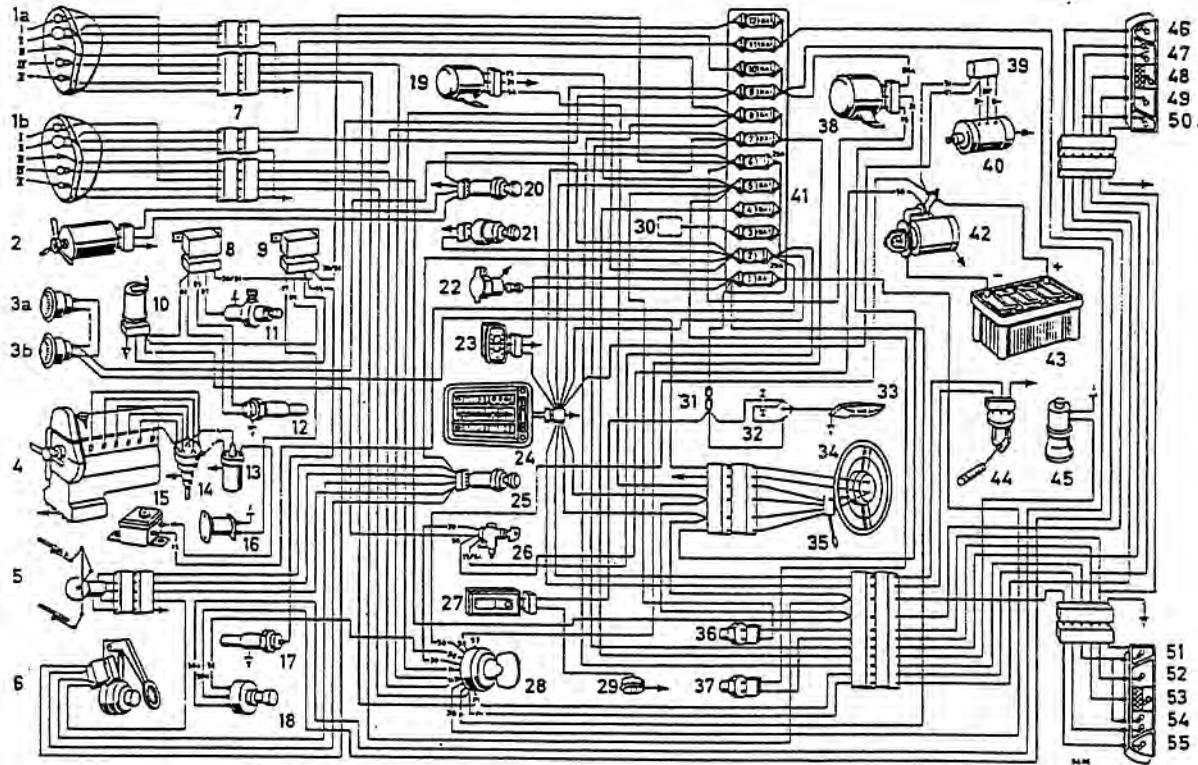


Fig. 15-0/4

- |  |  |   |
|--|--|---|
| 1a Lighting unit left                        | 10 Time switch                         | 33 Reading light  |
| I Flash signal light                         | 11 Electro-magnetic starting valve     | 34 Steering wheel with horn ring                          |
| II Upper beam and lower beam                 | 12 Thermo time switch                  | 35 Flash signal switch and upper beam flash signal switch |
| III Parking light                            | 13 Ignition coil                       | 36 Stop light switch                                      |
| IV Fog light                                 | 14 Distributor                         | 37 Reversing light switch                                 |
| V Clearance light                            | 15 Series resistance for ignition coil | 38 Beam flash signal                                      |
| 1b Lighting unit right                       | 16 Magnet for mixture control          | 39 Regulator (Lima)                                       |
| I Flash signal light                         | 17 Thermo switch                       | 40 Generator  |
| II Upper beam and lower beam                 | 18 Foot dimmer switch                  | 41 Fuses  |
| III Parking light                            | 19 Flash signal mechanism              | 42 Starter  |
| IV Fog light                                 | 20 Switch for heater blower motor      | 43 Battery  |
| V Clearance light                            | 21 Cigar lighter                       | 44 Fuel level indicator                                   |
| 2 Heater blower motor                        | 22 Socket                              | 45 Electric fuel feed pump                                |
| 3a Horn right                                | 23 Electric clock                      | 46 Flash signal right                                     |
| 3b Horn left                                 | 24 Instrument cluster                  | 47 Tail light and clearance light right                   |
| 4 Spark plugs (engine)                       | 25 Windshield wiper switch             | 48 Reversing light right                                  |
| 5 Windshield wiper                           | 26 Steering lock                       | 49 Stop light right                                       |
| 6 Foot pump and switch for windshield washer | 27 Roof light switch                   | 50 License plate light right                              |
| 7 Plug connection                            | 28 Rotary light switch                 | 51 License plate light left                               |
| 8 Relay for electromagnetic starting valve   | 29 Roof light                          | 52 Stop light left  |
| 9 Relay for automatic starter aid            | 30 Free for optional extra             | 53 Reversing light left                                   |
|  | 31 Plug connection                     | 54 Tail light and clearance light left                    |
|  | 32 Door contact switch left and right  | 55 Flash signal left                                      |

# Circuit Diagram for Model 220 SEb Sedan

2nd Version\*

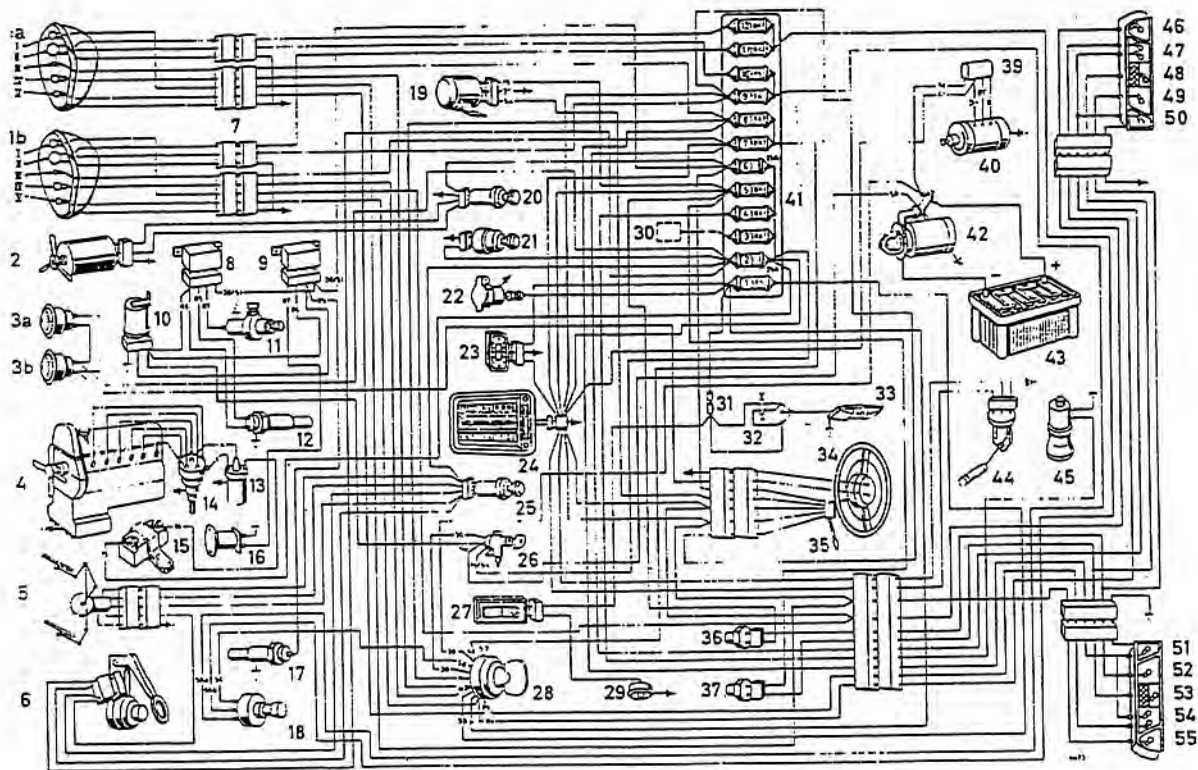


Fig. 15-0/5

- 1a Lighting unit left
  - I Flash signal light
  - II Upper beam and lower beam
  - III Parking light
  - IV Fog light
  - V Clearance light
- 1b Lighting unit right
  - I Flash signal light
  - II Upper beam and lower beam
  - III Parking light
  - IV Fog light
  - V Clearance light
- 2 Heater blower motor
- 3a Horn right
- 3b Horn left
- 4 Spark plugs (engine)
- 5 Windshield wiper, two-stage
- 6 Foot pump and switch for windshield washer
- 7 Plug connection
- 8 Relay for electromagnctic starting valve
- 9 Relay for automatic starter aid

- 10 Time switch (delay switch)
- 11 Electro-magnctic starting valve
- 12 Thermo time switch
- 13 Ignition coil
- 14 Distributor
- 15 Series resistance for ignition coil
- 16 Magnet for mixture control
- 17 Thermo switch
- 18 Foot dimmer switch
- 19 Flash signal mechanism
- 20 Switch for heater blower motor
- 21 Cigar lighter
- 22 Socket
- 23 Electric clock
- 24 Instrument cluster
- 25 Windshield wiper switch
- 26 Steering lock
- 27 Roof light switch
- 28 Rotary light switch
- 29 Roof light
- 30 Free for optional extra
- 31 Plug connection
- 32 Door contact switch left and right

- 33 Reading light
- 34 Steering wheel with horn ring
- 35 Flash signal switch and upper beam flash signal switch
- 36 Stop light switch
- 37 Reversing light switch
- 39 Regulator (Lima)
- 40 Generator
- 41 Fuses
- 42 Starter
- 43 Battery
- 44 Fuel level indicator
- 45 Electric fuel feed pump
- 46 Flash signal right
- 47 Tail light and clearance light right
- 48 Reversing light right
- 49 Stop light right
- 50 License plate light right
- 51 License plate light left
- 52 Stop light left
- 53 Reversing light left
- 54 Tail light and clearance light left
- 55 Flash signal left

## Circuit Diagram for Model 220 SEb Coupé B \*

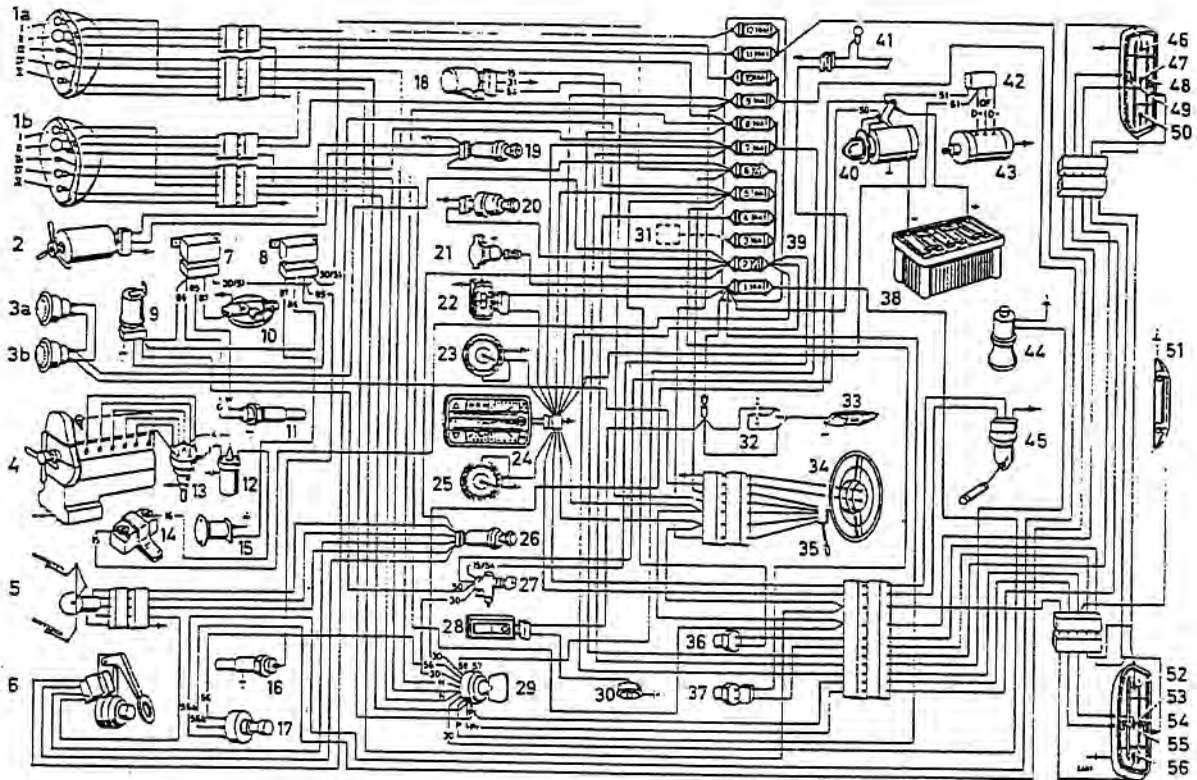
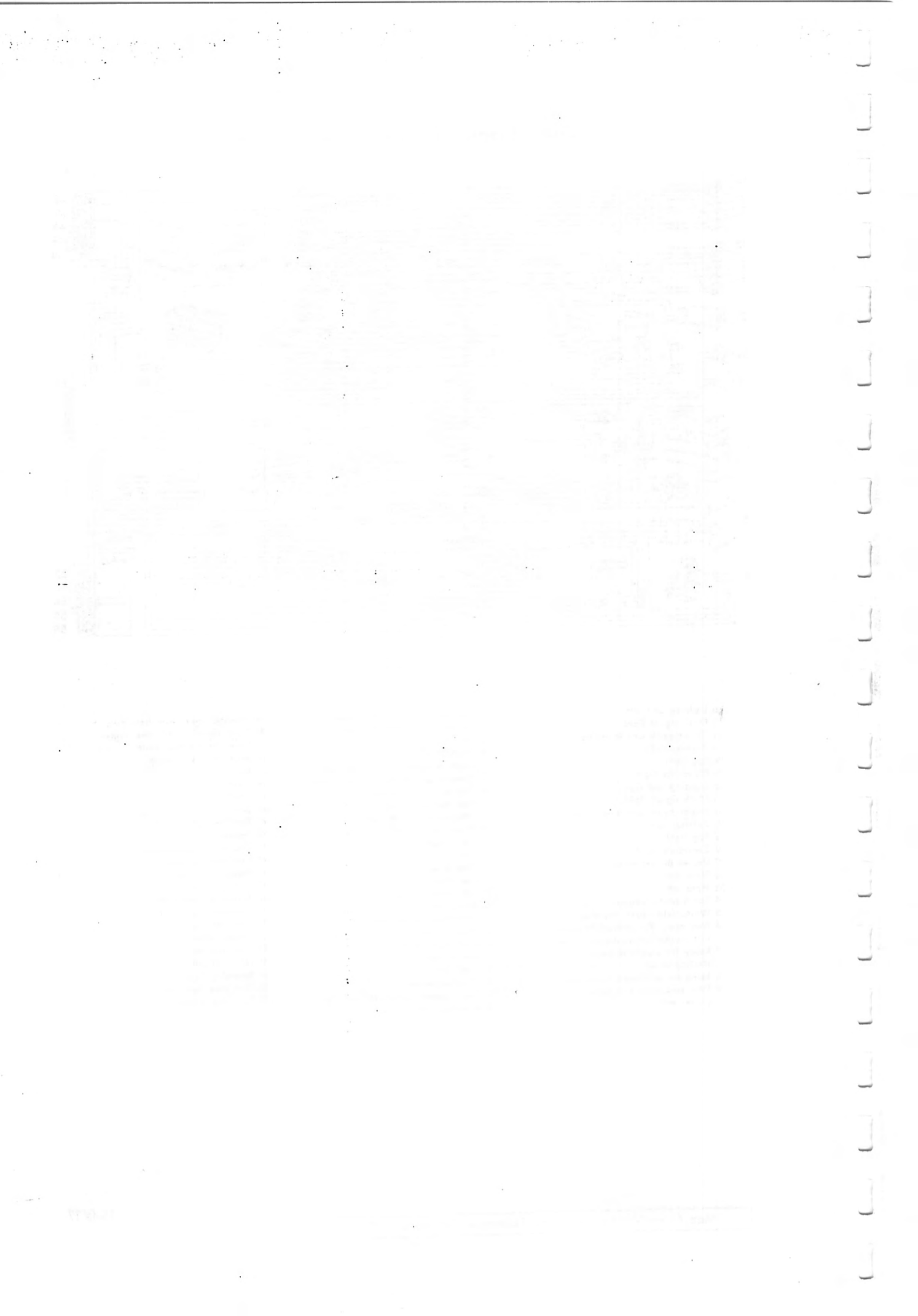


Fig. 15-0/6

- 1a Lighting unit left
  - I Flash signal light
  - II Upper beam and lower beam
  - III Parking light
  - IV Fog light
  - V Clearance light
- 1b Lighting unit right
  - I Flash signal light
  - II Upper beam and lower beam
  - III Parking light
  - IV Fog light
  - V Clearance light
- 2 Heater blower motor
- 3a Horn right
- 3b Horn left
- 4 Spark plugs (engine)
- 5 Windshield wiper, two-stage
- 6 Foot pump for windshield washer with switch for windshield wiper
- 7 Relay for electromagnetic starting valve
- 8 Relay for automatic starter aid
- 9 Time switch for automatic starter aid

- 10 Electro-magnetic starting valve
- 11 Thermo time switch (for para 10)
- 12 Ignition coil
- 13 Distributor
- 14 Series resistance for ignition coil
- 15 Solenoid switch for mixture control
- 16 Thermo switch (for para 15)
- 17 Foot dimmer switch
- 18 Flash signal mechanism
- 19 Blower switch with pilot light
- 20 Cigar lighter
- 21 Socket
- 22 Electric clock
- 23 Speedometer
- 24 Instrument cluster
- 25 Revolution counter
- 26 Windshield wiper switch
- 27 Steering lock
- 28 Roof light switch
- 29 Rotary light switch
- 30 Roof light
- 31 Optional extra
- 32 Door contact switch left and right
- 33 Reading light

- 34 Steering wheel with horn ring
- 35 Flash signal switch and upper beam flash signal switch
- 36 Reversing light switch
- 38 Battery
- 39 Fuses
- 40 Starter
- 41 Glove compartment light
- 42 Regulator (generator)
- 43 Generator
- 44 Electric fuel feed pump
- 45 Fuel level indicator
- 46 Flash signal right
- 47 Tail light right
- 48 Reversing light right
- 49 Clearance light right
- 50 Stop light right
- 51 License plate light
- 52 Stop light left
- 53 Tail light left
- 54 Reversing light left
- 55 Clearance light left
- 56 Flash signal left



## Removal and Installation of Starter

Job No.

15-1

### Removal:

1. Disconnect the ground cable at the negative terminal of the battery.
2. Disconnect the control cable at terminal 50 of the solenoid switch, and the battery cable 30 and the cable 51 (charging cable from generator to battery) at the contact terminal (4) of the solenoid switch (3) (Fig. 15-1/1).
3. Screw out the nuts (7) of the starter fixing screws (8) and remove the ground cable (1) to the cowl (Fig. 15-1/1).
4. Pull out the starter from the fixing screws (8) and remove downward.

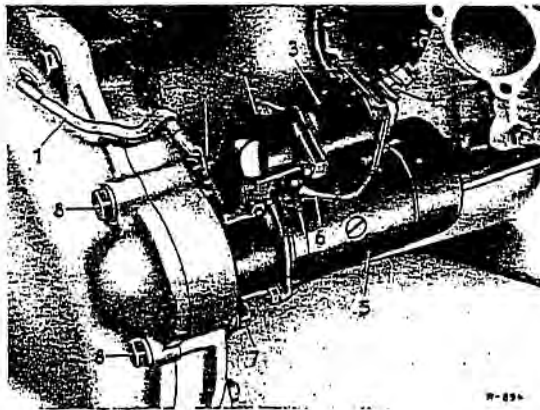


Fig. 15-1/1

- |                   |                    |
|-------------------|--------------------|
| 1 Ground cable    | 5 Starter          |
| 2 Hexagon screws  | 6 Connecting cable |
| 3 Solenoid switch | 7 Hexagon nut      |
| 4 Connecting bolt | 8 Hexagon screws   |

### Installation:

5. During installation pay attention to the following points:
  - a) Remember to attach the ground cable (1) to the cowl at the upper fixing screw.
  - b) The control cable must not be passed through the rubber cover cap of the battery cable since it will rub against the contact terminal for the battery cable and may become live. As a consequence the starter may be operated when the engine is running and may damage the starter gear rim. Therefore the control cable should be wound around cables 30 and 51 and should be connected directly to terminal 50.

## Removal and Installation of Solenoid Switch

### Removal:

1. Disconnect the ground lead at the negative terminal of the battery.
2. Remove the battery cable 30 and cable 51 at the contact terminal (4) of the solenoid switch (Fig. 15-2/1).  
Disconnect the control cable at terminal 50.

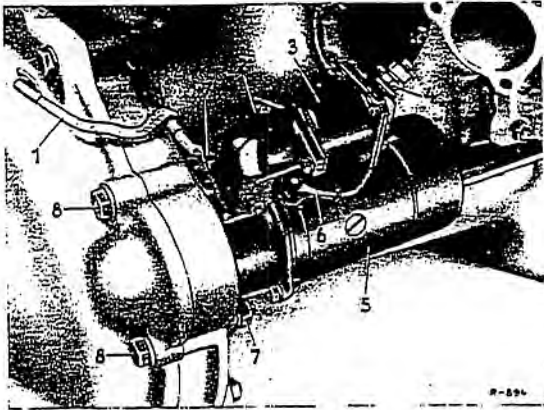


Fig. 15-2/1

- |                   |                    |
|-------------------|--------------------|
| 1 Ground strap    | 5 Starter          |
| 2 Hexagon screws  | 6 Connecting cable |
| 3 Solenoid switch | 7 Hexagon nut      |
| 4 Connecting bolt | 8 Hexagon screws   |

3. Loosen and remove the cable (6) from the field coil to the solenoid switch (Fig. 15-2/1).
4. Remove the two hexagon screws (2) at the drive bearing cover flange.
5. Disengage the solenoid switch from the actuating trigger and slide out the switch.

### Installation:

6. Check and if necessary, correct the adjustment dimension "a" at the solenoid switch.

When this is being done, the linkage yoke must be drawn in (for dimension and Fig. see Job No. 15-0, Section A).

After adjustment, the linkage yoke and counternut should be locked with a dab of Enamel FI 53 V 8.

7. The rest of the installation procedure is the reverse of the removal procedure.

# Trouble-Shooting Hints for the Starter

Job No.

15-6

Cause	Remedy
<b>Starter shaft fails to turn or turns too slowly when starter is switched on</b>	
<ol style="list-style-type: none"> <li>1. Battery discharged</li> <li>2. Battery defective</li> <li>3. Battery terminals loose, oxidised, or ground connection bad</li> <li>4. Starter terminals or brushes shorten to earth</li> <li>5. Carbon brushes not making proper contact with collector, sticking in their guides, worn, broken, oiled-up, or fouled</li> <li>6. Solenoid switch of starter damaged</li> <li>7. Excessive voltage drop in leads, damaged leads, loose contacts</li> </ol>	<ol style="list-style-type: none"> <li>1. Charge battery</li> <li>2. Check battery and if necessary, repair or replace</li> <li>3. Tighten terminals, clean terminals and clamps, and grease with acid-resisting grease</li> <li>4. Remove short</li> <li>5. Examine carbon brushes, and clean or replace; if necessary, clean guides in brush holder</li> <li>6. Replace solenoid switch</li> <li>7. Check starter leads and their contact terminals</li> </ol>
<b>Armature turns, but pinion fails to engage</b>	
<ol style="list-style-type: none"> <li>1. Pinion fouled</li> <li>2. Mesh damage to pinion or ring gear, burrs</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean pinion</li> <li>2. Remove burrs</li> </ol>
<b>When starter is switched on, armature turns until pinion is engaged, but then stops</b>	
<ol style="list-style-type: none"> <li>1. Battery insufficiently charged</li> <li>2. Carbon brush pressure inadequate</li> <li>3. Solenoid switch of starter out of order</li> <li>4. Excessive voltage drop in leads</li> </ol>	<ol style="list-style-type: none"> <li>1. Charge battery</li> <li>2. Examine carbon brushes, and clean or replace</li> <li>3. Replace solenoid switch</li> <li>4. Check leads and contact terminals</li> </ol>
<b>Starter continues to turn after the starter switch has been released</b>	
<p>Starter push-button switch fails to switch off, or solenoid switch is sticking</p>	<p>Immediately disconnect starter lead at battery or at starter. Repair or replace starter push-button switch or solenoid switch</p>
<b>Pinion does not engage, and starter spins freely at high speed</b>	
<p>Pinion or flywheel ring gear either very dirty or damaged; compression spring in solenoid switch weak or broken</p>	<p>Carefully clean pinion and ring gear or remove burrs on ring gear and on pinion (push vehicle backward and forward with gears engaged); replace compression spring in solenoid switch</p>
<b>Pinion engages, and starter begins to slip and rage</b>	
<p>Overrunning clutch slipping</p>	<p>Replace pinion and overrunning clutch as an assembly</p>

## Removal and Installation of Generator

### Removal:

1. Disconnect the ground cable at the negative terminal of the battery.
2. Disconnect the electric cables from the generator.
3. Loosen the two nuts (2) on the hexagon screws (1) of the generator mounting (Fig. 15-11/1).

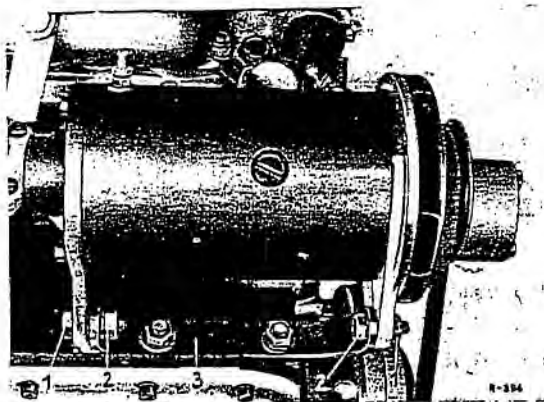


Fig. 15-11/1

- 1 Hexagon screw
- 2 Hexagon nut
- 3 Generator

4. Unscrew the nuts (1) and (2) from the tensioning screw (4) as far as it is necessary to be able to remove the Vee-belt (6) (Fig. 15-11/2).
5. Unscrew the nuts from the hexagon screws (1) on the generator support (3) (Fig. 15-11/1) and the fixing screw with clamping wedge from the tensioning screw (4) (Fig. 15-11/2) and remove the generator.

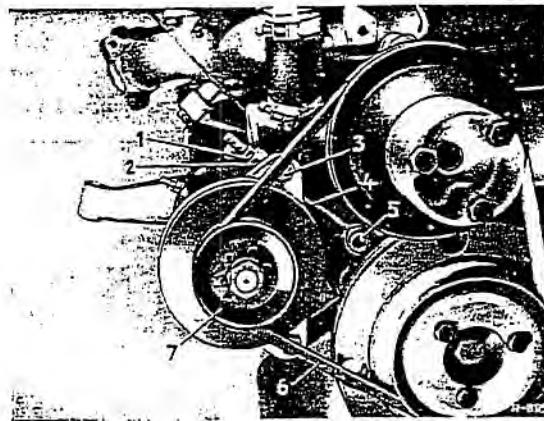


Fig. 15-11/2

- |                    |                   |
|--------------------|-------------------|
| 1 Lock nut         | 5 Socket screw    |
| 2 Clamp nut        | 6 Narrow Vee-belt |
| 3 Hexagon screw    | 7 Vee-pulley      |
| 4 Tensioning screw |                   |

### Installation:

6. During installation pay attention to the following points:
  - a) Before putting on the Vee-belt check the alignment of the pulleys.
  - b) The Vee-belt must be tensioned to such an extent that it can be pressed out of the straight by 5 mm to a maximum of 10 mm when moderate thumb pressure is applied.
  - c) When connecting the electric cables pay attention to the color coding. Connect: The black cable to terminal DF, the red cable to terminal D +, the brown cable to terminal D —.

If the cables are not connected correctly there may be pole reversal of the generator and consequently destruction of the regulator.



## Servicing Hints for Generator, with Generator removed from Vehicle

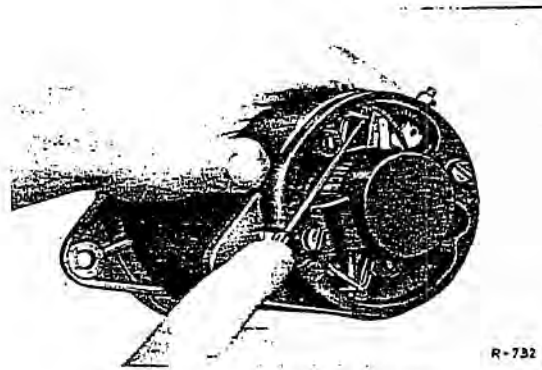
Job No.

15-12

The generator must be removed from the vehicle for servicing

### Carbon Brushes

The carbon brushes must be examined after 50,000 km unless the conditions in which the vehicle is operating (dust, dirt, etc.) require that the examination be carried out more frequently. The generator LJ/GG 240/12-2400 R 8 has a new brush holder design; the brush holders have been offset from the center and are no longer fastened to the collector bearing but to the armature housing. Insert a suitable screw driver under the carbon brush below the connecting wire and carefully push the brush upward until it engages in the gap between the brush holder and the armature housing. In this position the brush spring presses the carbon brush into an oblique position.



Checking the carbon brushes

Fig. 15-12/1

The brush and the brush holder must be free from dust, oil, and grease. If these parts are fouled or sticking and the brush does not make contact with sufficient pressure on the collector, they must be cleaned with a clean gasoline-soaked rag (not with cotton waste) and well dried. Never use emery paper, a knife or a file on the contact surface of the brush! Thoroughly blow out the brush holder with compressed air.

If a brush is broken, has come unsoldered or is worn to the point where either the spring or the stranded wire soldered into the brush is in danger of fouling the brush holder, it must be replaced. When inserting the brush, care must be taken to ensure that the spring does not strike hard against the brush. Always replace all brushes and only use the specified type for replacement!

### Collector

The condition of the surface of the collector is extremely important for the proper functioning of the generator. The surface of the collector should be uniformly smooth and grey-black in color; it must also be free from dust, oil, and grease. The collector must also run perfectly true and without radial deflection, since otherwise the carbon brushes will bounce in consequence of the high spots and will arc. Fouled collectors should be cleaned with a clean gasoline-soaked rag (not with cotton waste) and well dried. Scored and out-of-round collectors must be conditioned by precision-turning.

Under no circumstances must emery paper or a file be used on the collector.

### Lubrication

The generator is fitted with ball bearings (annular grooved bearings) which are provided with a grease reserve sufficient for their service life. No further lubrication is therefore necessary.

Job No.  
15-14

## Removal and Installation of Regulator Switch (Three-Element Voltage/Current Regulator)

### Removal:

1. Disconnect the ground cable at the negative terminal of the battery.
2. Disconnect the electric cables from the regulator (3), which is on the right wheel-arch, and unscrew the regulator from the bracket (2) (Fig. 15-14/1).

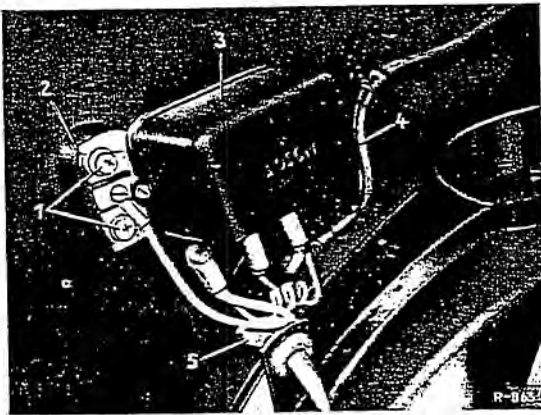


Fig. 15-14/1

- 1 Cross-recess head screws
- 2 Bracket
- 3 Voltage/current regulator
- 4 Cable sheaf from main wiring harness
- 5 Wiring harness from generator to regulator switch

**Note:** If any malfunction or defect is noticeable in the regulator it must always be replaced; no repairs to the regulator must be undertaken. Particular care must be taken to ensure that the regulator does not suffer any violent shocks.

### Installation:

3. When connecting the electric cables, pay attention to the color coding:

From the wiring harness from the generator to the regulator, connect:

the brown cable to the terminal D —,  
the black cable to the terminal DF,  
the red cable to the terminal D ÷ (61).

From the main wiring harness, connect:

the blue cable to the terminal D + (61),  
the red cable to the terminal B + (51).

**Note:** Be sure to connect cables to correct terminals. Incorrect connection of the terminals involves pole-reversal of the generator and results in the destruction of the regulator.

## Trouble Shooting Hints for the Generator

Job No.

15-17

When trouble occurs in the current supply system, it should always be borne in mind that the fault may lie not only in the generator or the regulator but in the battery, the leads, or at other points in the system.

<b>Battery not charging or not charging sufficiently</b>	
Cause	Remedy
<ol style="list-style-type: none"> <li>1. Carbon brushes not making proper contact with collector, sticking in the guides, worn, broken, oiled-up or fouled.</li> <li>2. Collector fouled or oiled-up.</li> <li>3. Collector worn.</li> <li>4. Faulty connections or other damage at the following points: cable 30 (battery cable) and cable 51 between battery and regulator, or cable 31 between battery and ground.</li> <li>5. Battery defective.</li> <li>6. Break or short-circuit in windings of generator or short-circuit to ground.</li> <li>7. Regulator defective.</li> <li>8. Fan belt too slack. V-pulleys worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Examine carbon brushes and clean or replace, as necessary.</li> <li>2. Clean collector.</li> <li>3. Re-condition collector by precision-turning and making saw-cuts between segments.</li> <li>4. Tighten connections or replace cables.</li> <li>5. Check battery and if necessary, replace.</li> <li>6. Check generator and if necessary, repair.</li> <li>7. Replace regulator.</li> <li>8. Tighten fan belt to specified tension. Replace V-pulleys.</li> </ol>
<b>Charging light does not light up with engine stopped and ignition switched on</b>	
Cause	Remedy
<ol style="list-style-type: none"> <li>1. Charging light bulb burnt out.</li> <li>2. Battery discharged.</li> <li>3. Battery defective.</li> <li>4. Cables of terminals 61, 30 or 31 loose or damaged.</li> <li>5. Regulator defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fit new bulb.</li> <li>2. Charge battery from outside source.</li> <li>3. Check battery and if necessary, replace.</li> <li>4. Bare, clean or replace cables; tighten contacts.</li> <li>5. Replace regulator.</li> </ol>

15-17/1

**Charging light fails to extinguish at high engine speed**

Cause	Remedy
1. Cable of terminal -61 shorting to ground. 2. Regulator defective.	1. Remove short or replace cable. 2. Replace regulator.

**Charging light flickers**

Cause	Remedy
1. Fan belt too slack. 2. V-pulleys worn.	1. Tighten fan belt to specified tension. 2. Replace V-pulleys.

# Glow Plug System for Diesel Engine

Job No.

15-30

## A. General

The glow plugs make possible starting of a cold engine by increasing the temperature of the compressed air and by igniting fuel droplets on the surface of the glow plug elements.

In the diesel engine combustion takes place by spontaneous ignition of the fuel injected into the highly compressed and therefore very hot air. The

compression temperatures for an engine at normal working temperature are in the region of about 600—800° C. When a cold engine is started, however, the compression temperatures attain only about 300° C. This temperature is not high enough to bring about spontaneous ignition of the fuel.

The glow plugs are supplied with heating current from the 12 volt battery via the push-pull switch. They are arranged in series together with the glow plug indicator (3) and the additional glow plug dropping resistor (4) (see Fig. 15-30/1) in such a way that the sum of all rated component voltages, including the voltage drop in the leads, corresponds to the rated voltage of the battery.

During starting, the glow plug indicator is shorted out so that when the battery voltage drops the thermal output of the glow plugs does not fall so much.

The duration of preheating depends on the temperature of the engine and the ambient temperature.

Average preheating times for a cold engine and the following ambient temperatures are given below:

At ambient temperature of + 20° C  
about 10 seconds

At ambient temperature of 0° C  
about 20 seconds

At ambient temperature of — 5° C  
about 30 seconds

At lower temperatures not more than 1 minute.

When the engine is at normal working temperature, preheating is unnecessary.

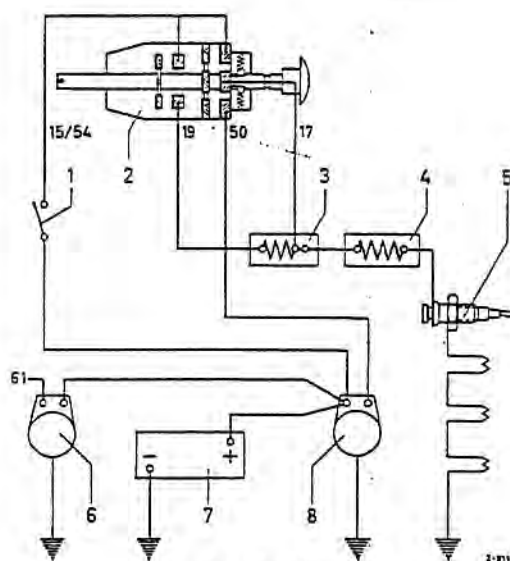


Fig. 15-30/1

- 1 Main switch
- 2 Push-pull switch
- 3 Glow plug indicator
- 4 Dropping resistor
- 5 Glow plug
- 6 Generator
- 7 Battery
- 8 Starter

Circuit diagram of a glow plug system with push-pull switch (four-position switch)

## B. Description of the Four Switch Positions

The electro-mechanical push-pull switch for the glow plug system has four positions: stop, drive, preheat and start. Also fitted to this push-pull switch is a detent which permits the key to be withdrawn only when the stop position is engaged.

Fig. 15-30/1 shows the circuit diagram for the components involved during starting. The push-pull switch (2) is shown in the drive position (F) in this diagram. The entire system can only come into action after actuation of main switch (1). This is done by turning ignition key to pos. 2 = „Drive“.

15-30/1

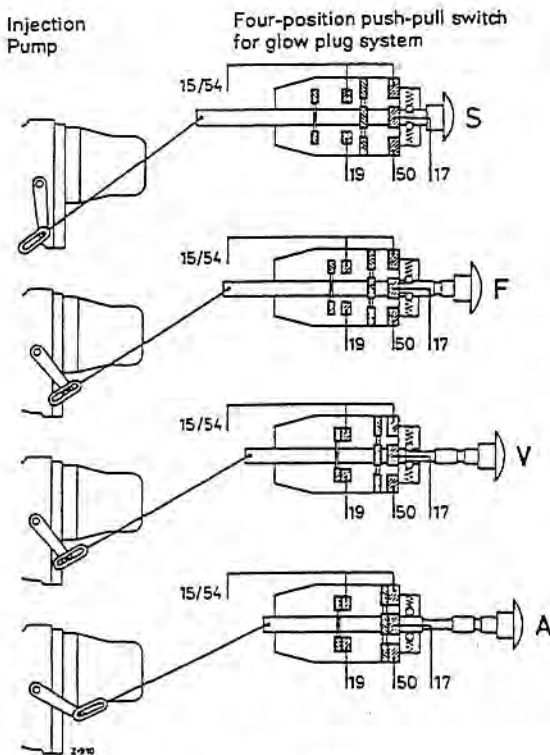


Fig. 15-30/2

S = Stop position  
 F = Drive position  
 V = Preheating  
 A = Starting

### 1. S = Stop Position

In the stop position the button of the push-pull switch (2) is pushed in all the way and the adjusting lever on the injection pump is therefore pushed completely forward by the cable control. In this position of the adjusting lever the control rod is completely in the "stop" direction; when turned off, the engine receives no more fuel and stops because the plungers of the pump elements are at zero delivery. Terminals 19, 50 and 17 receive no current in this position (see Figs. 15-30/1 and 15-30/2).

The ignition key may be withdrawn from the steering lock.

### 2. F = Drive Position

In the drive position the control cable with slot is in such a position relative to the adjusting lever that the slot is not in contact with the adjusting lever bolt, i. e. the adjusting lever is not actuated. After the switch button has been pulled out of the stop position it engages in

the next stop and remains in this position as long as the engine is running. Terminals 19, 50 and 17 receive no current in this position of the switch.

The ignition key cannot be withdrawn from the steering lock.

### 3. V = Preheating Position

When the switch is in the preheating position the same applies to the cable control and adjusting lever as for the F = drive position.

After the button of the push-pull switch (2) has been pulled into the drive position a slight resistance is felt. The switch must be held in this position until preheating has been completed (dependent on ambient temperature and temperature of the engine). In this switch position terminal 19 is supplied with current and causes the glow plugs (5) to glow by means of current supplied via the glow indicator (3) and the dropping resistor (4). Terminals 50 and 17 receive no current (see Figs. 15-30/1 and 15-30/2).

### 4. Starting Position

On completion of preheating, against the slight resistance the button is pulled out as far as it will go and held there until engine starts.

When the switch is in the starting position the bolt of the adjusting lever is at the opposite side of the slot (as compared with when the switch is in the stop position) and draws the adjusting lever completely to the rear. This shifts the control rod beyond the full-load stop and the injection pump is on starting delivery.

When the switch is in the starting position, terminals 50 and 17 receive a supply of current. The starter (8) is powered via terminal 50 (see Figs. 15-30/1 and 15-30/2).

Current continues to be supplied to the glow plugs (5) via terminal 17 when the switch is in the starting position. Since the glow indicator is shorted out during starting, the glow plugs take more current and starting is thus rendered easier.

When the button of the push-pull switch is released after the engine has started, the switch is automatically returned to the drive position by a spring.

# Glow Plug

Job No.

15-31

## A. General

Fig. 15-31/1 shows the construction of a glow plug. Via a contact bar (1) or a connecting cable, depending on the location of the plug, current is fed to the center electrode (13) or to the collar (3) of the outer electrode (11). The center electrode (13) and outer electrode (11) are connected together by the filament (6). The two electrodes are separated by the insulator (12) and insulated from the plug body (5) by the insulator (4). At the top of the glow plug a further plastic insulator (2) is fitted between center and outer electrodes. The connection insu-

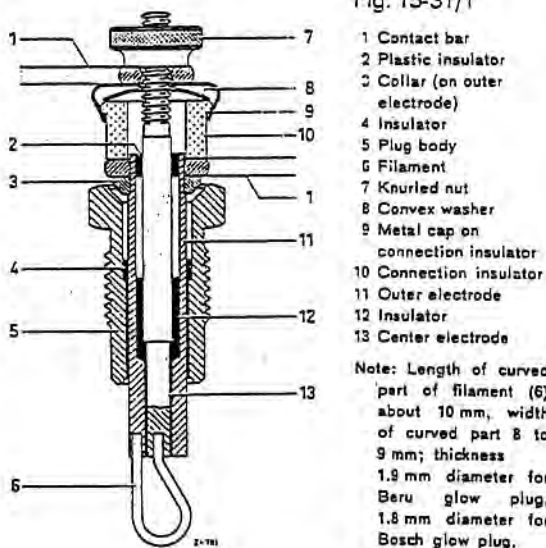
lator (10) separates the two leads. The convex washer incorporated into the insulator secures the knurled nut (7).

The life of the glow plug largely depends on the condition of the injection nozzles and on the combustion pattern. Excessively low injection pressure, jamming nozzle needles, coked-up and dripping nozzles and injection delivery too early may cause premature fracture of the plug filament. Moreover, formation of a bridge of carbon deposits may lead to grounding of the filament and consequent fusing of the latter.

The temperature of the filament during preheating is about 900—1000° C; in the engine at normal working temperature it is 600—800° C, due to heat of combustion. Temperatures above 800° C in continuous operation are equally damaging for the glow plugs.

Type designation of the glow plugs: Bosch KE/GA 1/21 and Beru 381 GK (2-pole, 0.9 V, approx. 40 A).

Note: On the Beru glow plug the core from which the filament projects does not carry current and is therefore insensitive to ground connection.



## B. Checking

A glow indicator with the same rated voltage as the glow plug system is provided in the instrument panel for monitoring the glow plug system.

During preheating, the glow indicator glows just as brightly (bright red) as the glow plugs and thus provides an indication of the condition of the plugs.

If the glow indicator does not glow, the filament of one of the glow plugs is usually broken or fused

because of grounding. To find out which glow plug is faulty, taking each plug in turn connect the two contact bars with the blade of a screwdriver.

Set the four-position push-pull switch to the preheating position V (see Job No. 15-30). If the glow indicator glows when a plug is short-circuited, that plug is faulty.

If the glow plug system is shorted to ground, the

15-31/1

glow indicator glows much more quickly and brightly. If the glow indicator continues to glow after the ground cable of the glow plug system has been disconnected, the system is shorted to ground. In this event, check the contact bars for short-circuiting with the cylinder head. If the contact bars are in order, one of the glow plugs may be short-circuited to ground. To establish which glow plug is faulty, switch on the glow plug system and disconnect the contact bars one after the other, starting at the ground side. When the contact bars are disconnected from the glow plug with short circuit

to ground, the flow of current is interrupted. The glow indicator stops glowing.

**Note:** When fitting new glow plugs, make sure that the rated voltage is correct. A faulty glow plug may indicate that the corresponding nozzle is faulty or that there is a defective ball pin in the prechamber.

Replace the faulty glow plug, remove the corresponding injection nozzle and prechamber, check and replace if necessary (see Job Nos. 07-22 and 01-5).

### C. Removal and Installation

#### Removal:

1. Remove all knurled nuts. Remove the connecting leads, connection insulators and the contact bars.
2. Remove glow plug with an offset box wrench SW 21 mm (Part No. 000 589 17 03 00).

#### Installation:

3. Before installing the glow plugs clean the glow plug passages and the bores in the prechambers with reamer (Part No. 636 509 03 53 00). Pack the grooves of the reamer with grease and ream out the glow plug passages.

A commercially available reamer having a diameter of 11 mm may also be employed for cleaning the glow plug passages. However, the following instructions should then be followed:

The reamer may only be inserted to a depth of about 55 mm, so that the ball pin in the prechamber is not damaged. A stop must be fitted to the reamer for this purpose (tightly seated rubber ring or something similar).

**Note:** Oil carbon (coke) is deposited in the glow plug passages in the course of time. In certain circumstances this may lead to short-circuiting of the glow plugs to ground and trouble in starting; apart from cleaning within the scope of normal servicing, the glow plug passages should therefore also be cleaned when extensive repairs to the cylinder head are carried out or when the glow plugs are replaced.

4. If the glow plug passages have been cleaned with the cylinder head installed, turn over engine a few times with the starter to blow any deposits out of the combustion space.
5. Slightly lubricate the thread of the glow plug with graphited oil. Screw the glow plug into the cylinder head and tighten with a torque of 5 mkp.
6. Connect the glow plugs to the contact bars. First fit the two outer bars with the larger terminal eyes, which connect the 1st and 2nd and the 3rd and 4th glow plugs. Position connection insulators and the contact bar for connecting the 2nd and 3rd glow plugs and tighten with the knurled nuts. Tighten connection lead and ground lead with knurled nut.
7. Check glow plugs for proper functioning (see Section A).



## Color Code and Function of Electric Leads

Job No.

54-1

*Modification: Models 190 c, 190 Dc and 300 SE added, Job No. revised.*

In the following tables the color code and function of all electric leads in the car are listed.

Index	Page
Leads direct to the fuse box (not fuse-protected)	54-1/2
Leads behind the fuse box (fuse-protected) to the consumer units	54-1/2
Leads of the glow plug system of the Diesel engine (Basic colors)	54-1/2
Leads for current generation and supply direct	54-1/2
Ground leads and connections	54-1/2
Consumer units of terminal 30 (cannot be switched off by means of the ignition lock)	54-1/2
Socket, electric clock, reading light, roof light, radio, glove compartment light, clearance lights, electro-magnetic starting valve	
Ignition switch and ignition, starter, high and low tension leads	54-1/3
Foot dimmer switch and headlights	54-1/3
Leads of terminal 58	54-1/3, 4
Parking light, tail lights, license plate lights, fog lights, instrument lighting, speed indicator light, electric clock	
Leads of terminals 15/54	54-1/4
Flash signal system, upper beam flash signal system, stop lights, cigar lighter, reversing lights, hand-brake pilot light, compressed air pilot light, valve block control (wheel changing)	
Signal system, wiper system, windshield washer	54-1/5
Fuel gage, choke control, defroster blower (heater blower), defroster blower	54-1/5, 6
Rear compartment heater blower, electric fuel feed pump	
Automatic auxiliary start mechanism	54-1/6
Leads of glow plug system of Diesel engine	54-1/6
Automatic DB transmission, automatic clutch	54-1/6, 7

Basic color	Color coding	Function of Leads	Remarks
		<b>Leads Direct to Fuse Box</b>	
red	—	from rotary light switch terminal 30 to fuse box terminal 30	all models
red	black	from ignition lock terminal 15/54 to fuse box terminal 15/54	all models
white	—	from foot dimmer switch terminal 56a to fuse box terminal 56a	all models
yellow	—	from foot dimmer switch terminal 56b to fuse box terminal 56b	all models
grey	—	from rotary light switch terminal 58 to fuse box terminal 58	all models
		<b>Leads behind the Fuse Box (Fuse-Protected) to Consumer Units</b>	
red	with color coding	all leads of terminal 30 (cannot be switched off by means of the ignition lock)	all models
black	with color coding	all leads of terminal 54 (can be switched off by means of the ignition lock)	all models
white	with and without color coding	To upper beam left and right and upper beam pilot light	all models
yellow	with and without color coding	To lower beam left and right	all models
grey	with color coding	all leads of terminal 58	all models
		<b>Leads of Glow Plug System of the Diesel Engine</b>	
violet	with color coding	all leads of glow plug system of Diesel engine	190 Dc
		<b>Leads Direct for Current Generation and Supply</b>	
black	—	starter lead from battery + to starter terminal 30	all models
black	—	starter lead from battery + to battery main switch	S. A.
black	—	from starter terminal 30 to ammeter	S. A.
red	—	from ammeter to regulator (Lima) terminal B + 51	S. A.
red	—	from starter terminal 30 to rotary light switch terminal 30	all models
red	—	from starter terminal 30 to regulator (Lima) terminal B+51	all models
red	—	from ammeter to rotary light switch terminal 30	S. A.
red	—	from rotary light switch terminal 30 to ignition lock terminal 30	all models
red	—	from rotary light switch terminal 30 to fuse box terminal 30	all models
blue	—	from regulator (Lima) terminal 61 to charging light	all models
		<b>Ground Leads and Connections</b>	
black	—	from negative battery pole to ground	all models
black	—	from negative battery pole to battery main switch	S. A.
black	—	from battery main switch to ground	S. A.
bright	—	ground leads from engine to chassis or corresponding ground connections of more than 4 mm <sup>2</sup>	all models
brown	—	ground leads direct to chassis within wiring harnesses	all models
		<b>Consumer Units of Terminal 30 (Cannot be switched off by means of the Ignition Lock)</b>	
red	—	from rotary light switch terminal 30 to fuse box	all models
red	white	from fuse box to socket	all models
red	yellow	from fuse box to electric clock	all models
red	green	from fuse box to reading light	all models
red	violet/ green	from fuse box to roof light	220 Sb, SEB 300 SE

Basic color	Color coding	Function of Leads	Remark
red	blue	from fuse box to radio	S. A.
red	green	from fuse box to rotary light switch terminal clearance light	all models
red	green/black	from rotary light switch terminal clearance light to clearance light switch	all models
green	black	from clearance light switch to clearance light left front and left rear	all models
green	—	from clearance light switch to clearance light right front and right rear	all models
black	pink/white	from fuse box to starter valve magnet	220 SEb, 300 SE
red	white/green	from fuse box to glove compartment lighting	220 SEb, 300 SE
red	—	<b>Ignition Switch and Ignition, Starter, High and Low Tension Leads</b> from rotary light switch terminal 30 to ignition lock terminal 30	all models
red	black	from ignition lock terminal 15/54 to fuse box terminal 54	all models
red	black	from ignition lock terminal 15/54 to ignition coil terminal 15	all models
red	black	from ignition lock terminal 15/58 to series resistance for ignition coil terminal 15	220 b, Sb, SEb and 300 SE
black	—	from series resistance for ignition coil terminal 16 to ignition coil terminal 16	220 b, Sb, SEb and 300 SE
black	—	from ignition coil terminal 1 to distributor terminal 1	190 c, 220 b, Sb, SEb and 300 SE
black	—	from ignition coil terminal 4 to distributor terminal 4	190 c, 220 b, Sb, SEb and 300 SE
black	—	from distributor to the spark plugs	190 c, 220 b, Sb, SEb and 300 SE
violet	—	from ignition lock terminal 50 to starter terminal 50	190 c, 220 b, Sb, SEb and 300 SE
white	yellow	<b>Foot Dimmer Switch and Headlights</b> from rotary light switch terminal 56 to foot dimmer switch terminal 56	all models
white	—	from foot dimmer switch terminal 56b to fuse box terminal 56b	all models
white	—	from fuse box terminal 56a to upper-beam right	all models
white	black	from fuse box terminal 56a to upper beam left	all models
white	blue	from fuse box terminal 56a to upper beam pilot light	all models
yellow	—	from fuse box terminal 56b to lower beam right	all models
yellow	black	from fuse box terminal 56b to lower beam left	all models
grey	—	<b>Leads of Terminal 58</b> from rotary light switch terminal 58 to fuse box terminal 58	all models
grey	red	from fuse box terminal 58 to parking light right, tail light right, license plate light right	all models
grey	black	from fuse box terminal 58 to parking light left, tail light left, license plate light left	all models
grey	violet	from fuse box terminal 58 to instrument lighting switch	all models

Basic color	Color coding	Function of Leads	Remarks
grey	blue	from instrument lighting switch to instrument lights	all models
grey	green/yellow	from fuse box terminal 58 to fog light switch	all models
grey	green	from fog light switch to fog lights left and right	all models
grey	blue	from instrument cluster switch to electric clock lighting	S. A. and 300 SE
grey	blue	from instrument cluster to speed indicator light	
		<b>Leads of Terminals 15/54 Flash Signal System</b>	
black	red/green	from fuse box terminal 54 to flash signal mechanism terminal 15	all models
black	white/green	from flash signal mechanism terminal 54 to flash signal switch terminal 54	all models
black	white	from flash signal switch terminal 54 left to flash signals front left and rear left	all models
black	green	from flash signal switch terminal 54 right to flash signals front right and rear right	all models
green	blue	from flash signal mechanism K to pilot light (only used if pilot light installed)	all models
black	white	from flash signal switch to pilot light left	all models
black	green	from flash signal switch to pilot light right	all models
		<b>Upper Beam Flash Signal System (Flash approach signal)</b>	
white	violet	from upper beam flash signal switch to fuse box terminal 56 a	all models
black	blue/white	from upper flash signal switch to fuse box terminal 15/54	all models
		<b>Stop Light</b>	
black	red/violet	from fuse box terminal 54 to stop light switch	all models
black	red	from stop light switch to stop lights left and right	all models
		<b>Cigar Lighter</b>	
black	yellow/green	from fuse box terminal 54 to cigar lighter	all models
		<b>Reversing Lights</b>	
black	yellow/red	from fuse box to reversing light switch	all models
grey	yellow	from reversing light switch to reversing lights left and right	all models
		<b>Hand Brake Control</b>	
black	brown/white	from fuse box terminal 15/54 to hand brake pilot light switch	all models
brown	white/red	from hand brake pilot light switch to instrument cluster pilot light	all models
		<b>Compressed-Air Control</b>	
black	brown/white	from fuse box terminal 15/54 to compressed-air control switch	300 SE
brown	white/red	from compressed-air control switch to instrument cluster pilot light	300 SE
		<b>Valve Block Control (Wheel Changing)</b>	
black	brown/white	from fuse box terminal 15/54 to valve block control switch	300 SE
brown	white/red	from valve block control switch to instrument cluster pilot light	300 SE
		<b>Signal System</b>	
black	yellow	from fuse box terminal 15/54 to horns I, II and III	all models
black	yellow/pink	from signal ring terminal horn contact to horns I, II and III	all models

Basic color	Color coding	Function of Leads	Remarks
		<b>Signal System with Relays</b>	
black	yellow/white	from fuse box terminal 15/54 to horn relay terminal 30/51	S. A.
black	yellow/white	from horn relay terminal 30/51 to terminal 86	S. A.
black	yellow	from horn relay terminal 87 to horns I, II and III	S. A.
black	yellow/violet	from horn relay terminal 87 via pull switch to horn II or III	S. A.
		<b>Windshield Wiper System</b>	
black	violet	from fuse box terminal 15/54 to wiper switch terminal +	all models
black	violet	from fuse box terminal 15/54 to wiper motor terminal +	all models
black	violet/blue	from wiper switch terminal 1 to wiper motor terminal 1	all models
black	violet/white	from wiper switch terminal 2 to wiper motor terminal 2	220 b, Sb, SEb 300 SE
black	violet/green	from wiper switch terminal 3 to wiper motor terminal 3	220 b, Sb, SEb 300 SE
		<b>Windshield Washer System</b>	
black	violet	from fuse box terminal 15/54 to foot pump terminal +	220 b, Sb, SEb 300 SE
black	blue/yellow	from foot pump terminal 1 to wiper switch terminal 1	220 b, Sb, SEb 300 SE
black	violet/pink	from foot pump terminal 2 to wiper switch terminal 2	220 b, Sb, SEb 300 SE
black	violet/white	from foot pump terminal 2 to wiper motor terminal 2	220 b, Sb, SEb 300 SE
		<b>Fuel Gage</b>	
black	blue	from fuse box terminal 15/54 to fuel gage terminal +	all models
blue	black	from fuel gage to fuel level indicator mechanism	all models
blue	green	from fuel gage to fuel level indicator mechanism terminal fuel reserve indicator	all models
		<b>Choke Control</b>	
black	red/blue	from fuse box terminal 15/54 to choke control switch	190 c, 220 b, Sb
pink	blue	from choke control switch to pilot light on instrument cluster	190 c, 220 b, Sb
		<b>Defroster Blower (Heater Blower)</b>	
black	green/pink	from fuse box terminal 15/54 to heater blower switch terminal +	all models
green	red	from heater blower switch 1st stage to heater blower motor 1st stage	all models
green	yellow	from heater blower switch 2nd stage to heater blower motor 2nd stage	220 b, Sb, SEb 300 SE
		<b>Defroster Blower (Rear Compartment Heater Blower)</b>	
black	green/pink	from fuse box terminal 15/54 to rear compartment heater blower switch terminal +	300 SE
black	green/pink	from fuse box terminal 15/54 to rear compartment heater blower motor standard stage	300 SE
green	red	from rear compartment heater blower switch 1st stage to rear compartment heater blower motor 1st stage	300 SE
green	yellow	from rear compartment heater blower switch 2nd stage to rear compartment heater blower motor 2nd stage	300 SE

Basic color	Color coding	Function of Leads	Remarks
black	white/red	<b>Electric Fuel Feed Pump</b> from fuse box terminal 15/54 to electric fuel feed pump terminal +	220 SEb, 300 SE
black	pink/red	<b>Automatic Auxiliary Start Mechanism (Mixture Control Knob)</b> from fuse box terminal 15/54 to automatic auxiliary start mechanism relay terminal 30/51	220 SEb, 300 SE
black	pink	from automatic auxiliary start mechanism relay terminal 87 to magnet for mixture control knob	220 SEb, 300 SE
black	pink/blue	from automatic auxiliary start mechanism relay terminal 86 to starter switch terminal 50	220 SEb, 300 SE
pink	—	from automatic auxiliary start mechanism relay terminal 85 to thermo switch	220 SEb,
		<b>Automatic Auxiliary Start Mechanism (Electro-Magnetic Starter Valve)</b>	
black	pink/red	from fuse box terminal 15/54 to electro-magnetic starter valve relay terminal 30/51	220 SEb, 300 SE
pink	blue	from electro-magnetic starter valve relay terminal 86 to thermo time switch terminal G	220 SEb, 300 SE
pink	white	from electro-magnetic starter valve relay terminal 85 to thermo time switch terminal W	220 SEb, 300 SE
black	pink/white	from electro-magnetic starter valve relay terminal 87 to magnet electro-magnetic starter valve	220 SEb, 300 SE
		<b>Automatic Auxiliary Start Mechanism (Time Relay)</b>	
pink	yellow	from automatic auxiliary start mechanism relay terminal 85 to time relay terminal 85	220 SEb, 300 SE
pink	yellow/black	from automatic auxiliary start mechanism relay terminal 86 to time relay terminal 86	220 SEb, 300 SE
		<b>Leads of Glow Plug System on Diesel Engine</b>	
red	black	from ignition lock terminal 15/54 to glow plug starter switch terminal 15/54	190 Dc
violet	blue	from glow plug starter switch terminal 19 to glow plug indicator resistor terminal 19	190 Dc
violet	white	from glow plug indicator resistor terminal 17 to glow plug series resistance terminal 17	190 Dc
violet	white	from glow plug starter switch terminal 17 to glow plug indicator resistor terminal 17	190 Dc
black	—	from glow plug series resistance to glow plug	190 Dc
violet	—	from glow plug starter switch terminal 50 a to starter terminal 50	190 Dc
bright	—	connecting leads of glow plugs	190 Dc
		<b>Automatic DB Transmission</b>	
black	red	from fuse box terminal 15/54 to double lift magnet	S. A. and 300 SE
brown	black	from kickdown switch to double lift magnet	S. A. and 300 SE
brown	white	from idle switch (accelerator pedal) to double lift magnet	S. A. and 300 SE
black	green/red	from fuse box terminal 15/54 to idle increase magnet terminal +	S. A. and 300 SE
green	red	from oil pressure switch on automatic transmission to idle increase magnet terminal 31	S. A. and 300 SE

Basic color	Color coding	Function of Leads	Remarks
		<b>Automatic Clutch</b>	
brown	black/ yellow	from fuse box terminal 15/54 to electro-magnetic pilot valve	S. A.
brown	white	from automatic clutch relay terminal 85 to servo motor switch	S. A.
brown	black/ yellow	from fuse box terminal 15/54 to automatic clutch relay terminal 86	S. A.
brown	red	from automatic clutch relay terminal 87 to solenoid for reducing valve terminal 54	S. A.
brown	black/ yellow	from electro-magnetic pilot valve terminal 54 to solenoid for reducing valve terminal 54	S. A.
black	—	from shift lever contact to electro-magnetic pilot valve terminal 31	S. A.
brown	white	from rear axle switch to servo motor	S. A.
brown	yellow	from thermo switch pilot light to pilot light switch (1st gear)	S. A.
brown	yellow	from pilot light switch (1st gear) to pilot light for automatic clutch	S. A.

## Removal and Installation of Instrument Cluster

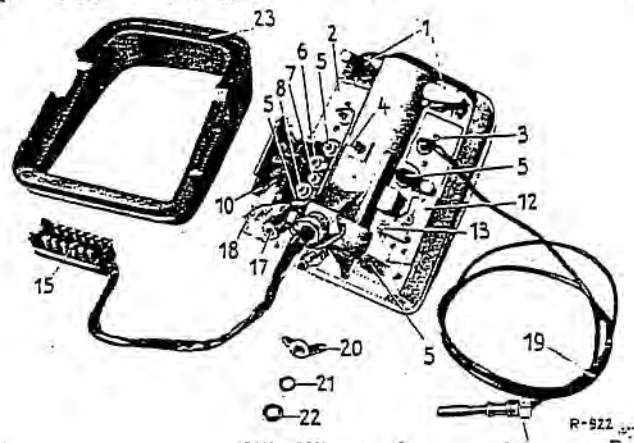


Fig. 54-11/1

- |                                |                                      |
|--------------------------------|--------------------------------------|
| 1 Pilot light, flash signal    | 13 Warning light, fuel gage          |
| 2 Oil pressure gage            | 15 12-pin plug                       |
| 3 Radiator thermometer (water) | 16 Speedometer connection            |
| 4 Fixing bolt                  | 17 Oil pressure gage line connection |
| 5 Instrument lighting          | 18 Adjustable dimmer resistance      |
| 6 Charging light               | 19 Capillary tube with heat feeler   |
| 7 Pilot light, choke control   | 20 Wing nut                          |
| 8 Pilot light, upper beam      | 21 Lock washer                       |
| 10 Contact cover               | 22 Washer                            |
| 12 Fuel gage                   | 23 Instrument cluster frame          |

## Removal:

1. Remove the left and right cluster cover under the instrument panel.
2. Pull out the 12-pin plug (15) from below the instrument panel (Fig. 54-11/2).

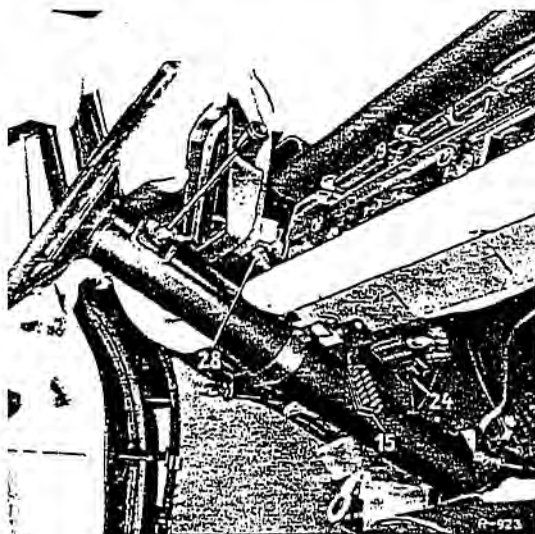


Fig. 54-11/2

- 15 12-pin plug for instrument cluster  
24 6-pin plug for steering wiring harness  
28 Speedometer drive

3. From behind the instrument panel, unscrew by hand the oil pressure gage line and the fastening nut (20) (wing nut) from the instrument cluster (Fig. 54-11/1).
4. Unscrew the capillary tube (19) for the radiator thermometer from the left side of the engine. Remove the rubber grommet for the capillary tube and the choke control, and pull the capillary tube toward the rear through the front wall.
5. Pull out the instrument cluster together with the frame toward the rear far enough to allow the speedometer drive shaft (28) to be disconnected (Fig. 54-11/2).
6. Remove the instrument cluster and frame (23) carefully, taking care not to damage the capillary tube (19) of the radiator thermometer (Fig. 54-11/1).

## Installation:

7. Installation is the reverse of the removal procedure.



# Instrument Cluster

Models 250 S, 250 SE, 300 SEB, 300 SEL

Job No.

54-11 a

## A. Removal and Installation of Instrument Cluster

### Removal:

1. Disconnect the ground cable from the battery.
2. Disconnect the capillary tube (1) for the radiator thermometer from the engine housing (Fig. 54-11 a/1).

**Note:** Close the threaded hole in the engine housing with a plug to prevent the cooling water from escaping.

3. Remove the left cover below the instrument panel.
4. Pull out the 13-pin plug (2) for the instrument cluster.

5. Unscrew the holder for the plug couplings.
6. Unscrew the fixing nut (5) for the instrument cluster.

**Note:** To prevent damage to the garnish molding on the instrument panel and to the steering column jacket cover these parts with a cloth.

7. Carefully pull out the instrument cluster (23) and disconnect the speedometer drive shaft and the oil pressure line (Fig. 54-11 a/2).
8. Remove the instrument cluster (23) completely.

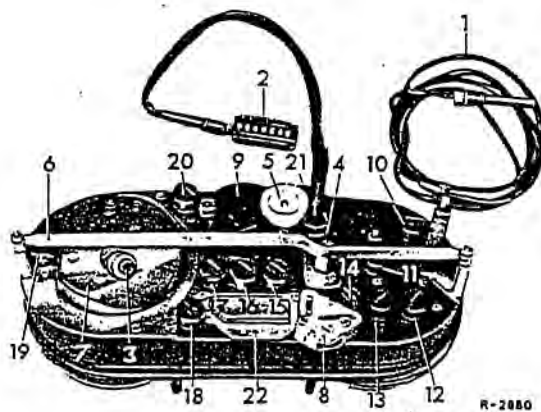


Fig. 54-11 a/1

- |                                   |  |
|-----------------------------------|--|
| 1 Capillary tube with heat feeler | 13 Level pilot light only on 300 SEL air suspension models |
| 2 13-pin plug                     | 14 Charging light  |
| 3 Speedometer connection          | 15 Pilot light, flash signal                               |
| 4 Oil pressure gage connection    | 16 Pilot light, upper beam                                 |
| 5 Fixing nut                      | 17 Pilot light, right flash signal                         |
| 6 Retainer                        | 18 Speedometer lighting                                    |
| 7 Speedometer                     | 19 Speedometer lighting                                    |
| 8 Adjustable lighting resistance  | 20 Speedometer and clock lighting                          |
| 9 Clock                           | 21 Clock and instrument cluster lighting                   |
| 10 Instrument cluster lighting    | 22 Cover of gear indicator (automatic transmission)        |
| 11 Warning light, fuel gage       |  |
| 12 Warning light, hand brake      |  |

### Installation:

9. Installation is the reverse of the removal procedure.

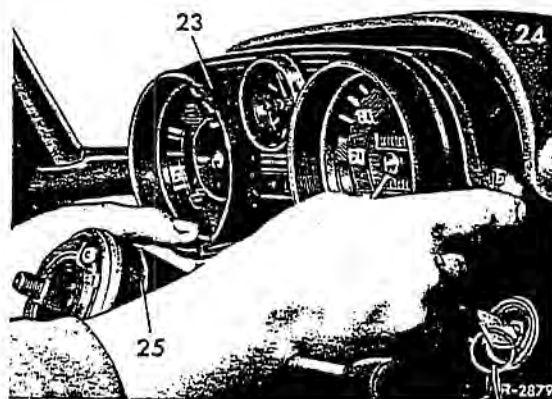


Fig. 54-11 a/2

- 23 Instrument cluster
- 24 Upper padding
- 25 Steering column jacket

## B. Replacement of Bulbs in the Instrument Cluster

1. Remove left cover below the instrument panel.

2. Unscrew the holder for the plug couplings (Fig. 54-11 a/1).

3. Carefully pull out the instrument cluster (23) until the sockets (10-21) of the bulbs become accessible (Figs. 54-11 a/1 and 2).

**Note:** To prevent damage to the garnish molding on the instrument panel and to the steering column jacket cover these parts with a cloth.

5. Remove the damaged bulb together with its socket and replace the bulb (Fig. 54-11 a/3).

6. Installation of the instrument cluster is the reverse of the removal procedure.

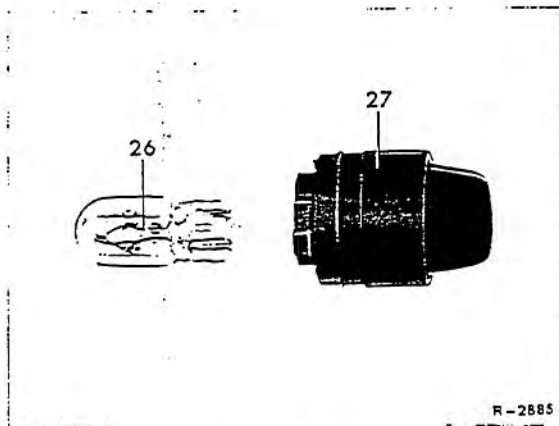


Fig. 54-11 a/3

26 Exchangeable bulb  
27 Socket

# Removal and Installation of Electric Clock

Job No.

54-12

Modification: Model 230 SL added

Models 190 c, 190 Dc, 220 b, 220 Sb, 220 SEb, 300 SE

## Removal:

1. Remove the right inside cover from the cowl.
2. From behind the instrument panel compress the two tensioning springs (2) of the electric clock mounting and remove the clock (1) toward the front (Fig. 54-12/1).

Note: When pushing out the clock care must be taken to ensure that the wood panel of the instrument panel is not damaged.

3. Pull the plug (3) out of the clock (Fig. 54-12/1).

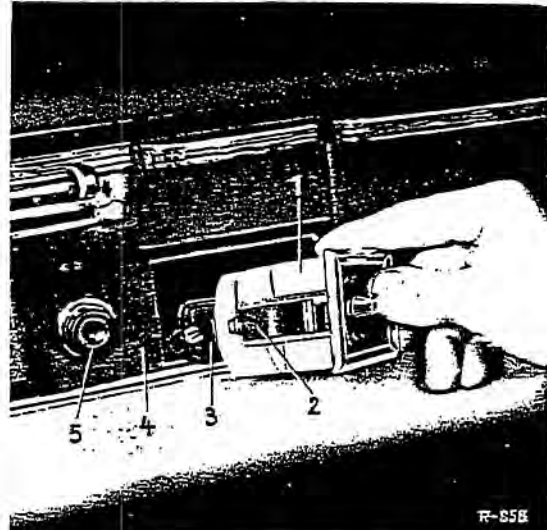


Fig. 54-12/1

## Installation:

Installation is the reverse of the removal procedure.

- |                     |                 |
|---------------------|-----------------|
| 1 Clock             | 4 Wood panel    |
| 2 Tensioning spring | 5 Cigar lighter |
| 3 Plug connection   |                 |

## Model 230 SL

## Removal:

1. Remove the glove compartment (see Job No. 68-1).
2. Unscrew the two knurled nuts (2) for the attachment of the clock (1); detach the cable (3) from the retainer (4) since the cable would be in the way during this operation (Fig. 54-12/2).
3. Pull out the plug (5), remove the bracket (6), and pull the clock out of the instrument panel.

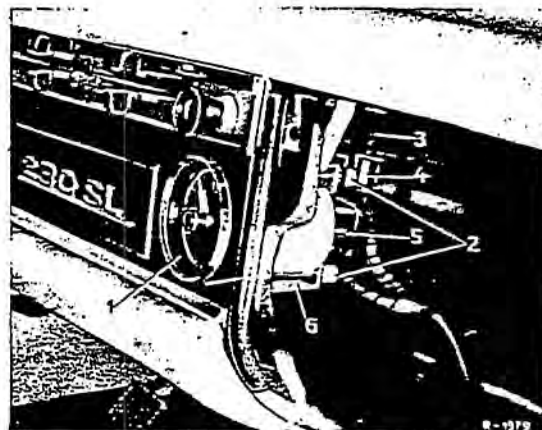


Fig. 54-12/2

## Installation:

4. Installation is the reverse of the removal procedure.

- |               |                  |
|---------------|------------------|
| 1 Clock       | 4 Cable retainer |
| 2 Knurled nut | 5 Plug           |
| 3 Cable       | 6 Bracket        |

Job No.

54-13

## Battery

### A. General Remarks on the Battery

The battery must be regularly serviced and must always be kept clean and dry. No dirt must be allowed to penetrate into the cells; gasoline, benzol or oil must not be allowed to come into contact with the sealing compound. The vent holes in the battery plugs must be kept free of obstructions so that the gases given off during charging can escape freely.

**Caution!** The oxyhydrogen gas given off is explosive. No tools or other metal objects must be placed on the battery because of the danger of shortcircuiting! (Fig. 54-13/1).

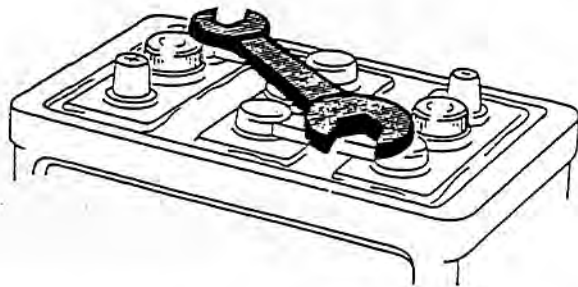


Fig. 54-13/1

Do not place metal parts on the battery

Distilled water must always be used for topping up the cells. The cells must never be topped up with sulphuric acid, irrespective of the density, unless it is clear beyond doubt that acid has been spilt out. In the latter case, the density of the acid remaining in the cells must be measured and acid of the same density used for topping up. New batteries should be filled – according to the instructions of the makers – with chemically pure accumulator acid.

**Under no circumstances should special electrolytes be used, since this would reduce the service life of the battery and would invalidate the guarantee of the battery manufacturers!**

Be careful when handling sulphuric acid! It attacks and destroys lacquer finishes, metal parts and fabrics.

**When mixing accumulator acid, the greatest care must be taken to ensure that the concentrated sulphuric acid is always added to the water or to the already-mixed accumulator acid and never vice versa!**

Acid which has been spilt or has overflowed can be rendered innocuous by means of a soda solution or ammonium chloride.

The connections and the terminal connecting bars of the battery must be kept perfectly clean. In order to prevent corrosion, the terminals and connection clamps must be greased both **inside** and **outside** with a good acid-resisting grease, e. g. Bosch Ft 1 V 40.

The capacity of a battery is the amount of electricity measured in Ah (= current  $\times$  time) which is delivered by the battery under discharge. In accordance with the German DIN standards and the SAE standards the rated capacity of a battery is given at an acid temperature of  $+20^{\circ}$  to  $+27^{\circ}$  C at the beginning of discharge and for a continuous discharge over a period of 20 hours and at a steady rate of current delivery. During discharge the voltage of a cell should not fall below 1.75 volts.

54-13/1

## B. Checking Battery Acid Level and Acid Density

1. Check the acid level and the acid density.

The battery should be topped up with pure distilled water. When the battery has been topped up with distilled water the acid density cannot be measured. The acid density can only be measured after the battery has been in operation for a short time.

A clean glass vessel and a glass funnel should always be used for topping up with distilled water. For acid level above the top-edge of the plates see Job No. 15-0. Small amounts of distilled water can also be added by means of a hydrometer (Fig. 54-13/2).



Fig. 54-13/2

**Note:** The work should never be carried out near a naked light owing to the danger of explosion due to the battery releasing oxyhydrogen gas.

2. Check the state of charge of the battery by measuring the acid density. Acid should be sucked out of the battery for this purpose by means of the hydrometer (areometer). The specific gravity of the battery acid can be read off on the scale marked on the float which is suspended in the acid. A fully-charged battery should give a specific gravity reading of  $1.285 = 32^\circ \text{Bé}$  at an acid temperature from  $+20^\circ$  to  $+27^\circ \text{C}$  (Fig. 54-13/3).



Fig. 54-13/3

The specific gravity of the battery acid in relation to the state of charge of the battery is shown in Job No. 15-0.

## C. Testing of Battery on Load

The individual cells of the battery are tested with the aid of a suitable cell tester. These testers are fitted with a fixed resistance or sometimes with an adjustable resistance so that the cells can be tested individually at a high amperage (mostly 200 Ampères). For an accurate test, the load should be suited to the size of the battery and adjusted with the aid of a variable resistance. But in workshop practice it is sufficient to use an available cell tester with a fixed resistance. The voltmeter which is incorporated in the cell tester can be used to read off the voltage drop of the individual cells under load. In the case of a fully-charged battery which is in good condition the voltage must not drop below 1.8 Volts within a period of 10 seconds. For the rest, the operating instructions given by the manufacturers of the tester should be adhered to.

In general, the test should be carried out in the following way:

1. Press the contact prods of the cell tester firmly on the two terminals of a cell (Fig. 54-13/4).
2. After a period of at most 10 seconds under load, read off the voltage on the voltmeter.

**Note:** If the battery is fully charged and is in good condition, the voltage must not drop below 1.8 Volts.



Fig. 54-13/4

3. Check all the cells in this way.

A more accurate test can be made by determining the starting current load capacity of the battery by subjecting it to a high discharge test with 3 times the current intensity of the rated battery capacity. During this test the cell voltage after 30 seconds should not drop below 1.6 Volts, and if the current intensity is 5 times the rated battery capacity the cell voltage should not drop below 1.4 Volts.

**Note:** This high discharge test should be carried out with a tester with which the current intensity can be kept constant and on which both amperage and voltage can be read off at the same time.

#### D. Normal Re-Charging of Battery

It is absolutely necessary to re-charge a battery if the acid density has fallen below 1.12 = 16° Bé (in the tropics, 1.08 = 12° Bé) or if the voltage of the individual cells has fallen to 1.8 Volts.

1. Unscrew the filler caps of the individual cells.
2. Check the acid level. **If the acid level is not above the plates add only sufficient distilled water to completely cover the plates before charging the battery!**

**Note:** Depending on the make of the battery the separators project 5-10 mm above the upper edge of the plates.

3. Connect the battery to a charger. The positive cable of the charger is connected to the positive terminal of the battery and the ground cable of the charger to the negative terminal of the battery.
4. Charge the battery with 1/10 of the rated capacity.

**Note:**

- a) While the battery is being charged, the acid temperature must not rise above 40° C (in the tropics, 45° C). If the acid temperature is higher, the rate of charging must be decreased and the period of charging increased.
- b) If the battery plates are sulfated (which can easily be seen from the white deposit on the positive and negative plates) the battery cannot be charged in the normal way. Since the counter e. m. f. has changed, the degree of sulfation determines the charging current permissible under the circumstances. Such batteries should always be charged at a much lower current intensity, appr. 1 % of the rated capacity of the battery. The current intensity can only be increased when the counter e. m. f. has dropped.

- c) The charging process can be considered to be finished when the cell voltage and the acid density no longer increase during a period of 1 hour. If the battery is fully charged the cell voltage should be 2.6 to 2.7 Volts.

The voltage must be measured with the charger switched on. When the charger is switched off the cell voltage drops to 2.2 Volts within 2 hours.

The acid density in a fully-charged battery should be  $1.285 = 32^\circ \text{ Bé}$  (in the tropics,  $1.23 = 27^\circ$ ). The acid density should be measured with the acid at the specified level (see Section A).

- d) During the charge, the charging room should be well ventilated. No naked lights must be used, owing to the danger of explosion occasioned by the release of oxyhydrogen gas.

5. Switch off the charger, disconnect the battery and again check the acid level.

**Note:** Any acid which has splashed or spilled over should be washed off with water or rendered innocuous by means of a soda solution or ammonium chloride. The battery should then be dried.

### E. Re-Charging of Battery with Quick-Charging Apparatus

If a quick charge is needed, discharged batteries can be charged at a considerably higher current rate. A considerable amount of time is saved in this process since a quick charge takes only approx. half an hour. Quick-charging, however, should not be made the rule and in any case should only be undertaken in the case of sound batteries which have already been in use and should never be undertaken at the first charge. A quick charge should in all cases be followed by a normal charge after a short service time in order to ensure complete adaptation of the plates. Before beginning a quick charge, it is absolutely necessary to check the battery and make sure that it is in good condition. It is useless to charge defective batteries in this way since this will only increase the damage to the battery. Before charging therefore, the battery should be repaired or alternatively, replaced by a battery which is in good order.

The modern, commercially available quick-charging plants are fully automatic. The rate and duration of charge are so arranged that it is impossible for overcharging and thus overheating to take place at all. The operating instructions for the charger which is being used should in all cases be strictly adhered to.

### F. Preparation of New Batteries

New batteries are generally delivered empty. Initial charging should be carried out according to the instructions issued with the battery.

The following is the general procedure adopted:

1. Unscrew the filler caps and fill the cells with chemically pure accumulator acid of a specific gravity of  $1.285 = 32^\circ \text{ Bé}$ . The acid should be 10 mm over the top edge of the separators and 15 mm over the edge of the plates.
2. It is absolutely essential that the battery should then be allowed to stand for 5–6 hours so that the plates can become completely soaked in the electrolyte.

**Note:** The acid level decreases somewhat during this period. Before the battery is charged the acid level must be above the

upper edge of the plates and should, if necessary, be topped up with acid of the same degree of density.

3. Charge the battery at a rate of 5% of the rated capacity or less until the voltage of each cell has risen to 2.6–2.7 Volts on charge and until all cells are actively gassing.
4. Measure the temperature of the battery acid from time to time. If the temperature rises above  $40^\circ \text{ C}$ , reduce the charging rate.
5. After the charge is completed check the acid density (specific gravity  $1.285 = 32^\circ \text{ Bé}$  at an acid temperature of  $+20^\circ$  to  $27^\circ \text{ C}$ ) and, if necessary, correct. If it is necessary to top up the battery with acid charge the battery for a short time afterwards in order to ensure that the battery acid is well mixed and distributed.

### G. Laying-Up of a Battery

If a battery is to be out of use for some time, the following procedure should be adopted:

1. Charge the battery according to the instructions (see Section C).
2. Coat the terminals and the cell connecting bars with acid-resisting grease.
3. Store the battery in a cool dry room where there is no danger of frost.
4. Discharge and re-charge the battery once a month. Never overcharge the battery. It should only be charged until all cells are actively gassing. Check the acid level.
5. Before every third re-charge first discharge the battery to 1.75 Volts per cell and then re-charge.

**Note:** A battery that is filled with acid must never be allowed to stand uncharged since the plates will soon become unserviceable through sulfation!



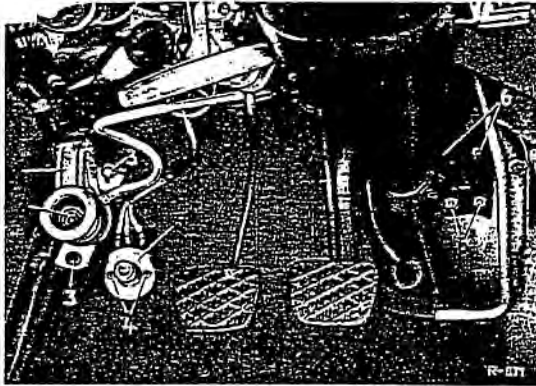
## Removal and Installation of Foot Dimmer Switch

Job No.

54-14

### Removal:

1. Detach the rubber mat at the front left toeboard and turn it back until the foot dimmer switch (5) becomes accessible (see Fig. 54-14/1).



2. Unscrew the two fixing screws (4), disconnect the electric cables and remove the foot dimmer switch (5) (Fig. 54-14/1).

### Installation:

3. When connecting the electric cables, pay attention to the color coding:  
Connect as follows:  
the white/yellow cable to Terminal 56,  
the white cable to Terminal 56a,  
the yellow cable to Terminal 56b.

Fig. 54-14/1

1 Lever for windshield wiper actuation  
2 Pump for windshield washer  
3 Fixing screws

4 Fixing screws  
5 Foot dimmer switch  
6 Hexagon nuts

## Removal and Installation of Left or Right Horn

Job No.

54-15

### Removal:

1. Disconnect the two electric cables from the horn (3).
2. Unscrew the hexagon screw (2) (Fig. 54-15/1) and remove the horn (3) together with the flexible suspension from the bearing bracket (1).

### Installation:

3. Installation is the reverse of the removal procedure.

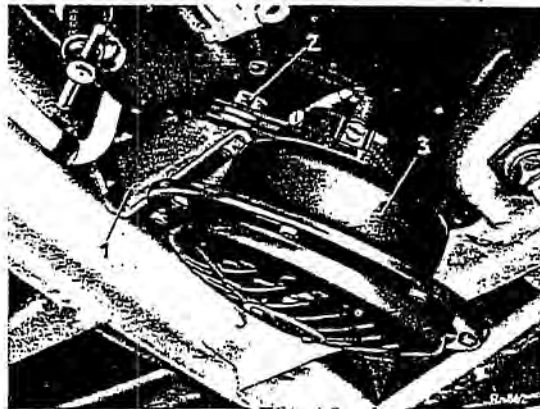


Fig. 54-15/1

1 Bearing bracket  
2 Hexagon screw  
3 Horn

## Removal and Installation of the Combined Switch for Flash Direction Signal and Upper Beam Flash Signal System

### Removal:

1. Disconnect the ground cable at the negative terminal of the battery.

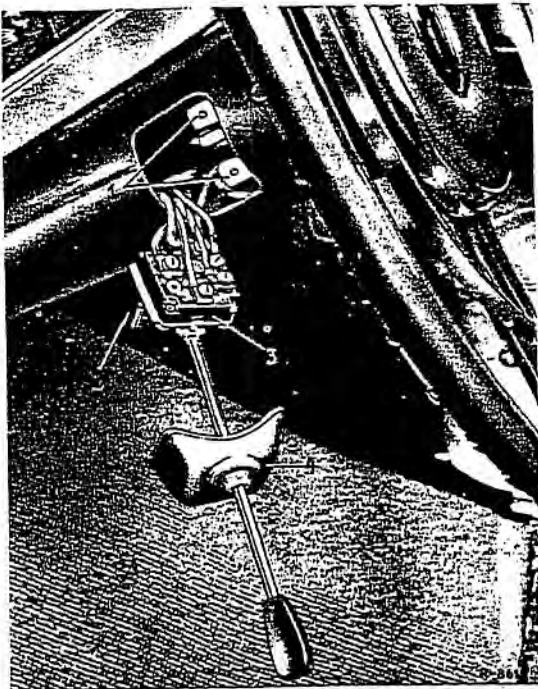


Fig. 54-17/1

- 1 Base in steering column jacket
- 2 Angle bracket
- 3 Switch
- 4 Rubber sleeve

2. Take the rubber sleeve (4) out of the steering column jacket and push it back (Fig. 54-17/1).
3. Unscrew the two cross-recess head screws on the angle bracket (2) from the base (1) of the steering column jacket.
4. Pull the switch (3) outward and disconnect the electric cables (Fig. 54-17/1).

### Installation:

5. During installation pay attention to the color coding. Connect:
  - the black-white-green cable to terminal 54,
  - the white-green cable to terminal 31,
  - the brown cable to ground,
  - the black-green cable to the terminal for the right flash direction signal,
  - the black-white cable to the terminal for the left flash direction signal.

**Note:** The black-yellow-pink cable is a direct connection between plug and horn contact.

## Front Lighting Unit

Job No.

82-1

### A. Removal and Installation of Left or Right Lighting Unit

#### Removal:

1. Remove the oval head countersunk screw (1) on the ornamental ring (4) and take off the ornamental ring (Fig. 82-1/1).



Fig. 82-1/1

1 Oval head countersunk screw  
4 Ornamental ring

2. Screw out the fixing screws (16) (Fig. 82-1/3) from the lighting unit and take out the

lighting unit far enough for the electric plug to be pulled out.

3. Pull out the 6-pin plug (2) and the 3-pin plug (3) and take off the lighting unit (Fig. 82-1/2).

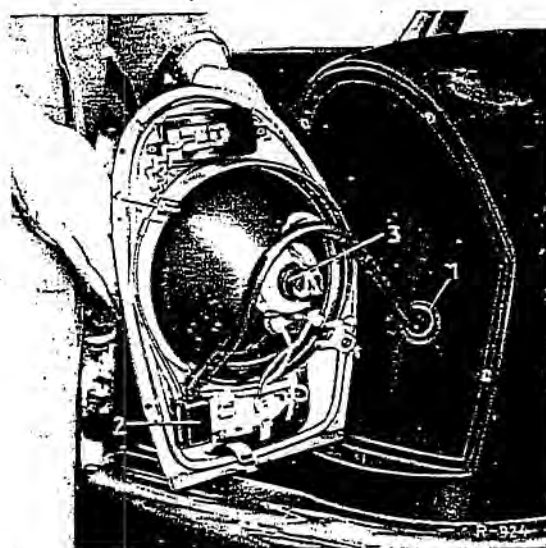


Fig. 82-1/2

2 6-pin plug  
3 3-pin plug

#### Installation:

4. Installation is the reverse of the removal procedure.

### B. Removal and Installation of Left or Right Headlight Lens

#### Removal:

1. Remove the ornamental ring (4) (see Section A No. 1).
2. Use a broad screw driver to turn the 6

swivel clips (17) away from the lens (21) and take out the lens (21) (Fig. 82-1/3).

#### Installation:

3. Installation is the reverse of the removal procedure.

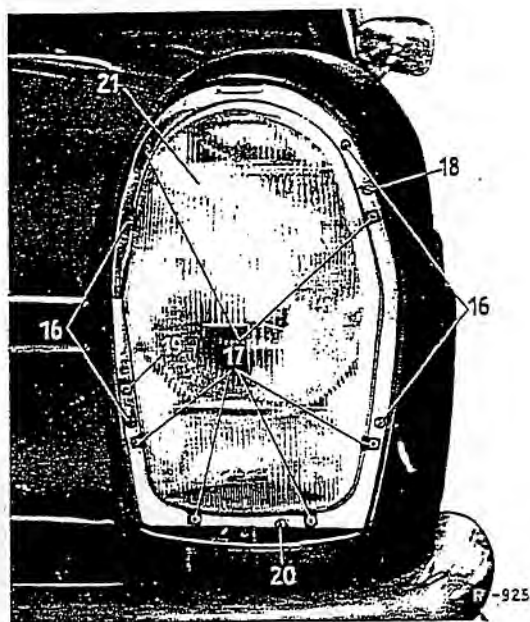


Fig. 82-1/3

- 16 Fixing screw for lighting unit
- 17 Swivel clips
- 18 Vertical plane adjusting screw for main headlight
- 19 Lateral plane adjusting screw for main headlight
- 20 Adjusting screw for fog light
- 21 Lens

### C. Replacing of Bulbs for Left or Right Main Headlight and Parking Light

#### Removal:

1. Screw out the lampholder (5) from the bayonet catch and remove the bulb for the main headlight (6) and the bulb for the parking light (7) (Fig. 82-1/4).

#### Installation:

2. Installation is the reverse of the removal procedure.

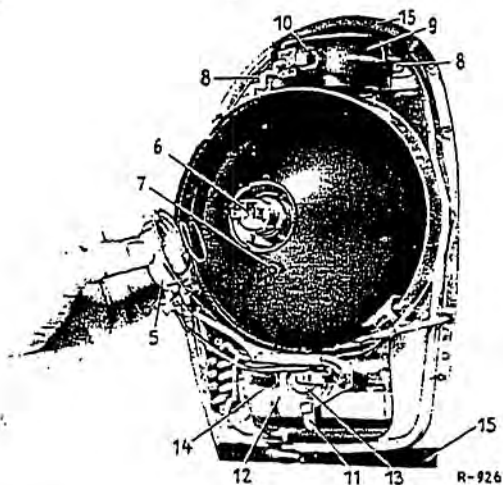


Fig. 82-1/4

- 5 Lampholder for main headlight and contact plate for parking light
- 6 Bulb for main headlight 40/45 W
- 7 Bulb for parking light 4 W
- 8 Swivel clip
- 9 Lampholder for flash direction signal
- 10 Bulb for flash direction signal 15 W
- 11 Retainer
- 12 Lampholder for fog light and clearance light
- 13 Bulb for fog light 35 W
- 14 Bulb for clearance light 35 W
- 15 Sealing frame

## D. Replacing Bulb for Left or Right Flash Direction Signal

### Removal:

1. Use a broad screw driver to turn the two swivel clips (8) away from the lampholder (9). Remove the lampholder (9) and take out the bulb (10) for the flash direction signal (Fig. 82-1/4).

### Installation:

2. Installation is the reverse of the removal procedure.

## E. Replacing Bulb for Left and Right Fog Light and Clearance Light

### Removal:

1. Pry off the retainer (11) from the lampholder (12) for the fog light and the clearance light. Take off the lampholder (12) and take out the bulb (13) for the fog light and the bulb (14) for the clearance light (see Fig. 82-1/4).

### Installation:

2. Installation is the reverse of the removal procedure.

**Note:** Do not touch the bulbs with bare (greasy) fingers; always use a clean cloth or a piece of tissue paper when inserting the bulbs. If this is not done, the bulbs give off a grease vapor when they become hot, and this vapor settles on the reflector and reduces its reflecting efficiency.

Job No.

82-2

## Headlight Adjustment

### A. Adjustment of Main Headlights

The front lighting units have headlights with an asymmetrical lower beam.

**When the headlights are adjusted, a load of 70 kg must be placed in the middle of the rear seats.**

The headlight adjustment device must be aligned exactly parallel to the car longitudinal axis.

The closer the adjustment device and its collecting lens is moved toward the headlight the more accurate will the adjustment be.

Headlights with asymmetrical lower beam are adjusted **only with relation to the lower beam.**

In the case of right asymmetrical lower beam the light-dark boundary runs horizontal on the left side and rises at the center at an angle of  $15^\circ$  toward the right (Fig. 82-2/1); in the case of left asymmetrical lower beams the picture is reversed.

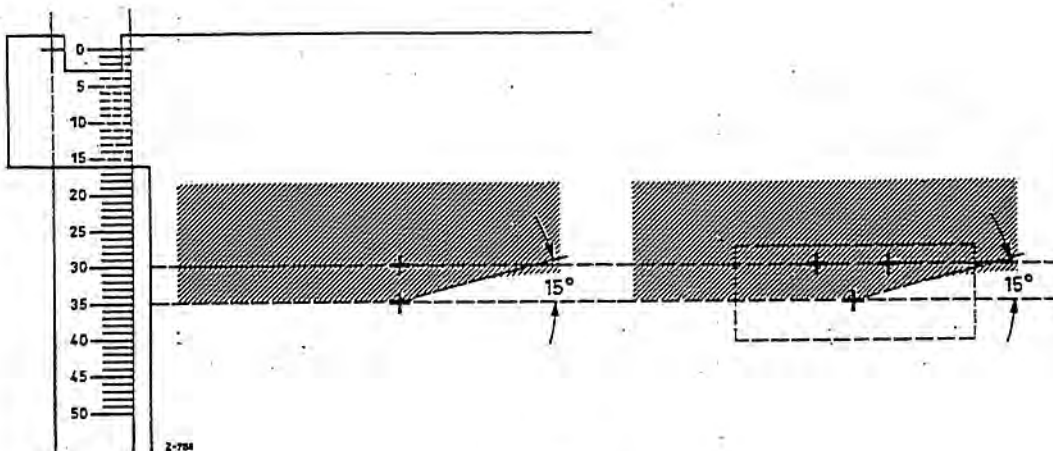


Fig. 82-2/1

#### Horizontal beam aiming:

Aim the headlight beams horizontally in such a way that the break in the light-dark boundary coincides with the lower cross on the adjusting screen (Fig. 82-2/1). If the break is not clearly visible the situation can be improved by covering the gusset on the left side of the diffusing lens several times by hand.

#### Vertical beam aiming:

The headlights are aimed vertically in such a way that the light-dark boundary runs vertically to the left of the break and coincides with the lower line of the adjusting screen (Fig. 82-2/1).

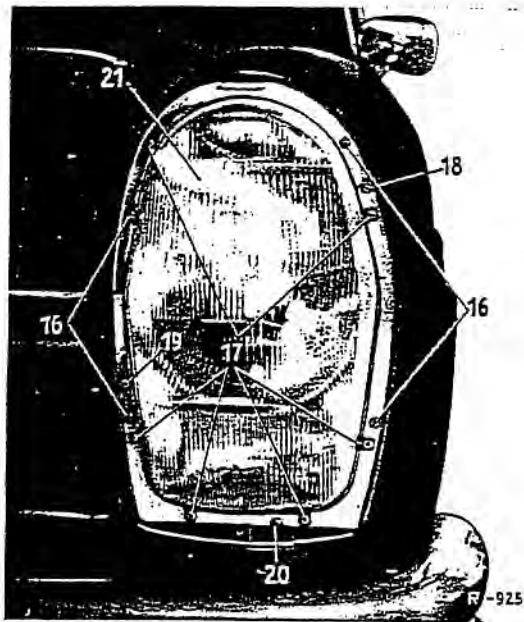


Fig. 82-2/2

- 16 Fixing screw for lighting unit
- 17 Swivel clip
- 18 Vertical plane adjusting screw for main headlight
- 19 Lateral plane adjusting screw for main headlight
- 20 Adjusting screw for fog light
- 21 Lens

### B. Adjustment of Fog Lights

1. Place a load of 70 kg in the middle of the rear seats.
2. Put the car 5 m from the adjusting screen.
3. On the adjusting screen mark the height  $H$  of the fog lights. Underneath this draw in the adjusting line at the specified distance ( $h$ ) marked on the lens of the fog lights (Fig. 82-2/4).

For the fog light in the lighting unit the distance ( $h$ ) is 12 cm.

4. Adjust the fog lights in such a way that the adjusting line lies in the center of the most brightly illuminated area of the adjusting screen (see Fig. 82-2/4).

**Note:** Check each fog light separately, cover the other while doing this.

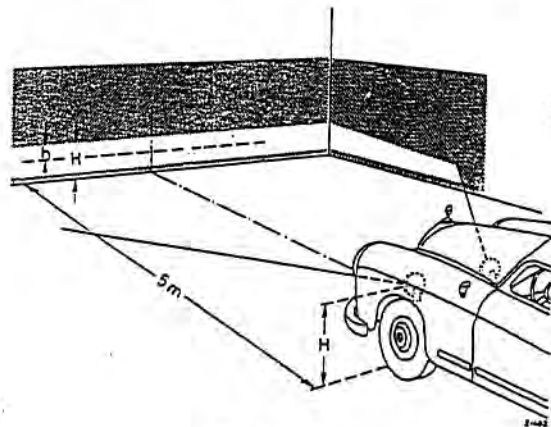


Fig. 82-2/4

## Windshield Wipers

### A. Removal and Installation of Windshield Wiper Motor

#### Removal:

1. Remove the right cover under the instrument panel.
2. Detach the short link (1) from the motor crank (2) by removing the snap ring and the washer (4) (Fig. 82-4/1).

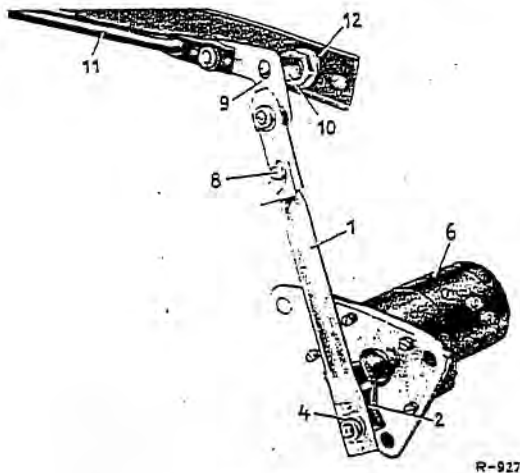


Fig. 82-4/1

- |                 |                   |
|-----------------|-------------------|
| 1 Link          | 9 Tandem lever    |
| 2 Motor crank   | 10 Adjusting gage |
| 4 Washer        | 11 Long link      |
| 6 Wiper motor   | 12 Holding plate  |
| 8 Locking screw | 13 Wiper shaft    |

3. From the engine compartment pull out the 6-pin plug (7), screw out the fixing screws (5) and remove the wiper motor (6) (82-4/2).

#### Installation:

4. Fit the wiper motor (6) and screw on by means of the fixing screws (5) (Fig.-82-4/2).

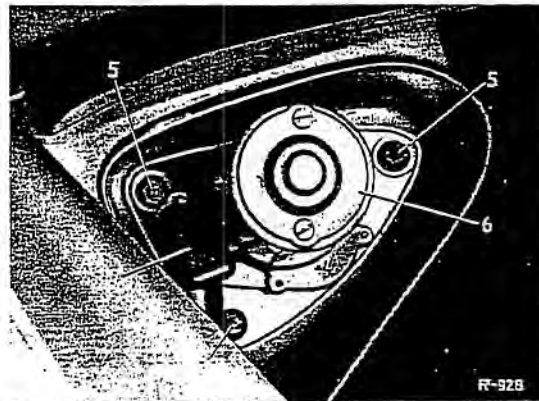


Fig. 82-4/2

- 5 Fixing screws  
6 Wiper motor  
7 6-pin plug

5. Insert the 6-pin plug (7) and put the wiper motor into the parking position by switching it on and off quickly.

**Note:** If only the wiping motor has to be replaced, the linkage should not be adjusted in any way. In particular the locking screw (8) on the short link (1) (Fig. 82-4/1) must not be loosened since otherwise complete readjustment of the drive linkage becomes necessary.

6. Attach the short link (1) to the motor crank (2) together with washer (4) and snap ring (Fig. 82-4/1).

7. Install the right cover below the instrument panel.

### B. Removal and Installation of Wiper Arm with Wiper Blade

#### Removal:

1. Unscrew the cap nut and remove together with spring washers.
2. Remove the wiper arm together with wiper blade.

#### Installation:

3. Installation is the reverse of the removal procedure; make sure that in the parking position the left wiper arm is below the right arm.



**Note:** The wiper shaft has a serrated cone and the wiper arm is mounted on this cone. The inner cone of a new wiper arm has no serrations. When the cap nut is tightened the serrations on the wiper shaft bite into the inner cone of the wiper arm. This guarantees better adjustment of the wiper arms. If necessary the serrations in the inner cone of the wiper arm can be eliminated as

follows; lightly mount the wiper arm on the wiper shaft and move it toward the right and the left until the serrations on the wiper arm have been evened out by the serrations on the wiper shaft.

Then readjust the wiper arm and firmly tighten the cap nut so that the serrations bite into the inner cone of the wiper arm in the new position.

### C. Removal and Installation of Left or Right Wiper Blade of Windshield Wiper

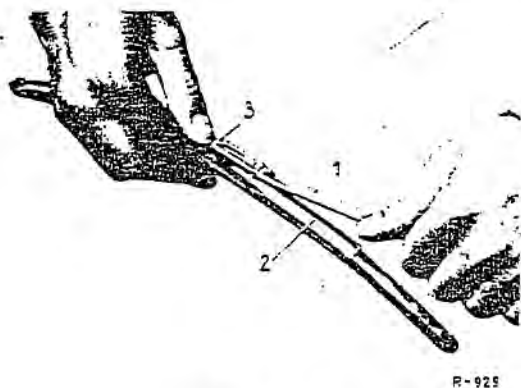


Fig. 82-4/3

- 1 Wiper arm
- 2 Wiper blade
- 3 Retaining spring

#### Removal:

1. Lift the wiper arm (1) with the wiper blade. Press down the retaining spring (3) on the wiper blade (2) and remove the wiper blade (2) in the direction indicated by the arrow (Fig. 82-4/3).

#### Installation:

2. Install the wiper blade (2) on the wiper arm (1) in the reverse direction and push it in until the retaining spring (3) is heard to click into position.

### D. Removal and Installation of Rubber Blade

#### Removal:

1. Remove the wiper blade (see Section C).
2. Push out the rubber blade (1) together with the two retaining springs (2) at the one end of the anchorage in the wiping blade (3) in the direction indicated by the arrow (Fig. 82-4/4).

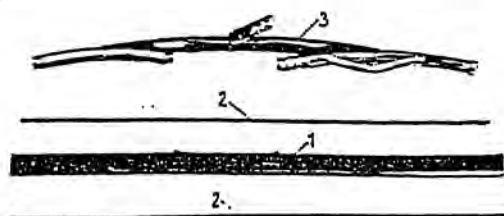


Fig. 82-4/4

- 1 Rubber blade
- 2 Retaining spring
- 3 Wiper blade

3. Pull out the two retaining springs (2) (Fig. 82-4/4).
4. Carefully take the rubber blade (1) out of the anchorage of the wiper blade (3) (Fig. 82-4/4).

#### Installation:

5. Loosely insert the rubber blade (1) into the one anchorage of the wiper blade (3) without retaining springs (2). Leave the long end free.
6. Carefully insert the two retaining springs (2) into the rubber blade (1) (see Fig. 82-4/5).
7. Slide the free end of the rubber blade (1) together with the retaining springs (2) into the other anchorage of the wiper blade (3) (Fig. 82-4/4).
8. Install the rubber blade (see Section C).

Modification: Section F added

### E. Removal and Installation of Push-Pull Switch for Windshield Wipers

#### Removal:

1. Remove the left cover from under the instrument panel.
2. Unscrew the control knob and the escutcheon from the push-pull switch.

3. Reaching behind the instrument panel take out the push-pull switch.
4. Pull off the plug from the push-pull switch.

#### Installation:

5. Installation is the reverse of the removal procedure.

### F. Removal and Installation of Windshield Wiper Linkage with Plate

Model 230 SL

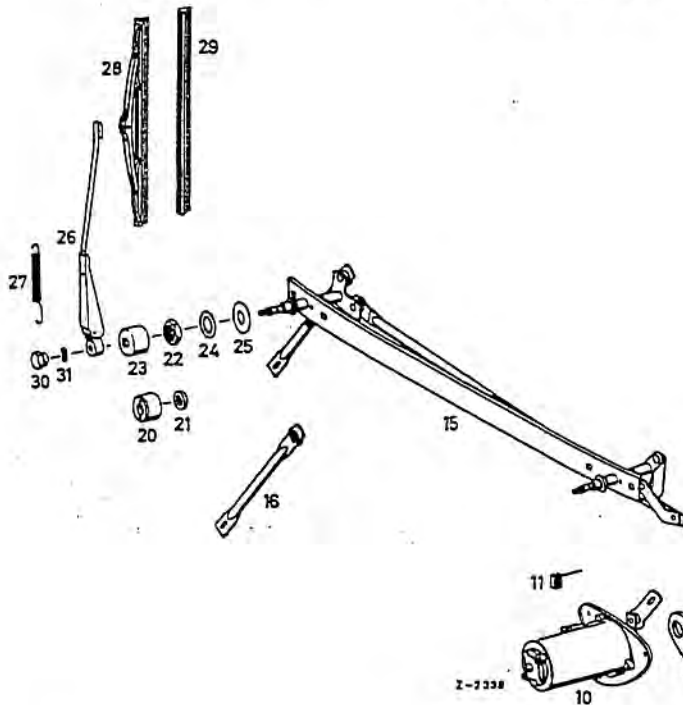


Fig. 82-4/5

- 10 Wiper motor
  - 11 Carbon brush
  - 12 Base plate
  - 15 Windshield wiper linkage with plate
  - 16 Adjustable drive rod
  - 20 Cap nut
  - 21 Sealing ring
  - 22 Hexagon nut
  - 23 Capsule
  - 24 Washer
  - 25 Washer
  - 26 Wiper arm
  - 27 Tension spring
  - 28 Wiper blade
  - 29 Rubber blade
  - 30 Cap nut
  - 31 Corrugated washer
- 1st version
- 2nd version

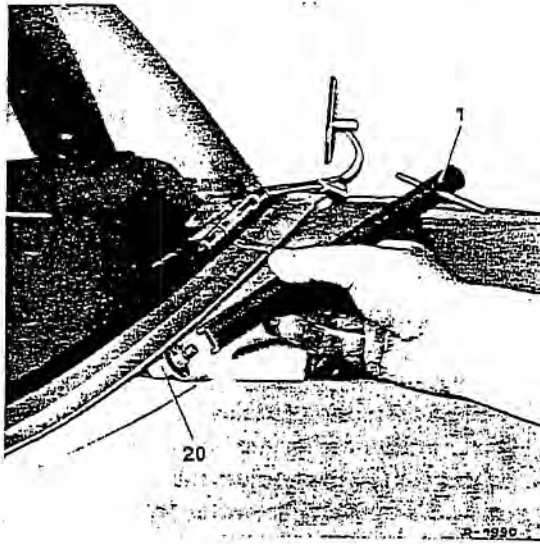
#### Removal:

1. Remove the glove compartment (see Job No. 68-1).
2. Remove the clock (see Job No. 54-12, Section B).
3. Detach the cables for the operating system for heating and ventilation (see Job No. 83-2, Section A).
4. Remove the distribution box (see Job No. 83-2, Section B).
5. Remove the right defroster nozzle (see Job No. 83-2, Section E).
6. Remove the steering wheel (see Job No. 46-2).
7. Remove the support and pedals (see Job No. 29-1, Section B).
8. Remove the left defroster nozzle (see Job No. 83-2, Section F).
9. Remove both wiper arms with blades (see Section B).
- 10a. Use the special wrench to unscrew the cap nut (20) (Fig. 82-4/6) and remove together with the sealing ring. (1st version).

- 10b. Take off the capsule (23). Unscrew the hexagon nut (22) and remove together with the washers (24) and (25). (2nd version.)
11. Unscrew the windshield wiper linkage together with the plate from the front wall and remove (Figs. 82-4/5 and 7).

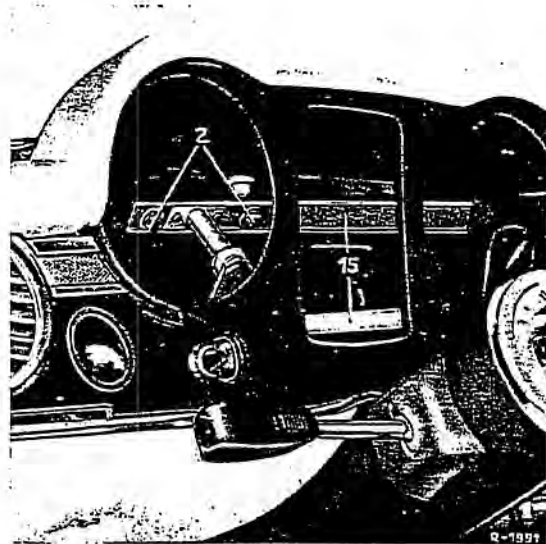
**Installation:**

12. Installation is the reverse of the removal procedure.



**Fig. 82-4/6**

- 1 Special wrench
- 20 Cap nut



**Fig. 82-4/7**

- 2 Plate fixing screws
- 15 Windshield wiper linkage with plate

## Removal and Installation of Windshield Washer

### Removal:

1. Take out the left rubber mat on the front floor.
2. Unscrew the oval-head screws at the left front wall insulating panel and take out the insulating panel.
3. Pull off the suction hose from the foot pump and screw out the two fixing screws (3) (Fig. 82-5/1).

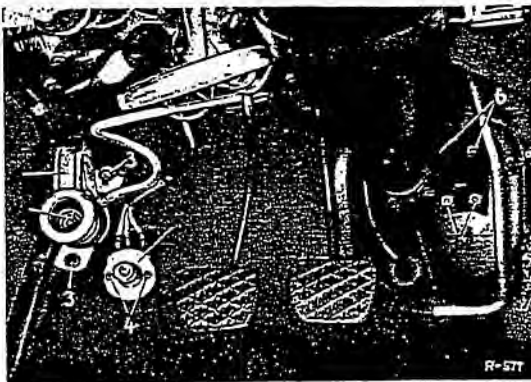


Fig. 82-5/1

- 1 Lever for windshield wiper operation
- 2 Pump for windshield washer
- 3 Fixing screws
- 4 Fixing screws
- 5 Foot dimmer switch
- 6 Hexagon nuts

4. Remove the foot pump and pull out the plug.

5. Remove the water container and the hoses in the engine compartment and the spray nozzles at the engine hood.

### Installation:

6. Installation is the reverse of the removal procedure.

**Note:** A nozzle needle is supplied for the adjustment of the nozzles and for cleaning blocked nozzles. This needle is in a plastic box together with the spare fuses in the tool bag.

7. Adjust the spray nozzles as follows: Insert the nozzle needle into the nozzle opening about 2 mm, and adjust the ball nozzle in such a way that the water jet is given the desired direction.

8. Dilute 1 part Mercedes-Benz windshield cleaning fluid in 12 parts of water and mix well. Pour this solution into the water container (water container capacity appr. 1.2 liters).

**Note:** In winter dilute 1 part Mercedes-Benz concentrate in 6 parts of water and mix well. This solution does not freeze at temperatures down to  $-9^{\circ}\text{C}$ . This solution is also suitable for cleaning smeared (greasy) windshields.

**Caution!** Any concentration of the fluid higher than the one given above will attack the car finish.

## Removal and Installation of Combined Left or Right Rear Light

Job No.

82-13

The large rear light designated "a" is installed in Models 220 SE and 220 SEb. The small rear light designated "b" is installed in Model 220 b. Since the procedure for removing and installing the two rear lights is essentially the same the following text refers to both rear light "a" and rear light "b".

### Removal:

1. Pull out the six-pin plug (1) and in the case of rear light "b" also the two-pin plug (2) from the housing (3) of the rear light (see Figs. 82-13/1a and 82-13/1b).
2. Screw out the fixing nuts (4) and remove the lamp housing together with the sealing frame (Figs. 82-13/1a and 82-13/1b).

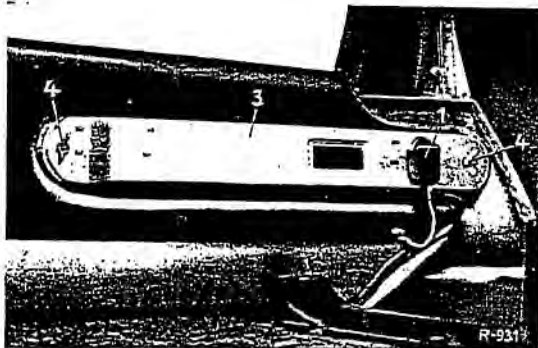


Fig. 82-13/1a

- 1 Six-pin plug
- 2 Lamp housing
- 3 Fixing nut

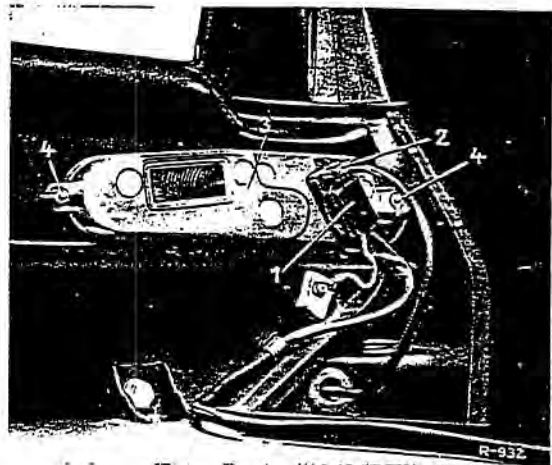


Fig. 82-13/1b

- 1 Six-pin plug
- 2 Two-pin plug
- 3 Lamp housing
- 4 Fixing nut

3. If necessary replace the bulbs (see Figs. 82-13/2a and 82-13/2b).

### Installation:

4. Installation is the reverse of the removal procedure.

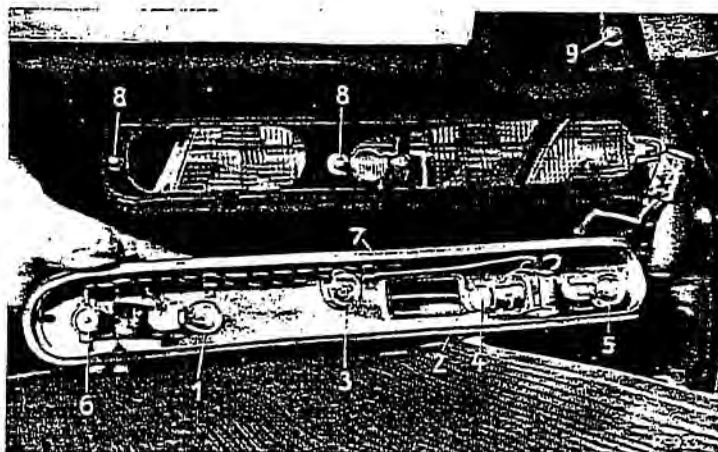


Fig. 82-13/2a

Models 220 Sb, 220 SEb

- 1 Bulb for brake light 15 W
- 2 Bulb for clearance light 3 W
- 3 Bulb for reversing light 15 W
- 4 Bulb for tail light 5 W
- 5 Bulb for flash direction signal 15 W
- 6 Bulb for license plate light 10 W
- 7 Sealing frame inside
- 8 Fixing nut for cover
- 9 Fixing nut for embellisher

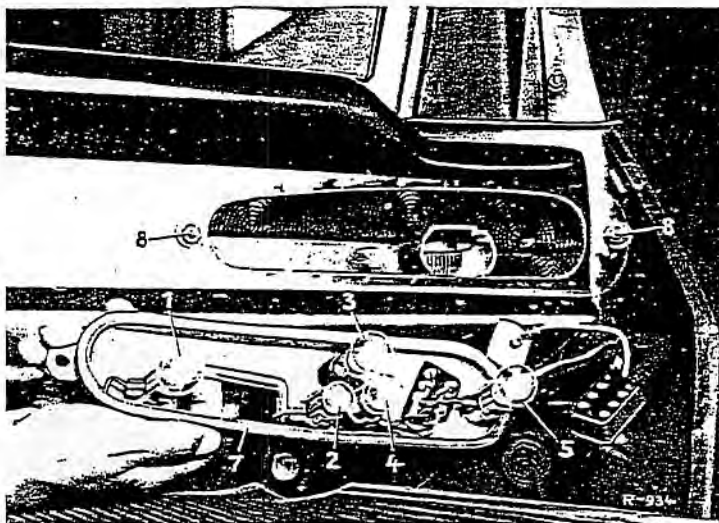


Fig. 82-13/2b

Typ 220 b

- 1 Bulb for brake light 15 W
- 2 Bulb for clearance light 3 W
- 3 Bulb for reversing light 15 W
- 4 Bulb for tail light 5 W
- 5 Bulb for flash direction signal 15 W
- 7 Sealing frame inside
- 8 Fixing nut for cover
- 9 Fixing nut for embellisher

Job No.
82-15

## Removal and Installation of Rotary Light Switch

### Removal:

1. Remove the left insulating panel from below the instrument panel (see Job No. 68-3).
2. Pull out the rotary light switch control knob. Screw out the escutcheon by means of a hooked wrench and pull out the control knob completely.
3. Reach behind the instrument panel and pull out the rotary light switch toward the front.
4. Disconnect the electric cables.

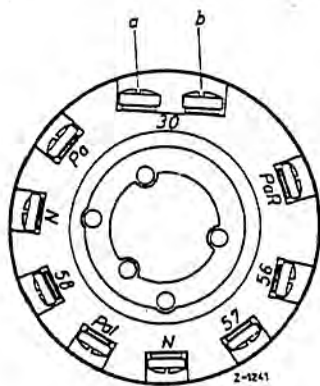


Fig. 82-15/1

### Installation:

5. Connect the electric cables to the rotary light switch. When doing this pay attention to the color coding and connect as follows:
  - The red cable (4 mm<sup>2</sup> section) and the red cable (2.5 mm<sup>2</sup> section) to "a" of terminal 30.
  - The red cable (1 mm<sup>2</sup> section) (lead No. 5) to "b" of terminal 30. The two green cables (1 mm<sup>2</sup> section) to terminal PaR.
  - The white-yellow cable (2.5 mm<sup>2</sup> section) to terminal 56.
  - The grey-green-yellow cable (2.5 mm<sup>2</sup> section) to one of the two terminals N.
  - The two grey-green cables (1.5 mm<sup>2</sup> section) to the other terminal N.
  - The red-green cable (1 mm<sup>2</sup> section) to terminal PaL.
  - The two green-black cables (1 mm<sup>2</sup> section) to terminal PaL.
  - The grey cable (1.5 mm<sup>2</sup> section) to terminal 58.
  - Terminal 57 should remain free.
6. The remaining installation operations are the reverse of the removal procedure.

# Interference Suppressors for Radio

Job No.

82-20

*Modification: Arrangement of Interference Suppressors (Figs. 82-20/1 to 6) added*

Good radio reception can only be obtained when the following instructions for interference suppression are carefully adhered to. The total resistance in the ignition circuit should be between 13 k  $\Omega$  and a maximum of 16 k  $\Omega$ . If the resistance values are higher, ignition performance will be reduced excessively with the result that misfiring may occur at high engine speeds.

Interference suppressors	optional		Remarks
	Bosch Part No.	Beru Part No.	
1. Spark plugs with suppressors (5 k $\Omega$ )	see spark plug table		<b>Use only approved spark plugs</b>
2. Spark plug suppressor caps (angular form) (1 k $\Omega$ ) Spark plug suppressor cap (straight form) (1 k $\Omega$ )	EM/W1/11 000 156 15 10 EM/W 1/14 000 159 12 42	OE 4/1 000 156 16 10 BE 4/1 000 159 13 42	190 c, 220 b, 220 Sb 220 SEb
3. Spark plug suppressor cap (1 k $\Omega$ )	EM/W 1/20 000 156 17 10	VES 1 K 000 156 18 10	
4. Water protective caps	Bosch type —	G 1 PL 000 159 07 85	
5. Distributor rotor arm with interference suppression (5 k $\Omega$ )	ZVVZ 5 Z 5 Z 000 158 11 31	EVL 4/6 Z —	
6. Suppressor condenser with insulated return cable to ignition coil terminal 15	EMKO 20 Z 1 Z 3 MF 000 156 29 01	SK 215 L 3 MF 000 156 31 01	Fig. 82-20/1

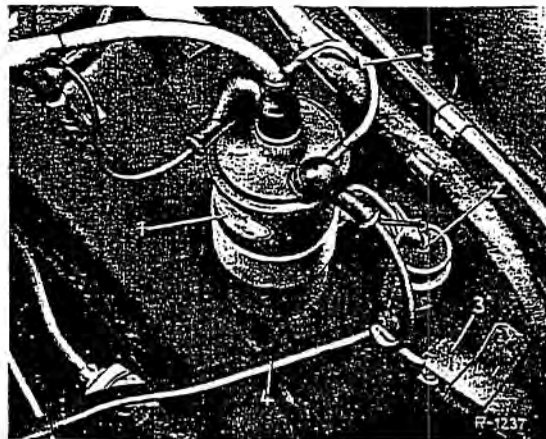


Fig. 82-20/1

- 1 Ignition coil
- 2 Suppressor condenser to ignition coil terminal 15
- 3 Series resistance
- 4 Ground cable to engine block
- 5 Connection cable for electric revolution counter

82-20/1

7. Regulator cut-out switch with spot-welded ground straps. If a radio is installed subsequently it is necessary to suppress the standard regulator cut-out switch with two additional ground straps Part No. 180 540 03 41 (Fig. 82-20/2).

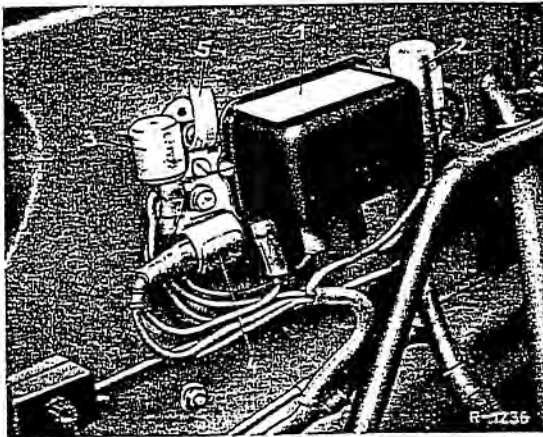


Fig. 82-20/2

- 1 Regulator cut-out switch
- 2 Feed-through condenser at regulator terminal 51
- 3 Choke and condenser suppressor at regulator terminal DF
- 4 Feed-through condenser at regulator terminal 61
- 5 Ground strap 180 540 03 41

Interference suppressors	optional		Remark
	Bosch Part No.	Beru Part No.	
8. Feed-through condenser at regulator terminal 51	EMKO 21 Z 2 Z 2.5 MF 000 156 37 01	SK 211R 3 MF 000 156 20 01	Fig. 82-20/2
9. Feed-through condenser at regulator terminal 61	EMKO 21 Z 1 Z 0.5 MF 000 156 26 01	SK 219 R 0.5 MF 000 156 33 01	Fig. 82-20/2
10. Choke and condenser suppressor at regulator terminal DF	EM/SD 3/1 0.005 MF 000 156 28 01	—	Fig. 82-20/2
11. Feed-through condenser at terminal Df of the generator	EMKO 21 Z 1 Z 0.5 MF 000 156 26 01	SK 210 R 0.5 MF 000 156 30 01	Fig. 82-20/3

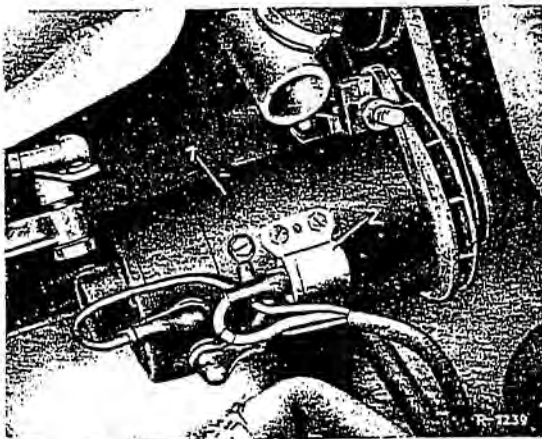


Fig. 82-20/3

- 1 Generator
- 2 Feed-through condenser at terminal Df of the generator



12. 1 Ground strap Part No. 10 120 820 00 72 between capillary tube of the radiator thermometer and the cowl (Fig. 82-20/4).
13. 1 Ground strap Part No. 10 120 820 00 72 between choke control and cowl (Fig. 82-20/4).
14. 1 Ground strap Part No. 180 540 00 41 between speedometer drive shaft and cowl (Fig. 82-20/4).

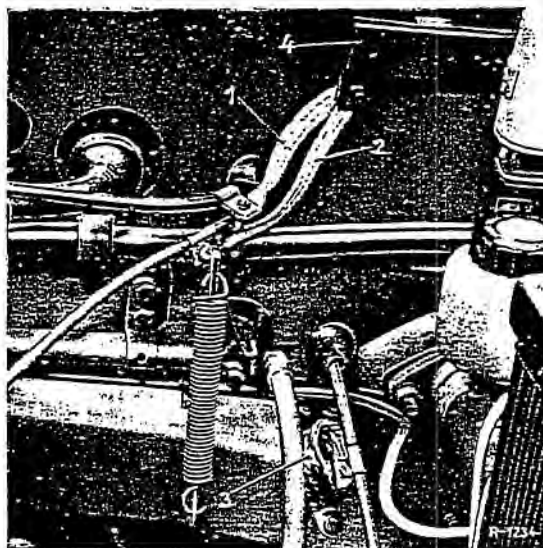


Fig. 82-20/4

- 1 Ground strap between choke control and cowl
- 2 Ground strap between capillary tube of the radiator thermometer and cowl
- 3 Ground strap between speedometer drive shaft and cowl
- 4 Relay bracket

15. 1 Ground strap Part No. 180 540 01 41 from ground connection of the condenser at the ignition coil to the engine (Figs. 82-20/1 and 82-20/5).
16. 1 Ground strap Part No. 180 540 00 41 from the engine to the left radiator mounting (Fig. 82-20/5).

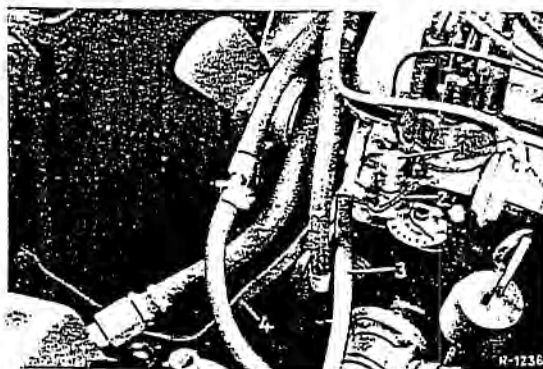


Fig. 82-20/5

- 1 Ignition condenser at distributor
- 2 Ground strap from distributor to engine block
- 3 Ground strap from engine block to ignition coil
- 4 Ground strap from engine block to radiator mounting

17. 1 Ground strap Part No. 180 540 04 41 from the hood to the cowl (Fig. 82-20/6).

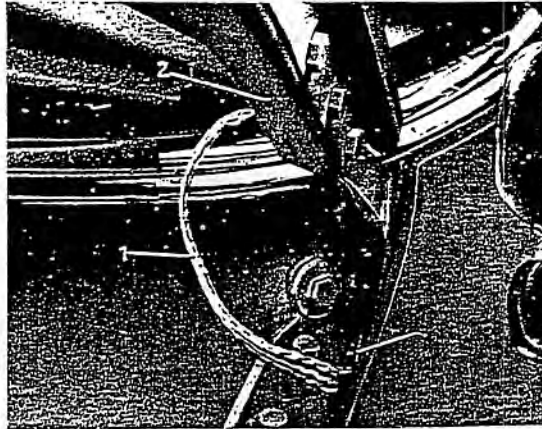


Fig. 82-20/6

- 1 Ground strap between hood and cowl
- 2 Hood
- 3 Connection at cowl

18. 2 Complete wheel hub contacts for the front wheels.

**Note:** In order to enable the ground straps to be tightened properly an ordinary washer should be installed in addition to the spring washer.

## Windows – Group 67

	Job No.
<b>Windshield with Garnish Molding and Reveal Molding</b>	67-1
A. Removal and Installation of Lower Left and Right Windshield Garnish Molding	
B. Removal and Installation of Windshield Reveal Molding	
C. Removal and Installation of Windshield	
<b>Windshield with Garnish Molding and Reveal Molding (Models 250 S, 250 SE, 300 SEb, 300 SEL)</b>	67-2
A. Removal and Installation of Lower Left and Right Windshield Garnish Molding	
B. Removal and Installation of Windshield Reveal Molding	
C. Removal and Installation of Windshield	
<b>Back Window with Garnish Molding</b>	67-3
A. Removal and Installation of Lower Left and Right Back Window Garnish Molding	
B. Removal and Installation of Back Window	

## Panels – Group 68/69

<b>Removal and Installation of Glove Compartment (Model 230 SL)</b>	68-1
<b>Removal and Installation of Glove Compartment (Models 250 S, 250 SE, 300 SEb, 300 SEL)</b>	68-2
<b>Padding on Instrument Panel (Models 250 S, 250 SE, 300 SEb, 300 SEL)</b>	68-3
A. Removal and Installation of Upper Padding	
B. Removal and Installation of Lower Padding	
<b>Removal and Installation of Left and Right Embellisher on Rear Pillar</b>	69-5

## Front and Rear Doors – Group 72/73

<b>Removal and Installation of Reveal Molding on Left or Right Front or Rear Door</b>	72-3
<b>Removal and Installation of Window Regulator Handle on Left or Right Front or Rear Door</b>	72-4
<b>Removal and Installation of Control Knob for Ventilator Lock on Left or Right Front Door</b>	72-5
<b>Removal and Installation of Arm Rest and Grip Handle on Left or Right Front or Rear Door</b>	72-6
<b>Removal and Installation of Door Trim Panel on Left or Right Front or Rear Door</b>	72-7
<b>Removal and Installation of Window Regulator and Sliding Window on Left or Right Front Door</b>	72-8
<b>Removal and Installation of Garnish Molding at Ledge of Left or Right Front or Rear Door</b>	72-9

67 to 81/1

	Job No.
<b>Removal and Installation of Outer and Inner Sealing Strip on Front or Rear Door</b>	72-10
<b>Removal and Installation of Flexible Window Channel on Left or Right Front or Rear Door</b>	72-12
<b>Ventilator and Ventilator Lock</b>	72-13
A. Removal and Installation of Ventilator on Left or Right Front Door	
B. Removal and Installation of Ventilator Lock on Left or Right Front Door	
<b>Removal and Installation of Garnish Moldings at Window Frame of Left or Right Front Door</b>	72-15
<b>Removal and Installation of Weatherstrip for Front or Rear Door</b>	72-16
<b>Door Lock and Handles</b>	72-17
A. Removal and Installation of Front or Rear Inner Door Handle	
B. Removal and Installation of Front or Rear Door Handle	
C. Removal and Installation of Door Lock for Front or Rear Door	
D. Removal and Installation of Striker on Left or Right Front or Rear Door	
<b>Removal and Installation of Fixed Window on Left or Right Rear Door</b>	73-13

## Rear Compartment Lid – Group 75

<b>Removal and Installation of Rear Compartment Lid</b>	75-1
<b>Removal and Installation of Rear Compartment Lid Weatherstrip</b>	75-4

## Sliding Roof – Group 78

<b>Steel Sliding Roof</b>	78-1
A. Removal and Installation of Sliding Roof	
B. Remedies for Binding Locking Lever (Handle)	
C. Remedies for Binding Sliding Roof	

## Tops – Group 79

<b>Removal and Installation of Side Windows of Coupé Roof (Model 230 SL)</b>	79-10
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# Windshield with Garnish Molding and Reveal Molding

Job No.

67-1

## A. Removal and Installation of Lower Left and Right Windshield Garnish Molding

### Removal:

1. Remove the fixing nut (1) for the garnish molding (2) at the lower left and right of the windshield (Fig. 67-1/1).



Fig. 67-1/1

- 1 Fixing nut
- 2 Lower left garnish molding at windshield

2. Use a folding rule or a flat piece of wood (3) to lift the garnish molding left and right

out of the press fasteners and remove it. Before doing this carefully push the covering of the center joint aside (Fig. 67-1/2).

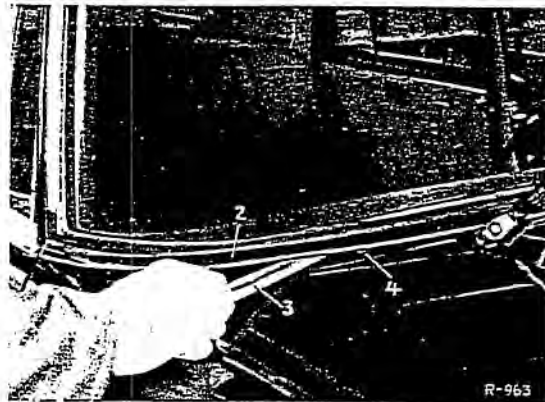


Fig. 67-1/2

- 2 Garnish molding
- 3 Flat piece of wood
- 4 Press fastener

### Installation:

3. Insert the upper part of the press fasteners (6) in the retaining plates (5) of the garnish molding (2) (Fig. 67-1/3).

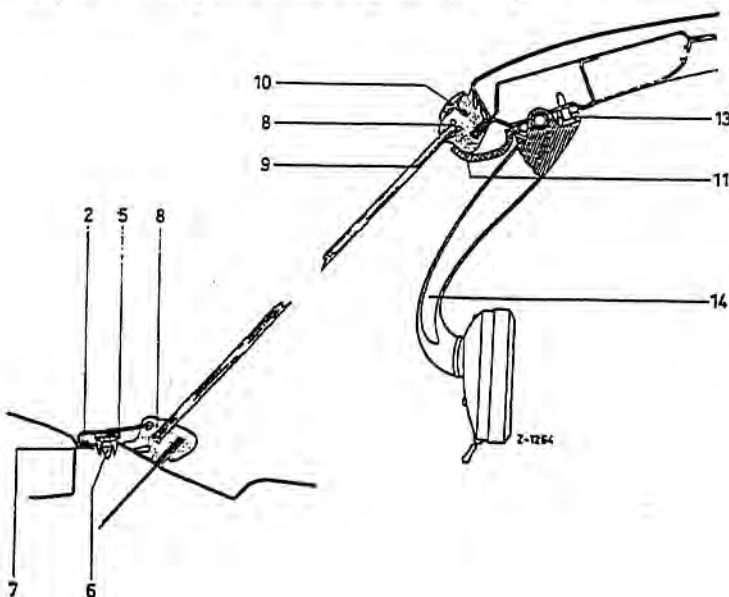


Fig. 67-1/3

- 2 Lower garnish molding
- 5 Retaining plate
- 6 Press fastener, upper part
- 7 Press fastener, lower part
- 8 Rubber molding
- 9 Windshield glass
- 10 Ornamental frame
- 11 Upper reveal molding
- 13 Retaining plate for rear view mirror
- 14 Rear view mirror

4. Insert the lower part of the press fasteners (7) in the fixing holes below the windshield glass.
5. Push the covering for the joint onto the left or right garnish molding.
6. Position the left and right garnish molding in such a way that the bolt at the outer end fits the fixing hole in the front fender (see Fig. 67-1/1) and that the upper parts (6) and the lower parts (7) of the press fasteners are aligned (Fig. 67-1/4; do not press them together yet).
7. Use a folding rule to lift the rubber lip of the rubber molding (8) over the garnish molding (2) and press the press fasteners together by a slight pressure on the garnish molding.
8. When the right and left garnish molding have been installed, carefully push the covering over the joint.
9. Screw in the fixing nut (1) together with the washer and lock washer underneath the front fender (see Fig. 67-1/1).

## B. Removal and Installation of Windshield Reveal Molding

### Removal:

1. Take the rear view mirror (14) out of the retaining plate (13) (see Fig. 67-1/3).

**Note:** The base of the rear view mirror has a spring lock.

2. Unscrew the retaining plate (13) for the rear view mirror.
3. Unscrew and remove the upper right and upper left reveal molding.
4. Unscrew the three fixing nuts (6) for the right lower reveal molding and the two fixing nuts for the left lower reveal molding and remove the reveal moldings (Fig. 67-1/4).

### Installation:

5. Installation is the reverse of the removal procedure.

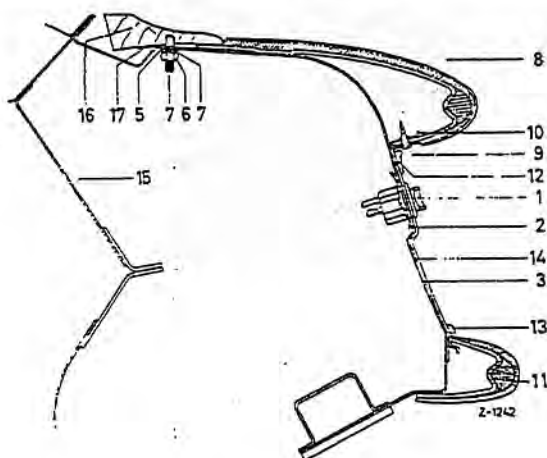


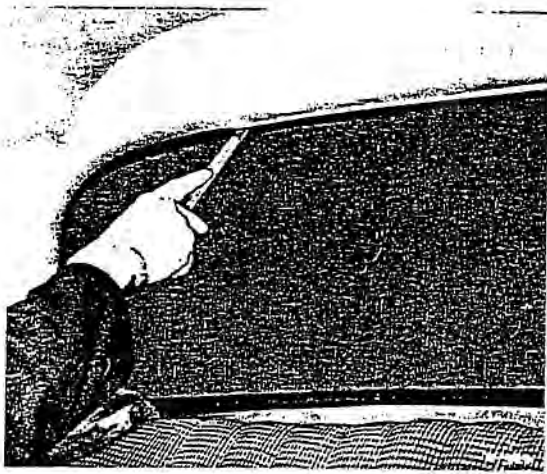
Fig. 67-1/4

- |                               |                           |
|-------------------------------|---------------------------|
| 1 Toggle switch               | 10 Clip-on nut            |
| 2 Clamping springs            | 11 Lower padding          |
| 3 Instrument panel            | 12 Upper garnish molding  |
| 5 Washer                      | 13 Lower garnish molding  |
| 6 Fixing nut with lock washer | 14 Instrument panel cover |
| 7 Threaded pin                | 15 Front wall             |
| 8 Upper padding               | 16 Reveal molding         |
| 9 Countersunk tapping screw   | 17 Felt base              |

## C. Removal and Installation of Windshield

### Removal:

1. Remove the windshield reveal molding (see Section B).
2. Remove the left and right lower windshield garnish molding (see Section A).
3. Use a flat piece of wood to push the rubber lip of the rubber molding from the inside behind the sheet metal edge (Fig. 67-1/5).
4. Carefully remove the windshield glass together with the rubber molding from the outside; if necessary, apply slight pressure from the inside.

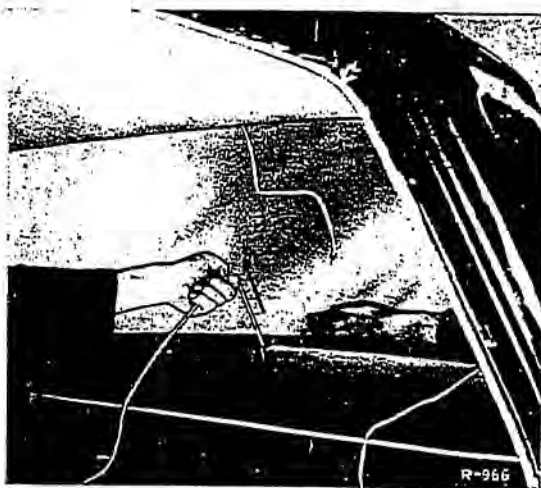
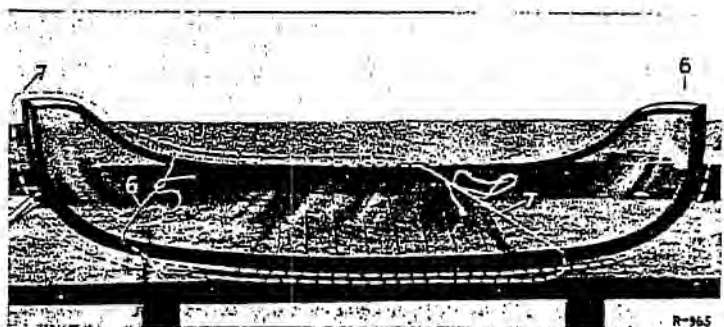


Shown at back window  
Fig. 67-1/5

5. Carefully remove the ornamental frame from the rubber molding and then remove the rubber molding from the windshield glass.

Fig. 67-1/6  
(Shown at back window)

- 6 Greased cord
- 7 Greased cord



Shown at back window  
Fig. 67-1/7

#### Installation:

6. Put the windshield glass, convex side down, on a suitable soft surface and install the rubber molding on the windshield glass (Fig. 67-1/6).

**Note:** Scrupulous cleanliness is required in handling the glass in order to prevent scratches.

7. Turn the windshield glass over and run a folding rule through the garnish molding groove along the rubber molding in order to clear the groove.
8. Coat the retaining section of the ornamental frame (10) with soapy water and carefully press the retaining section into the receiving groove of the rubber molding (8) (see Fig. 67-1/3).
9. Turn the windshield over and install two enamelled cables or two greased cords (6 and 7) into the retaining groove of the rubber molding and lightly rub the rubber molding with glycerine or tallow (Fig. 67-1/6).

10. Coat the spot-weld flange around the windshield opening with sealing cement BO 375/10 and fit the windshield glass together with the rubber molding into the windshield opening from the outside and position it accurately since later adjustments are not possible. Then press it home under slight pressure while at the same time an assistant lifts from the inside the rubber lip of the rubber molding over the spot-weld flange of the windshield opening by carefully pulling out the greased cord (6 and 7) or the enamelled cable.

The cable or cord must always be pulled out in the direction parallel to the glass in order to avoid damage to the rubber lip (Fig. 67-1/7).

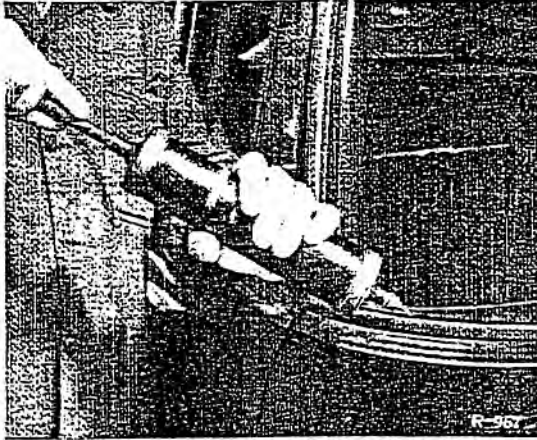


Fig. 67-1/8

11. Press window sealing cement BO 375/10 between windshield glass and rubber molding to provide a tight seal (Fig. 67-1/8).
12. Install the right and left lower windshield garnish molding (see Section A).
13. Install the right and left upper windshield reveal molding (see Section B, paras 1 to 3).

#### D. Removal and Installation of Windshield Reveal Molding on Model 230 SL

##### Removal:

1. Remove the reveal molding on the left and the right of the front pillar.
2. Detach the left cover below the instrument panel at the front and let it hang toward the rear.
3. Remove the revolution counter.
4. Reach through the opening for the revolution counter in the instrument panel and remove the two accessible nuts (SW 9) from the left reveal molding.

**Note:** Knurled Socket Wrench 110 589 03 09 00 (SW 9) is a suitable tool for loosening the nuts.

5. Remove the glove compartment (see Job No. 68-1).

6. Reach through the opening for the glove compartment in the instrument panel and remove the third nut from the left reveal molding and both nuts from the right reveal molding.
7. Lift out the reveal molding.

**Note:** The reveal molding on the driver's side must be lifted with particular care to prevent damage to the instrument panel leather cover by the two outer threaded pins of the reveal molding. It is advisable to slide a thin piece of leather or similar material under the threaded pins.

##### Installation:

Installation is the reverse of the removal procedure.



# Windshield with Garnish Molding and Reveal Molding

Job No.

67-2

Models 250 S, 250 SE, 300 SEb, 300 SEL

## A. Removal and Installation of Lower Left and Right Windshield Garnish Molding

### Removal:

1. Unscrew the screw (1) on the door box pillar (Fig. 67-2/1).
2. Slide a plastic or wooden wedge between the rubber seal and the garnish molding and press the garnish molding out of the clips (2) toward the front by tilting the wedge (see Fig. 68-3/1).

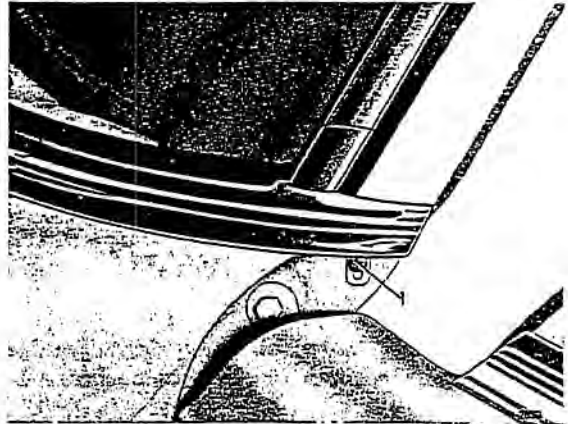


Fig. 67-2/1

1 Fixing screw for garnish molding

### Installation:

3. Installation is the reverse of the removal procedure.

## B. Removal and Installation of Windshield Reveal Molding

### Removal:

1. Remove the left and right cover under the instrument panel.
2. Remove the left and right reveal moldings from the door box pillar.
3. Remove the glove compartment (see Job No. 68-2).
4. Back out the two plastic nuts on the right reveal molding and remove the reveal molding.

**Note:** The most suitable tool for backing out the plastic nuts is Knurled Socket Wrench 110 589 03 09 00 (SW 9).

5. Back out the plastic nut on the left reveal molding (right left). Lift the reveal molding to release the threaded bolt and pull it out of its mounting toward the right.

### Installation:

6. Installation is the reverse of the removal procedure.

## C. Removal and Installation of Windshield

See Job No. 67-1, Section C.

Job No.
67-3

## Back Window with Garnish Molding

### A. Removal and Installation of Lower Left and Right Back Window Garnish Molding

#### Removal:

1. Unscrew the left and right fixing screw at the end of the garnish molding at the left and the right (beside the striker for the rear door).
2. Further removal is essentially the same as described for the windshield garnish molding under Job No. 67-1, No. 2.

#### Installation:

3. See Job No. 67-1, Nos. 3 to 8.
4. Screw in the fixing screw at the right and the left at the end of the garnish molding (beside the striker for the rear door).

### B. Removal and Installation of Back Window

#### Removal:

1. Remove the lower left and right garnish molding of the back window (see Section A).
2. Subsequent removal procedures are essentially the same as described for the windshield in Job No. 67-1, Section C, Nos. 3 to 5.

#### Installation:

3. Installation is essentially the same as described for the windshield in Job No. 67-1, Section C, Nos. 6 to 13.
4. Install the left and right lower back window garnish molding.

# Removal and Installation of Glove Compartment

Job No.

68-1

Model 230 SL

## Removal:

1. Remove the right cover under the instrument panel (4 screws).
2. Detach the two cables (2) from the cable connector (1) for the glove compartment reading light (Fig. 68-1/1).
3. Detach the cover (1) for the glove compartment bottom along the front side and use a short special screw driver (3) to unscrew the four oval head countersunk screws (2) attaching the glove compartment (Fig. 68-1/2).
4. Also unscrew the three countersunk screws (4) for attaching the glove compartment at the top using the same short special screw driver.
5. Close the glove compartment lid and lift out the glove compartment.

## Installation:

6. Installation is the reverse of the removal procedure. After screwing on the glove compartment stick down the cover for the glove compartment bottom with Dekalin adhesive.

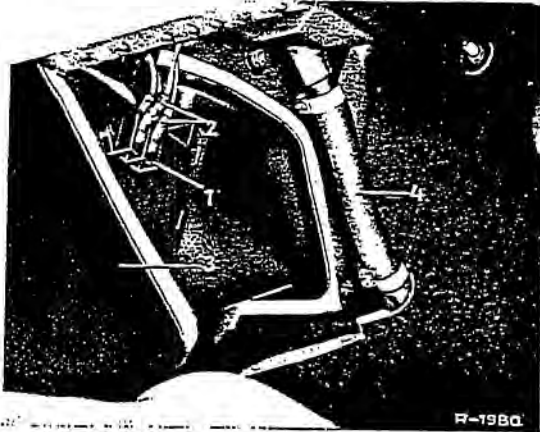


Fig. 68-1/1

- |   |                    |
|---|--------------------|
| 1 Cable connector                             | 3 Center cover     |
| 2 Cable for reading light (glove compartment) | 4 Water drain hose |

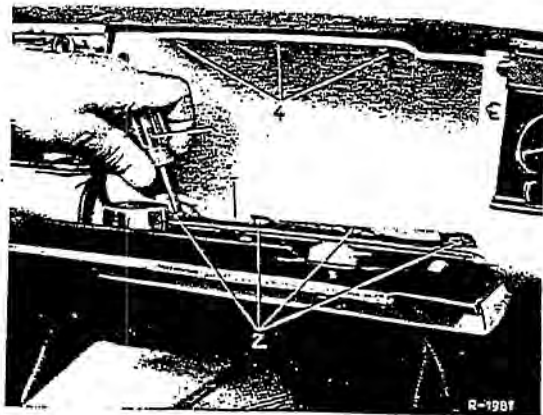


Fig. 68-1/2

- |                                      |
|--------------------------------------|
| 1 Cover for glove compartment bottom |
| 2 Oval head countersunk screws       |
| 3 Screw driver (Dowidat 149 KPV/02)  |
| 4 Countersunk screws                 |

Job No.

68-2

## Removal and Installation of Glove Compartment

Models 250 S, 250 SE, 300 SEb, 300 SEL

### Removal:

1. Unscrew the glass cover of the glove compartment light and take out the bulb.
2. Screw out the fixing screws (6) of the glove compartment and remove the compartment toward the interior of the car.

### Installation:

3. Installation is the reverse of the removal procedure.

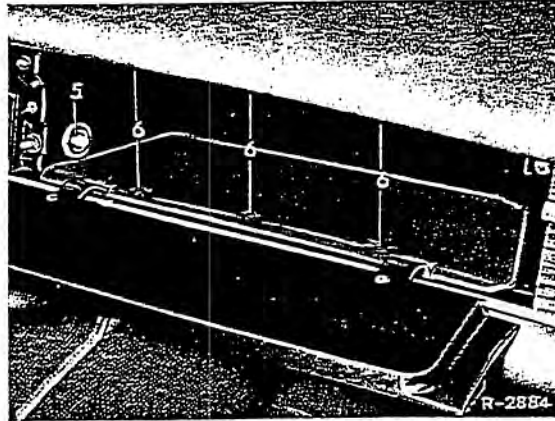


Fig. 68-2/1

5 Glass cover of glove compartment light  
6 Fixing screws

# Padding on Instrument Panel

Job No.

68-3

Models 250 S, 250 SE, 300 SEb, 300 SEL

## A. Removal and Installation of Upper Padding

### Removal:

1. Remove the reveal molding of the windshield (see Job No. 67-2, Section B), and unscrew the loudspeaker grille.
2. Remove the self-tapping screws (1) for the attachment of the padding (Fig. 68-3/1).
3. First lift the padding slightly upward (see arrow in picture) and then pull it down toward the interior of the car.

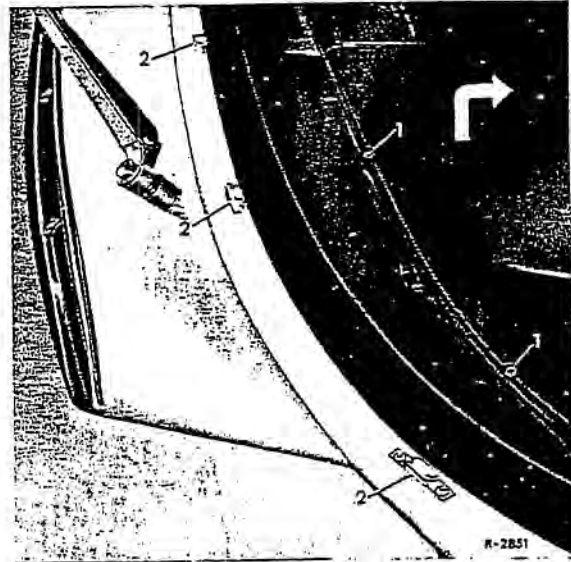


Fig. 68-3/1

1 Self-tapping screws  
2 Clips

### Installation:

4. Installation is the reverse of the removal procedure.

## B. Removal and Installation of Lower Padding

### Removal:

1. Loosen the connections between steering column jacket and instrument panel.
2. Turn out the fixing screws for the padding at the lower side of the instrument panel.
3. Pull the padding out of the garnish molding.

### Installation:

4. Installation is the reverse of the removal procedure; make sure that the clips of the padding engage properly in the garnish molding.

1950

# MEMORANDUM

TO : SAC, [illegible]

[illegible text]

[illegible text]

[illegible text]

DATE: [illegible]

[illegible text]

[illegible text]

## Removal and Installation of Left and Right Embellisher on Rear Pillar

Job No.

69-5

### Removal:

1. Insert a wire hook in the air outlet on the rear pillar and bend up the fixing plate (2) toward the rear (Fig. 69-5/1).

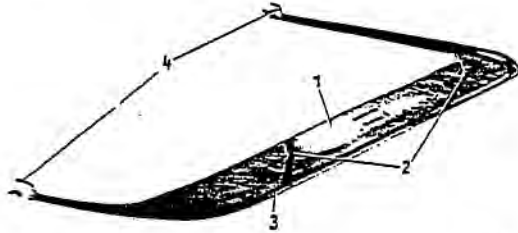


Fig. 69-5/1

- |                |              |
|----------------|--------------|
| 1 Embellisher  | 3 Recess     |
| 2 Fixing plate | 4 Fixing lug |

2. Pull out the embellisher (1) from the fixing slots toward the front and remove.

### Installation:

3. Insert a 2 mm diameter Terostat tape in the recess (3) of the embellisher.
4. Insert the fixing lugs (4) of the embellisher in the fixing slots. Push the embellisher toward the rear in the fixing slots, press it against the rear pillar and bend the fixing plate toward the front by means of a screw driver.

20-20-20  
100

100-100-100  
100-100-100

100-100-100

100-100-100  
100-100-100



100-100-100  
100-100-100  
100-100-100  
100-100-100





## Removal and Installation of Reveal Molding at Left or Right Front or Rear Door

Job No.

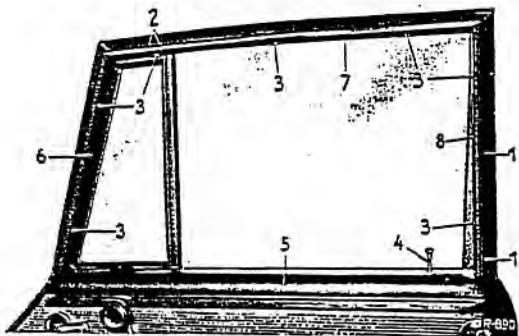
72-3

The reveal molding consists of the following parts:

Reveal molding front	}	Wood (only 220 Sb and 220 SEb)
Reveal molding top		
Reveal molding rear		
Reveal molding bottom, clamping part		

### Removal:

1. Remove the button for the inside safety lock (4) (Fig. 72-3/1).



(Shown at front door)

Fig. 72-3/1

- 1 Fixing screws for window frame rear garnish molding
- 2 Fixing screws for ventilator
- 3 Fixing screws for reveal molding
- 4 Button for inside safety lock
- 5 Reveal molding bottom
- 6 Reveal molding front
- 7 Reveal molding top
- 8 Reveal molding rear

2. Lift the lower reveal molding (5) upward by hand, and remove together with the retaining clips (Fig. 72-3/1).
3. Unscrew the fixing screws (3) for the front reveal molding, the top reveal molding (7), and the rear reveal molding (8) and remove the reveal moldings (Fig. 72-3/1).

### Installation:

4. Fit and screw on the front (6), top (7), and rear (8) reveal molding.
5. Insert the retaining clips in the lower reveal molding (5) and press the retaining clips into the corresponding holes in the door inner panel.
6. Screw in the button for the inside safety lock.

Job No.

72-4

## Removal and Installation of Window Regulator Handle at Left or Right Front or Rear Door

### Removal:

1. Press the padding (3) of the window regulator handle out from behind and pull it off upward (Fig. 72-4/1).

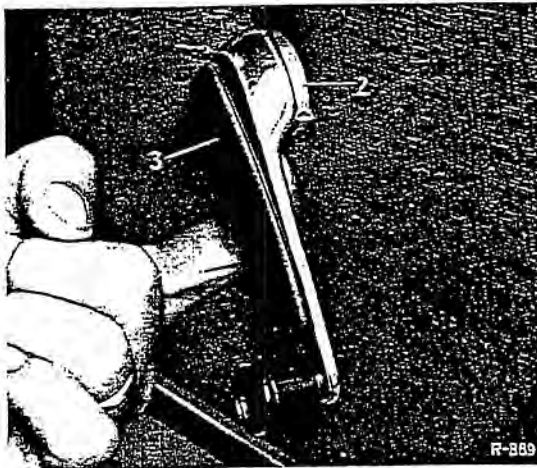


Fig. 72-4/1

2 Spacer  
3 Padding

2. Unscrew the fixing screw (1) for the window regulator handle and remove the regulator handle together with the spacer (2) (Fig. 72-4/2).

### Installation:

3. Insert the spacer (2) and the regulator handle and tighten by means of the fixing screw (1) (Fig. 72-4/2).



Fig. 72-4/2

1 Fixing screw  
2 Spacer  
3 Padding

4. Insert the padding (3) as shown in Fig. 72-4/2 by means of the retaining spring in the window regulator handle.

## Removal and Installation of Control Knob for Ventilator Lock on Left or Right Front Door

Job No.

72-5

### Removal:

1. Insert a wire hook (3) in the bore of the control knob (4) and press off the cap (2) of the control knob (4) toward the front (Fig. 72-5/1).

**Note:** At the point marked (1) at the rear part of the control knob (4) there is a bore for pressing out the control knob cap (2).

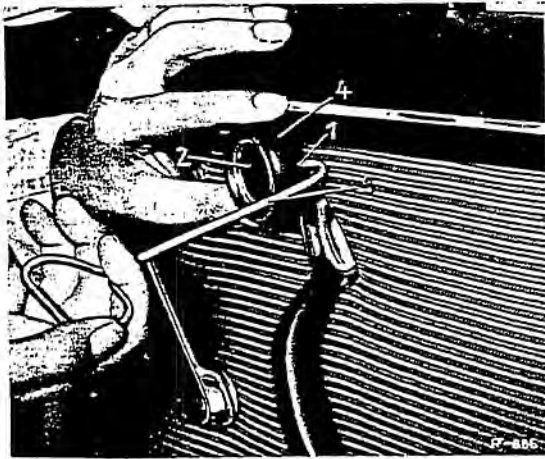


Fig. 72-5/1

- 1 Marked point
- 2 Control knob cap
- 3 Wire hook
- 4 Control knob

2. Screw out the fixing screw in the center of the control knob and remove the control knob.

### Installation:

3. Put the control knob (4) on the pin of the ventilator lock and screw on in the center of the knob by means of the fixing screw.
4. Press in the cap (2) of the control knob (4).

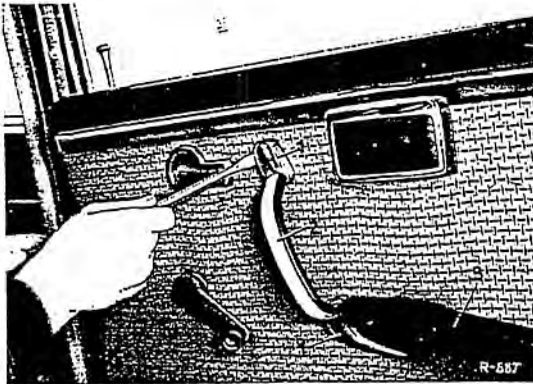
Job No.

72-6

## Removal and Installation of Arm Rest and Grip Handle on Left or Right Front or Rear Door

### Removal:

1. Unscrew the two fixing screws for the arm rest (3) and remove the arm rest.
2. Remove the control knob for the ventilator lock in the case of the front door (see Job No. 72-5).
3. Carefully lift the two caps (1) for the grip handle (2) by means of a screw driver and push them back (Fig. 72-6/1).



Shown at rear door

Fig. 72-6/1

- 1 Cap
- 2 Grip handle
- 3 Arm rest

4. Unscrew the fixing screws for the grip handle and remove the grip handle.

### Installation:

5. Screw on the grip handle (2) and press on the two caps (1) by hand until they click into place.
6. Screw on the arm rest (3).
7. In the case of the front door install the control knob for the ventilator lock (see Job No. 72-5).

## Removal and Installation of Door Trim Panel on Left or Right Front or Rear Door

Job No.

72-7

### Removal:

1. Remove the window reveal molding (see Job No. 72-3).
2. Remove the window regulator handle (see Job No. 72-4).
3. Remove the control knob for the ventilator lock (see Job No. 72-5; applicable only to the front door).
4. Remove the arm rest and the grip handle (see Job No. 72-6).
5. Use a screw driver to pry off the insert (1) of the recess (2) for the inside door handle of the front or rear door (Fig. 72-7/1).
6. Unscrew the fixing screw in the recess (2) and remove the recess (2) (see Job No. 72-7/1).

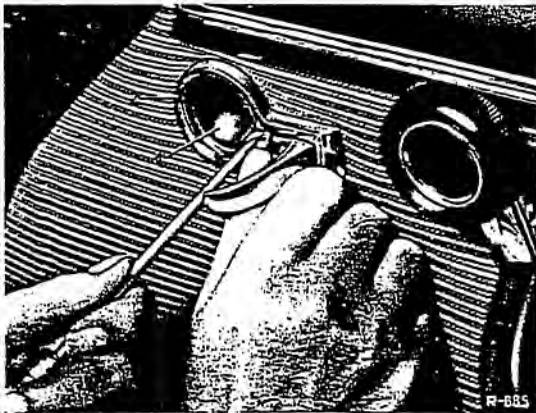


Fig. 72-7/1

1 Insert  
2 Recess

7. Unscrew the fixing screw (3) for the edge plate (4) and remove the edge plate (4) (Fig. 72-7/2).

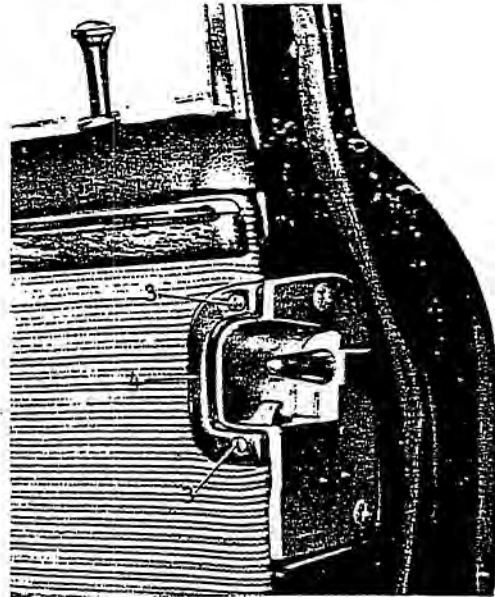


Fig. 72-7/2

3 Fixing screw  
4 Edge plate

8. Slide a folding rule or a similar tool from the side under the door trim panel and press out the plastic fasteners which fasten the door trim panel to the door inner panel at the two vertical slides.
9. Slide the door trim panel over the inside door handle and lift it out of the lower retainer.

### Installation:

10. Installation is the reverse of the removal procedure.

Job No.
72-8

## Removal and Installation of Window Regulator and Sliding Window in Left or Right Front or Rear Door

Modificación: Fig. 72-8/1

### Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Remove the inner sealing strip (see Job No. 72-10).
3. Wind the sliding window down to its lowest position and remove the two fixing screws (1) for the sliding window from the lower sash channel (2) (Fig. 72-8/1).

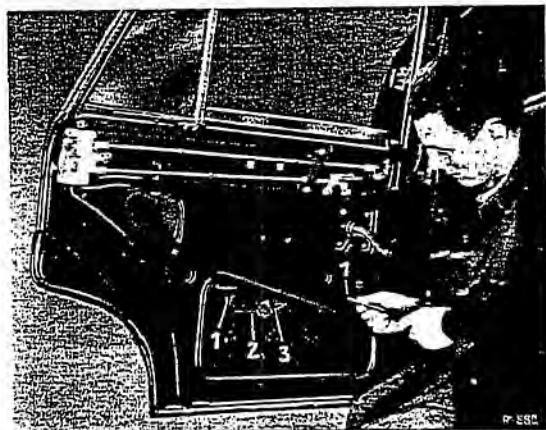


Fig 72-8/1

Shown at rear door

- 1 Fixing screws
- 2 Sash channel
- 3 Window regulator



Fig. 72-8/2

Shown at rear door

- 1 Fixing screw for window regulator
- 3 Fixing holes for run channel

4. Slide the door window glass upward by hand and carefully clamp in position by means of a wooden wedge (Fig. 72-8/2).
5. Remove the two fixing screws (3) for the window run channel and push the run channel toward the door outer panel (Fig. 72-8/2).
6. Unscrew the four fixing screws (1) for the window regulator and remove the window regulator together with lower sash channel through the opening in the door inside panel (Fig. 72-8/2).
7. Remove the wooden wedge and carefully slide the window glass downward by hand.



Fig. 72-8/3

Shown at rear door

8. Pull the window run channel slightly toward the hinge side (front door) or toward the lock side (rear door). This frees the sliding window; get a hold on the pane through the opening in the door inner panel, turn it 90° inside the window shaft, and remove upward (Fig. 72-8/3).

### Installation:

9. Installation is the reverse of the removal procedure.

## Removal and Installation of Garnish Molding at Ledge of Left or Right Front or Rear Door

Job No.

72-9

### Removal:

1. Unscrew the nut (1) of the fixing screw at the hinge side and remove together with washer and lock washer (Fig. 72-9/1).

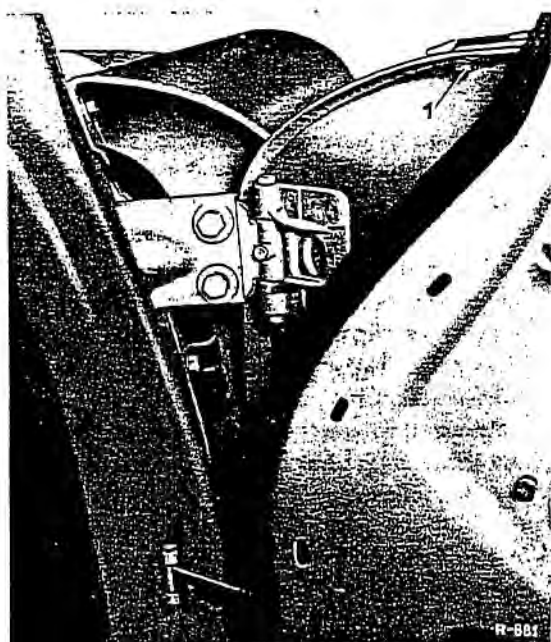


Fig. 72-9/1

1 Nut

2. Slide a folding rule or a similar blunt-edged tool under the hinge-side end of the garnish molding and carefully pull it through under the garnish molding toward the lock side in order to detach the retaining clips.
3. Remove the garnish molding.

### Installation:

4. Insert the retaining clips in the retainers on the underside of the garnish molding.
5. Press the garnish molding together with the retaining clips into the holes on the door outer panel.
6. Screw on the garnish molding at the hinge side with nut, washer and lock washer.

Job No.
72-10

## Removal and Installation of Outer and Inner Sealing Strip on Front or Rear Door

*Modification: new para 2*

### Removal:

1. Remove door trim panel (see Job No. 72-7).
2. By means of a screwdriver push the retaining clips of the inner sealing strip upward and remove the sealing strip together with the retaining clips upward.
3. Remove the garnish molding at the ledge (see Job No. 72-9).

4. The outer sealing strip (2) together with the retaining clips (1) is removed upward in the same way (Fig. 72-10/1).

### Installation:

5. Insert the new retaining clips (1) in the door (Fig. 72-10/1).

**Note:** Usually when the sealing strip is removed, the retaining clips (1) are left on the strip.

It is hardly possible to remove the clips from the sealing strip without damaging either the clips or the strip. It is advisable therefore always to use new retaining clips when installing a new sealing strip. The sealing strip on the front door is fastened by three clips and the strip of the rear door by four clips.

6. Press the sealing strip (2) into the clips from above (see Fig. 72-10/1).
7. Install the garnish molding at the ledge (Job No. 72-9).
8. Install the window regulator and the sliding window.



Fig. 72-10/1

1 Retaining clip  
2 Sealing strip



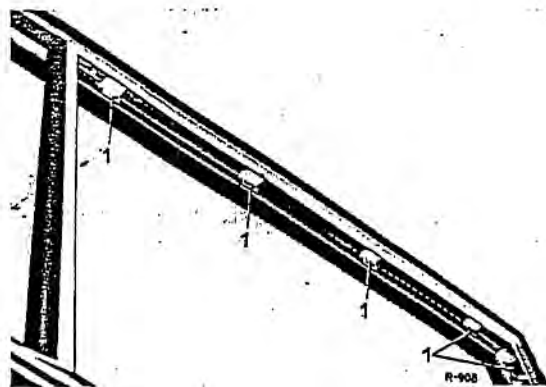
# Removal and Installation of Flexible Window Run Channel on Left or Right Front or Rear Door

Job No.

72-12

## Removal:

1. Remove the sliding window see Job No. 72-8
2. Remove the inner and outer sealing strip (see Job No. 72-10).
3. Pry the cemented part of the flexible window run channel (vertical parts) loose and pull it out together with retaining clips (1) in the upper horizontal area (Fig. 72-12/1).



Shown at rear door

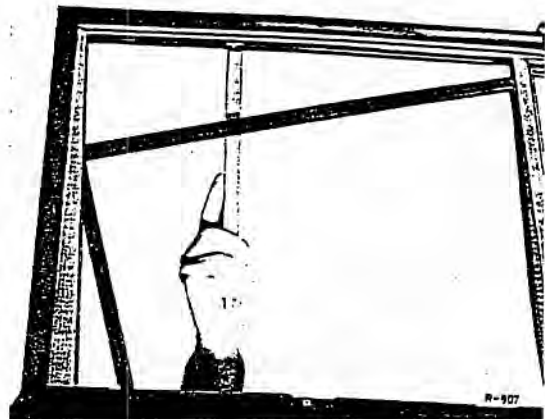
Fig. 72-12/1

1 Retaining clip

**Note:** The retaining clips cannot be removed from the window run channel without damaging either the clips or the channel. When a new window run channel is installed, new retaining clips must therefore be used.

## Installation:

4. Put the retaining clips in the door by means of a wooden driver (Fig. 72-12/2).
5. Fit the flexible window run channel, bend it as required and tap it into place by means of a hammer and wooden driver
6. Use bodywork adhesive to cement the flexible window run channel to the two vertical sides (Fig. 72-12/4) and straighten it, especially in the corners, by means of a wooden driver.
7. Install the outer and inner sealing strips (see Job No. 72-10).



Shown at rear door

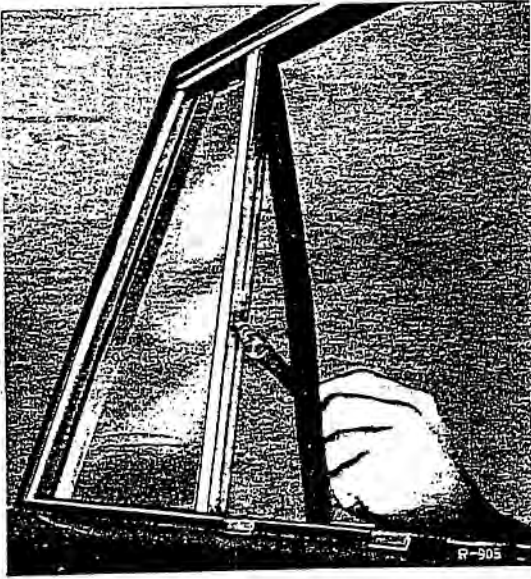
Fig. 72-12/2

by light taps, starting at the top corner on the hinge side of the door (Fig. 72-12/3).



Shown at rear door

Fig. 72-12/3



Shown at rear door

Fig. 72-12/4



Shown at rear door

Fig. 72-12/5

- 1 Slot
- 2 Window run channel

8. Install the sliding window see Job No. 72-8.
9. Insert the window run channel (2) and fix it loosely in the slots (1) (Fig. 72-12/5).
10. Cement the flexible window run channel to the screwed-on window run channel.
11. Adjust the screwed-on window run channel in the slotted holes (1) in such a way that the window glass has a side clearance of appr. 2 mm.
12. Check the sliding window for ease of movement by raising and lowering it several times. If necessary, straighten the window run channel by means of a wooden driver.

# Ventilator and Ventilator Lock

Job No.

72-13

## A. Removal and Installation of Ventilator on Left or Right Front Door

### Removal:

1. Remove the window regulator and the sliding window (see Job No. 72-8).
2. Remove the outer and inner sealing strip (Job No. 72-10).
3. Remove the flexible window run channel (see Job No. 72-12).
4. Unscrew the hexagon screw (1) (Fig. 72-13/1).

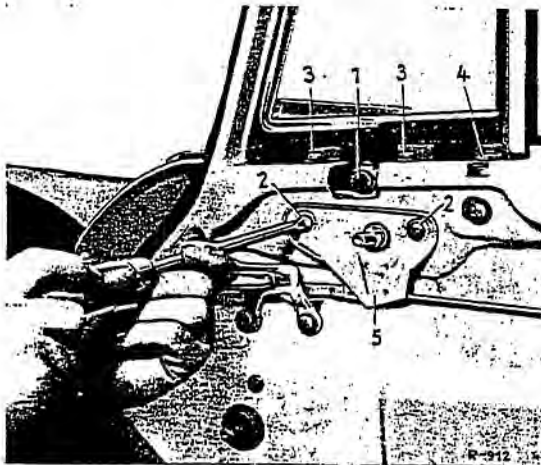


Fig. 72-13/1

- 1 Hexagon screw
- 2 Fixing screw
- 3 Fixing screw
- 4 Fixing screw
- 5 Mounting plate

5. Slightly loosen the two fixing screws (2) for the ventilator lock and push the ventilator lock downward in the slotted holes in order to free the lower pivot pin of the ventilator (Fig. 72-13/1).

6. Unscrew the fixing screws (3) and (4).
7. Unscrew the two top fixing screws (2) (see Fig. 72-13/1) and take out the ventilator together with the ventilator frame (Fig. 72-13/2).

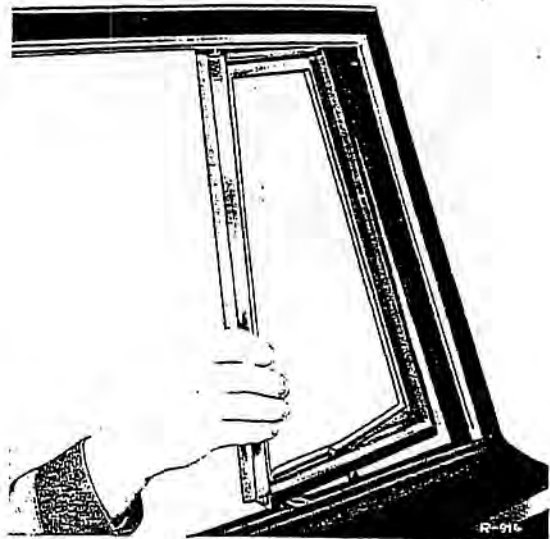


Fig. 72-13/2

### Installation:

8. Installation is the reverse of the removal procedure (see also Section B, No. 6).

## B. Removal and Installation of Ventilator Lock on Left or Right Front Door

### Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Remove the hexagon screw (1) (see Fig. 72-13/1).
3. Unscrew the fixing screws (2) and (3) for the ventilator lock (see Fig. 72-13/1).

4. Take out the mounting plate (5) (see Fig. 72-13/1) for the grip handle and remove the ventilator lock through the opening in the door inner panel (Fig. 72-13/3).

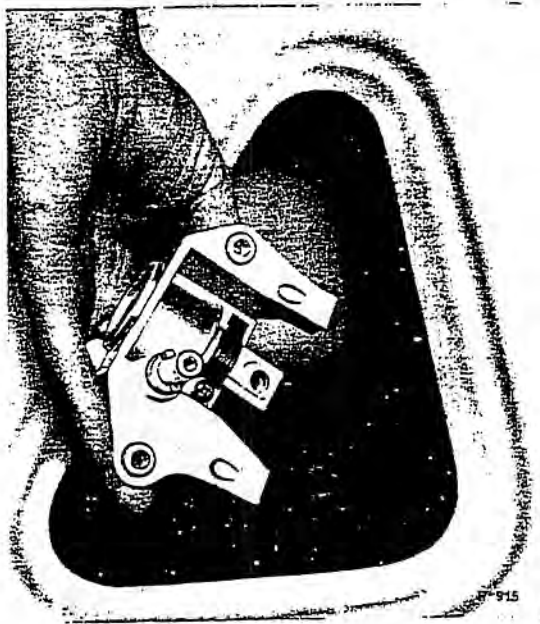


Fig. 72-13/3

**Installation:**

5. During re-installation do not omit the mounting plate (5) for the grip handle (see Fig. 72-13/1).

6. When re-installing the ventilator lock, put the control knob (1) loosely on the pin and align the lug (2) with the pivot pin eye (3) by turning the knob (Fig. 72-13/4).

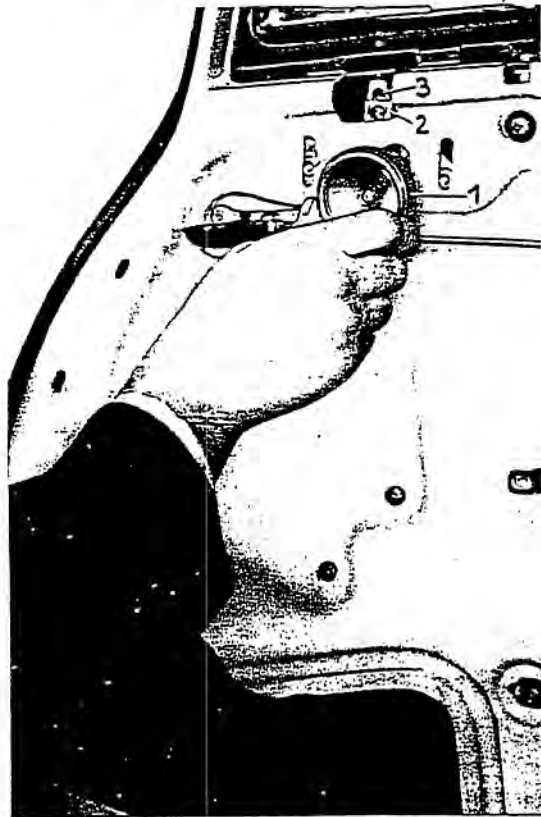


Fig. 72-13/4

- 1 Control knob
- 2 Lug
- 3 Pivot pin eye

# Removal and Installation of Garnish Moldings at Window Frame of Left or Right Front or Rear Door

Job No.
72-15

## Removal:

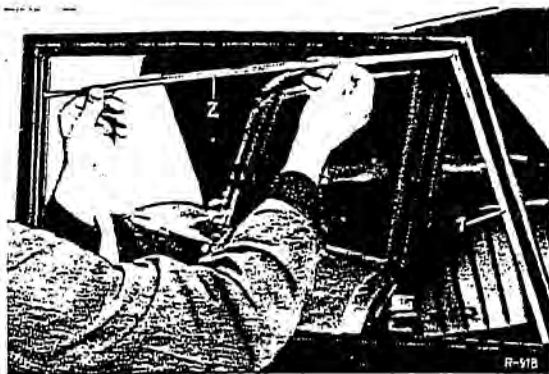
1. Remove the window regulator and the sliding window (see Job No. 72-8).
2. Remove the flexible window run channel (see Job No. 72-12).
3. Remove the ventilator (see Job No. 72-13).
4. Unscrew the two fixing screws (1) for the garnish molding at the rear and remove the garnish molding (see Fig. 72-3/1 and 72-15/1).



Shown at front door

Fig. 72-15/1

1 Fixing strap



Shown at front door

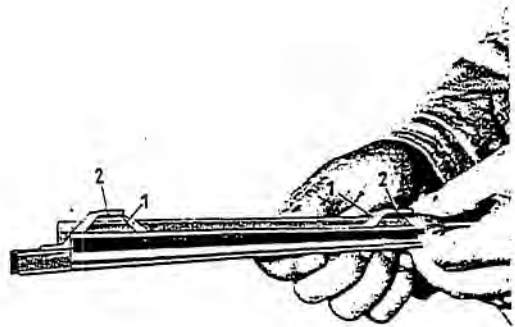
Fig. 72-15/2

1 Front garnish molding  
2 Upper garnish molding

5. Remove the upper garnish molding (2) (Fig. 72-15/2).
6. Remove the front garnish molding (1) (Fig. 72-15/2).

## Installation:

7. Fit the front garnish molding (1) and the upper garnish molding (2) and insert them, making sure that a snug fit is obtained at the corner (Fig. 72-15/2).
8. Put a clip-on nut (2) on each of the two fixing straps (1) of the rear garnish molding (Fig. 72-15/3).



R-909

Fig. 72-15/3

1 Fixing strap  
2 Clip-on nut

9. Insert the rear garnish molding (Fig. 72-15/1).
10. Screw on the rear garnish molding by means of the two fixing screws (1) (see Fig. 72-3/1).
11. Install the ventilator (see Job No. 72-13).
12. Install the flexible window run channel (see Job No. 72-12).
13. Install the window regulator and the sliding window (see Job No. 72-8).

Job No.

72-16

## Removal and Installation of Weatherstrip for Front or Rear Door

The weatherstrip (2) is held in place by the sheet metal section of the door groove (Fig. 72-16/2). At the hinge side outside the groove the weatherstrip is cemented by Terokal Rubber Adhesive I and fixed by means of spreader clamps.

### Removal:

1. Carefully detach the weatherstrip (2) where it is cemented and lift the plastic spreader clamps (1) out of the fixing holes in the door inner panel (3) (Fig. 72-16/1). Carefully scrape off all rubber and adhesive residues.

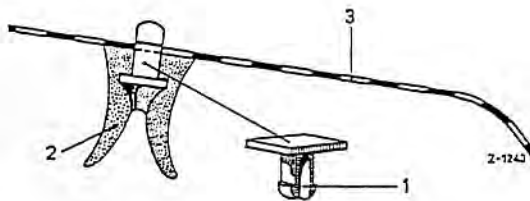


Fig. 72-16/1

- 1 Plastic spreader clamp
- 2 Weatherstrip
- 3 Door inner panel

2. Pull out the rest of the weatherstrip from the retaining section and remove it (Fig. 72-16/2).

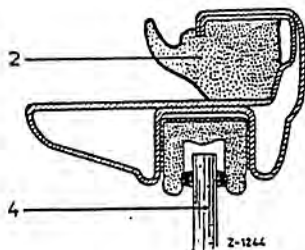


Fig. 72-16/2

- 2 Weatherstrip
- 4 Window glass

### Installation:

3. Press the weatherstrip (2) into the retaining section of the door (Fig. 72-16/2).
4. Insert the plastic spreader clamps (1) in the weatherstrip.

**Note:** For the front door 6 spreader clamps (1) are needed and for the rear door 4 spreader clamps (Fig. 72-16/1).

5. Coat the door inner panel in the area of the weatherstrip with Terokal Rubber Adhesive II and press the spreader clamps (1) into the holes in the door inner panel (Fig. 72-16/1).

**Note:** The weatherstrip is applied by means of a so-called two-component adhesive. The weatherstrip supplied as a replacement part has been treated with Terokal Rubber Adhesive I. The vulcanizing effect which produces a firm bond between rubber and sheet metal is brought about when the two components come into contact.

# Door Lock and Actuating Mechanism

Job No.

72-17

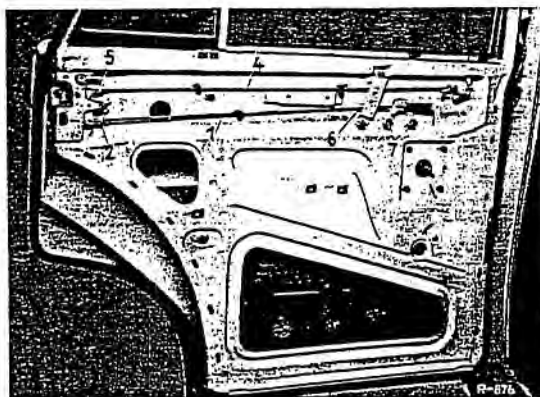
## A. Removal and Installation of Front or Rear Inner Door Handle

### Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Use a screw driver to press out the locking spring (6) and detach the pull rod (1) (Fig. 72-17/1).
3. Unscrew the two fixing screws (7) and remove the inner door handle (Fig. 72-17/1).

### Installation:

4. Installation is the reverse of the removal procedure. Please remember that before the fixing screws (7) are tightened the inner door handle must be pushed toward the hinge side to give it initial tension.



Shown at rear door

Fig. 72-17/1

- |                                   |                  |
|-----------------------------------|------------------|
| 1 Pull rod                        | 5 Locking spring |
| 2 Locking spring                  | 6 Locking spring |
| 4 Pull rod for inside safety lock | 7 Fixing screw   |

## B. Removal and Installation of Front or Rear Door Handle

### Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Back out the fixing screw (1) about two turns. Unscrew the fixing screw (2) (Fig. 72-17/2).

3. Push the door handle toward the hinge side and remove together with the rubber pads (Fig. 72-17/3).

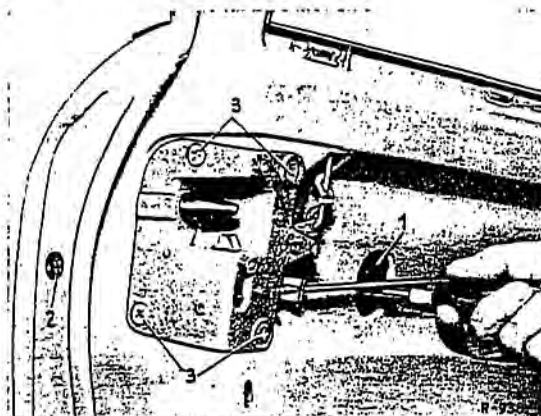


Fig. 72-17/2

- |                                |
|--------------------------------|
| 1 Fixing screw for door handle |
| 2 Fixing screw for door handle |
| 3 Fixing screw for door lock   |

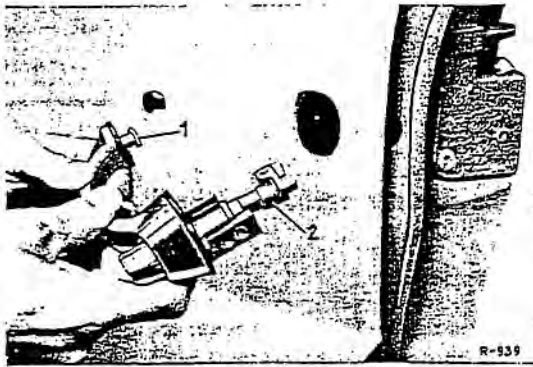


Fig. 72-17/3

- 1 Fixing screw
- 2 Pressure bolt base

**Installation:**

4. Apply talc to the two rubber pads and insert the door handle together with the rubber pads.
5. Apply slight pressure to the door handle and check the clearance between pressure bolt base and pressure pin of the door lock, and if necessary adjust the clearance to 1-2 mm by adjusting the pressure bolt base (see Fig. 72-17/3).
6. Screw in the fixing screw (2) together with a large washer and tighten well. Then tighten the fixing screw (1) (see Fig. 72-17/2).

**C. Removal and Installation of Front or Rear Door Lock**

**Removal:**

1. Remove the door trim panel (see Job No. 72-7).
2. Detach the locking spring (2) by means of a screw driver and detach the pull rod (1) (Fig. 72-17/4).

**Note:** On the rear door an additional job 2a is necessary:

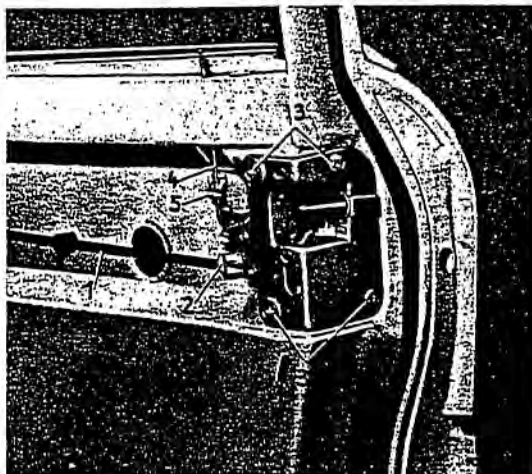
- 2a. Detach the locking spring (5) by means of

a screw driver and detach the pull rod (4) for the inside safety lock (see Fig. 72-17/1).

3. Unscrew the four fixing screws (3) and remove the lock (Fig. 72-17/4).

**Installation:**

4. Installation is the reverse of the removal procedure. Please note that the two fixing screws (3) at the front end of the door must be tightened first.



Shown at front door

Fig. 72-17/4

- 1 Pull rod
- 2 Locking spring
- 3 Fixing screw
- 4 Pull rod
- 5 Locking spring



## D. Removal and Installation of Striker on Left or Right Front or Rear Door

### Removal:

1. Unscrew the fixing screws and remove the striker together with shim.

### Installation:

2. Screw the striker into place and lightly tighten the screws. Close the door so that the striker can adjust itself with relation to the door lock. If necessary correct the position of the striker by adding shims.

**Note:** Shims are available in three different thicknesses:

Part No. 10 120 723 02 05 0.5 mm thick

Part No. 10 120 723 03 05 1.0 mm thick

Part No. 10 120 723 04 05 1.5 mm thick

3. With the door closed, shift the position of the striker by pressing in or pulling out the door in such a way that the outer panels of the two doors are flush with the outer panels of the fenders. Then open the door and tighten the fixing screws for the striker.

Job No.

73-13

## Removal and Installation of Fixed Window on Left or Right Rear Door

### Removal:

1. Remove the door trim panel (see Job No. 72-7).
2. Remove the sliding window.
3. Remove the inner and outer sealing strip (see Job No. 72-10).
4. Remove the flexible window run channel (see Job No. 72-12).
5. Unscrew the two fixing screws (1) at the stop bracket (5) and remove the stop bracket (5) (Fig. 73-13 1).

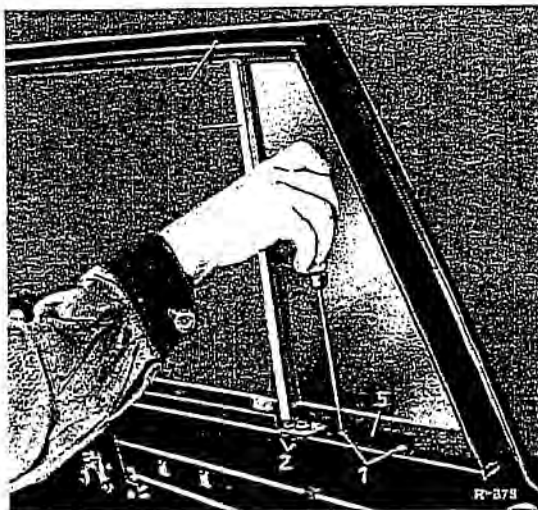


Fig. 73-13/1

- 1 Fixing screw
- 2 Fixing screw
- 3 Fixing screw
- 4 Window stay bar
- 5 Stop bracket

6. Unscrew the fixing screw (3) at the top of the stay bar (Fig. 73-13/1).
7. Unscrew the two fixing screws (2) at the mounting plate at the bottom of the stay bar (see Fig. 73-13/1).
8. Remove the stay bar (4) as shown in Fig. 73-13/2.

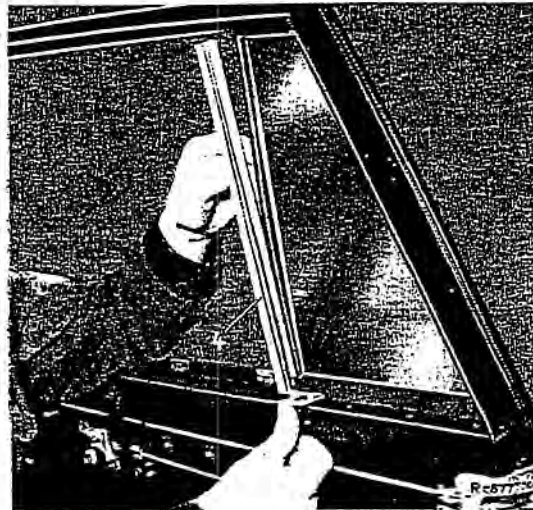


Fig. 73-13/2

4 Stay bar

9. Remove the glass (6) together with the rubber molding (7) toward the front (Fig. 73-13 3).

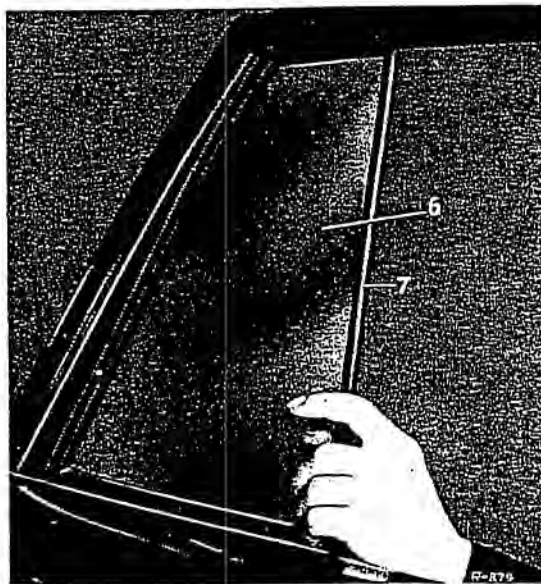


Fig. 73-13/3

- 6 Window glass
- 7 Rubber molding

### Installation:

10. Installation is essentially the reverse of the removal procedure.

## Removal and Installation of Rear Compartment Lid

Job No.
75-1

### Removal:

1. Remove the cottered pin (1) from the torsion bar (3) (Fig. 75-1/1). Then release the torsion bar by means of Removal Tool 1115890261 (see Fig. 00-1/1).

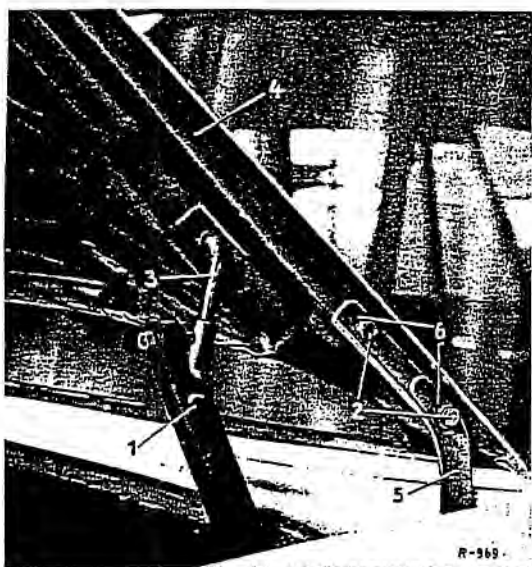


Fig. 75-1/1

- |                |                        |
|----------------|------------------------|
| 1 Cottered pin | 4 Rear compartment lid |
| 2 Fixing screw | 5 Rear lid hinge       |
| 3 Torsion bar  | 6 Slotted hole         |

2. Unscrew the fixing screws (2) at the left and the right of the rear lid hinge (5). Remove the rear compartment lid (4) together with the torsion bar (3) (see Fig. 75-1/1).

**Note:** If necessary, remove the chrome figures of the model number, the Mercedes star, and the rubber buffers.

### Installation:

3. First lightly attach the rear compartment lid to the hinge brackets and close the lid. Move the lid back and forth in the slotted holes of the hinges (6) in order to produce uniform clearance between the rear compartment lid and the adjoining body parts.
4. Adjust the rubber buffers cushioning the rear compartment lid by adding shims or by shortening the buffers until the lid has its proper outside fit.

Job No.

75-4

## Removal and Installation of Rear Compartment Lid Weatherstrip

### Removal:

1. Remove the cemented weatherstrip and carefully scrape off the remains of the rubber and the adhesive.

### Installation:

2. Coat the groove around the rear compartment opening with Terokal Rubber Adhesive II and press the weatherstrip into the groove while it is still wet.

**Note:** The weatherstrip is cemented into the groove by means of a so-called two-component adhesive. The weatherstrip supplied as a replacement part has already been treated with Terokal Rubber Adhesive I.

The vulcanizing effect which produces a firm bond between rubber and sheet metal is brought about when the two components come into contact.

# Steel Sliding Roof

Job No.

78-1

## A. Removal and Installation of Sliding Roof

1. Unscrew the left and right sliding rail (1).
2. Unscrew the locking lever and the recess insert.
3. Lift the headlining frame out of the clamps (2) along the front edge (Fig. 78-1/1).
4. Push the sliding roof back as far as it will go and remove the headlining (3) toward the front (Fig. 78-1/2).

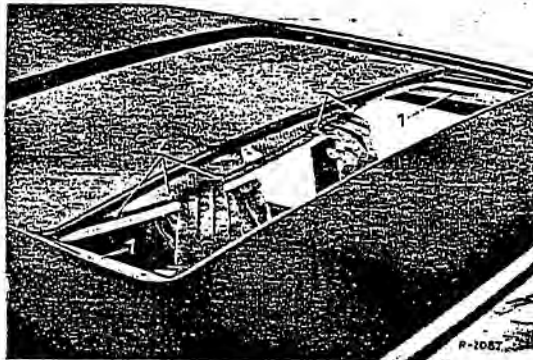


Fig. 78-1/1

1 Sliding rail      2 Clamps

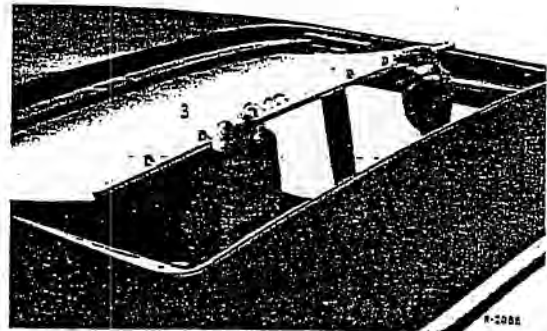


Fig. 78-1/2

3 Headlining

5. Push the sliding roof forward and remove.
6. Installation is the reverse of the removal procedure.

Before the operations are carried out which are described below it is almost always necessary to remove the sliding roof beforehand.

## B. Remedies for Binding Locking Lever (Handle)

### 1. Cause:

Frame too narrow in the region above the stop wedge.

### Remedy:

Recent cars have been provided with a local dent 1.2 mm deep in this particular region. On older cars this dent should be made subsequently as shown in Fig. 78-1/3. Apply the piece of hard wood as nearly horizontally as possible. Do not make the dent deeper than 1.2 mm (see also Fig. 78-1/5).

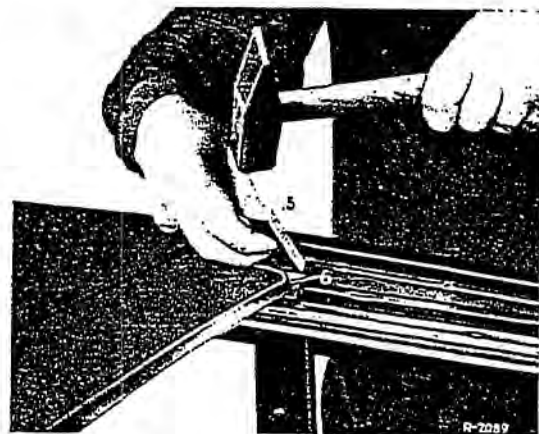


Fig. 78-1/3

5 Piece of hard wood

6 Stop wedge

2. Cause:

Brake rods (8) binding in the end supports.

Remedy:

Put shims under the clamps (7) (Fig. 78-1/4).

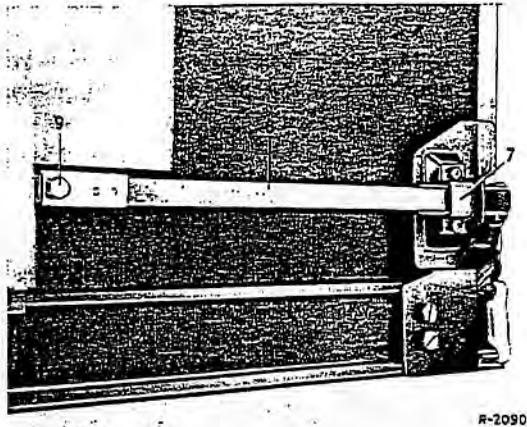


Fig. 78-1/4

- 7 Clamp
- 8 Brake rod
- 9 Locking screw for longitudinal adjustment

3. Cause:

Linkage not greased.

Remedy:

Grease the linkage at the contact points and at the joints.

4. Cause:

Brake rods (8) adjusted too wide toward the outside.

Remedy:

Loosen the locking screws (9), install the sliding roof, and with the roof partly opened adjust the brake linkage in such a way that efficient braking action is obtained when the roof is locked (Fig. 78-1/4).

Then check the height of the closed roof (alignment with roof top) and correct any differences in height by adjusting the stop wedge (6) by means of the adjusting screw (Fig. 78-1/5).

5. Cause:

The lateral plastic wedges (10) which press the sliding roof forward when it is closed are situated too far forward (Fig. 78-1/5).

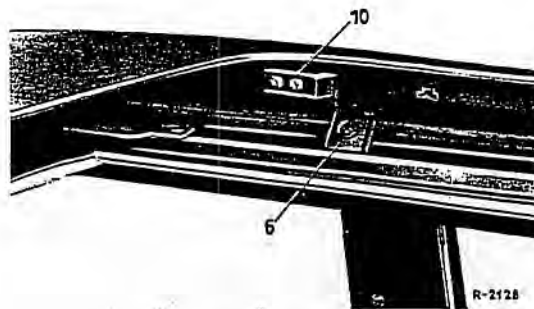


Fig. 78-1/5

- 6 Stop wedge
- 10 Plastic wedge

Remedy:

Slightly move the plastic wedges backward, if necessary refile the slotted holes in the plastic wedges (Fig. 78-1/6).

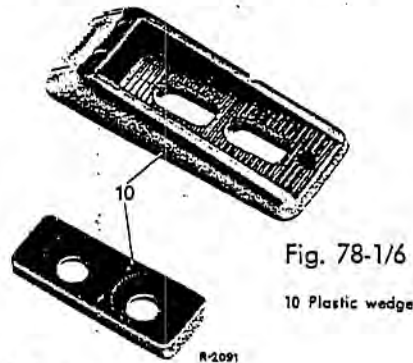


Fig. 78-1/6

- 10 Plastic wedge

### C. Remedies for Binding Sliding Roof

1. Cause:

Excessive curvature at the sides of the headlining frame.

Remedy:

Adjust the curvature to the proper dimension: the height "a" as indicated by the two arrows should be 40—60 mm (Fig. 78-1/7).

2. Cause:

Insufficient lateral curvature of the headlining frame at the rear.

Remedy:

Adjust the curvature to the proper dimension: the height "b" as indicated by the two arrows should be 10—15 mm (Fig. 78-1/7).

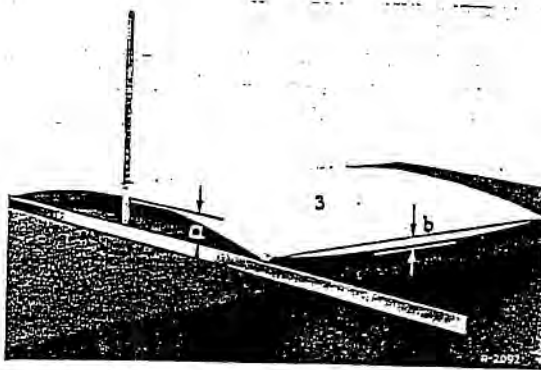


Fig. 78-1/7  
3 Headlining

**3. Cause:**

Lateral sliding tapes (linen adhesive tape) sweat and become sticky.

**Remedy:**

Recent cars have been provided with stainless steel rails replacing the sliding tapes. On other cars the sliding tapes should be replaced by steel rails. The steel rails are inserted in the front cover rail (12) with their hook-shaped front end (Fig. 78-1/8).

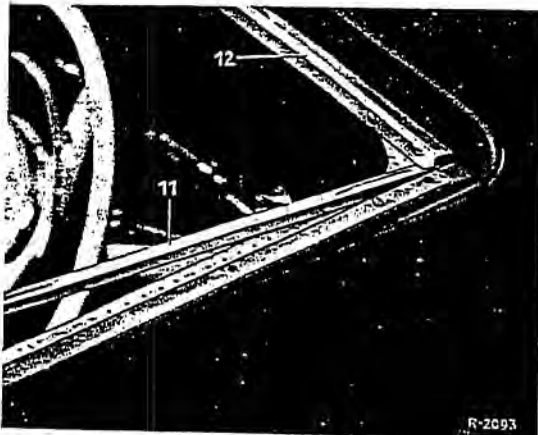


Fig. 78-1/8  
11 Steel rail 12 Cover rail

**4. Cause:**

On older cars the headlining (15) is glued to the center cross strut (13) of the sliding roof frame and partly covered with linen adhesive tape (14) (see situation A in Fig. 78-1/9).

78-1/9). The linen adhesive tape (14) sweats and becomes sticky or partly detached. On recent cars the headlining (15) is no longer glued to the frame, but is laid in the modified frame profile of the cross strut (13) with a strip of cardboard (16) (see situation C in Fig. 78-1/9).

**Remedy:**

Remove the adhesive tape and detach the glued headlining from the frame and cut it in such a way that it only goes as far as the trough of the corrugation (17). Re-attach the headlining (see situation B in Fig. 78-1/9).

These measures serve to keep the contact pressure in this region at a minimum.

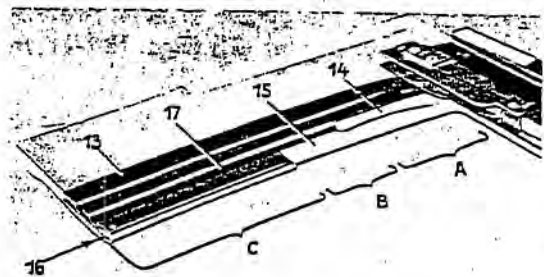


Fig. 78-1/9

shown at a model

- |                        |                    |
|------------------------|--------------------|
| 13 Cross strut         | 16 Cardboard strip |
| 14 Linen adhesive tape | 17 Corrugation     |
| 15 Headlining          |                    |

**5. Cause:**

Adjustment of sliding angles (18) and (19) of the sliding roof too narrow.

**Remedy:**

Release angle adjustment. The rear sliding angles (19) can be given more lateral play than the front angles since at this point the roof is always under lateral stress produced by the brake rods (Fig. 78-1/10).

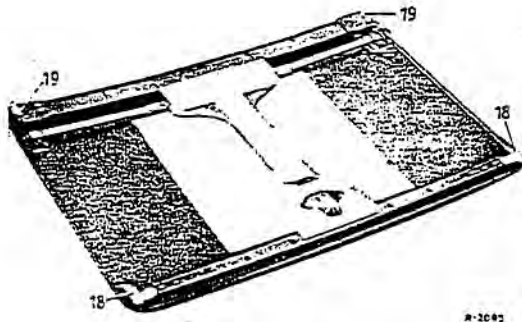


Fig. 78-1/10

18 Front sliding angle      19 Rear sliding angle

**6. Cause:**

Sliding angles (18) and (19) and as a result the plastic sliding jaws are misaligned in the rails.

**Remedy:**

Take the sliding jaws off the sliding angles and re-align the angles in both directions by means of a ruler (21) (Figs. 78-1/11 and 12).

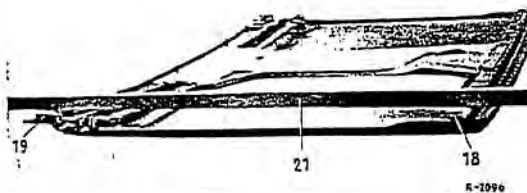


Fig. 78-1/11

18 Front sliding angle      21 Ruler  
19 Rear sliding angle



Fig. 78-1/12

18 Front sliding angle      21 Ruler  
19 Rear sliding angle

**7. Cause:**

Slide rails and sliding jaws dirty.

**Remedy:**

Clean the sliding rails. Replace the sliding jaws. Remove all traces of adhesive on the sliding surfaces.

**8. Cause:**

Sliding leathers (22) on the two rear corners of the headlining frame turn over when roof is slid in and bind (Fig. 78-1/13).

**Remedy:**

Check the sliding leathers, cut down if necessary or install new sliding leathers.

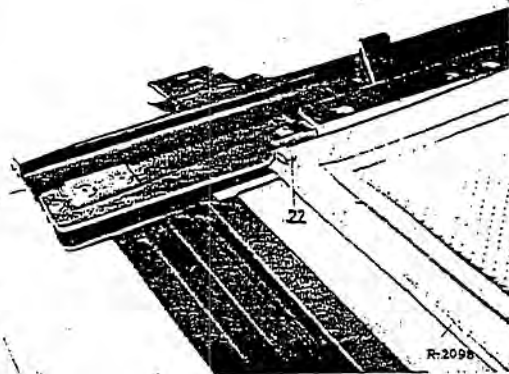


Fig. 78-1/13

22 Sliding leather      Shown at a model

**9. Cause:**

The headlining is attached in several layers and therefore too thick in the front corner at the end of the sliding surface for the headlining frame.

**Remedy:**

Remove the sliding rail and re-adjust the front part of the sliding surface downward (Fig. 78-1/14).

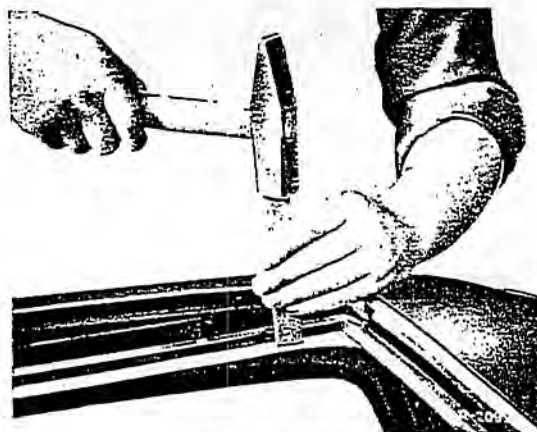


Fig. 78-1/14



# Removal and Installation of Side Windows of Coupé Roof

Job No.

79-10

Model 230 SL

## Removal:

1. Place the coupé roof on a clean support (felt or similar material) with the top facing downward.
2. Use a drift to knock out the pin (Fig. 79-10/1).

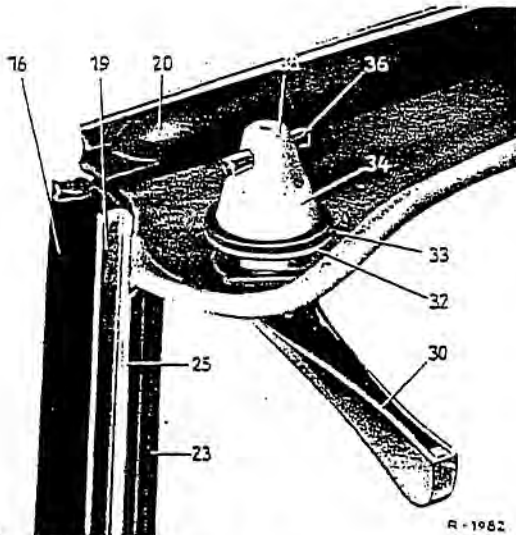


Fig. 79-10/1

- 16 Weatherstrip
- 19 Sealing rail
- 20 Lower sealing
- 23 Window reveal molding
- 25 Interior ornamental molding
- 30 Locking handle
- 32 Washer
- 33 Washer
- 34 Spacer ring
- 35 Protective cap
- 36 Pin

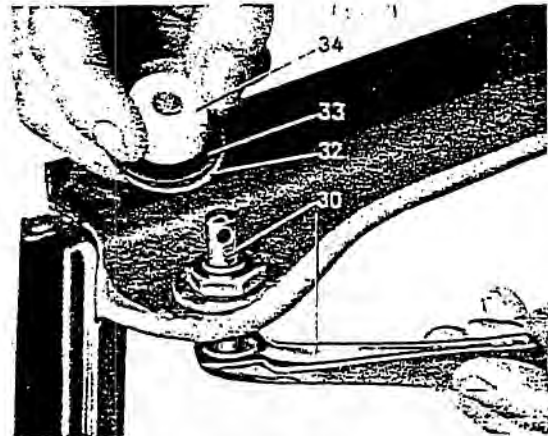


Fig. 79-10/2

- 30 Locking handle
- 32 Washer
- 33 Washer
- 34 Spacer ring

4. Pull the weatherstrip (16) out of the sealing rail (19) as far as the corner. Then unscrew and remove the sealing rail (19) (Fig. 79-10/3).

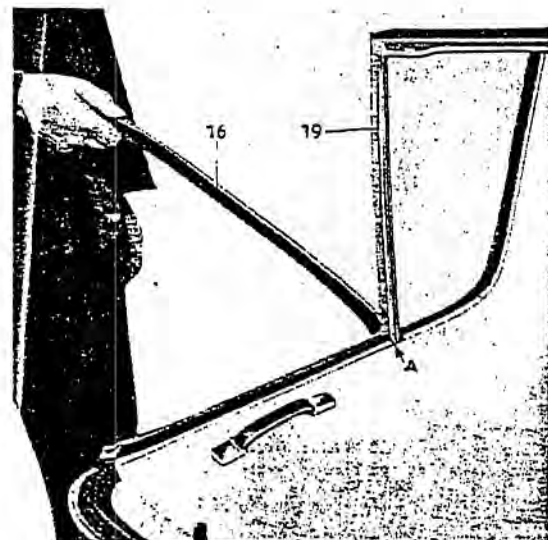


Fig. 79-10/3

- 16 Weatherstrip
- 19 Sealing rail

3. Remove protective cap (35), spacer ring (34) and washers (33) and (32) upward and remove the locking handle (30) downward (Figs. 79-10/1 and 2).

5. Unscrew the interior ornamental molding (25) and remove (Fig. 79-10/4).

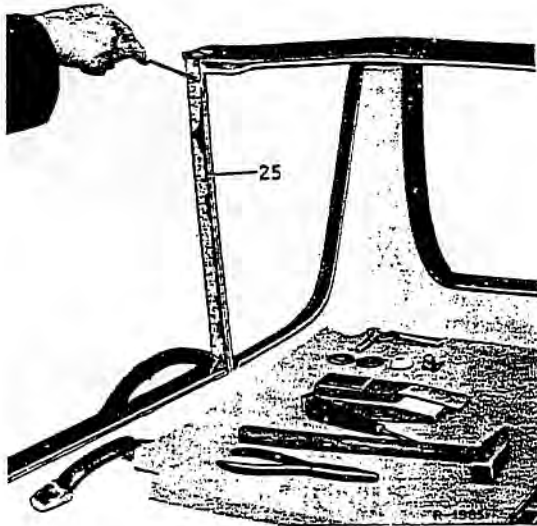


Fig. 79-10/4

25 Interior ornamental molding

6. Remove the window reveal molding (22) and (23) (Fig. 79-10/5).

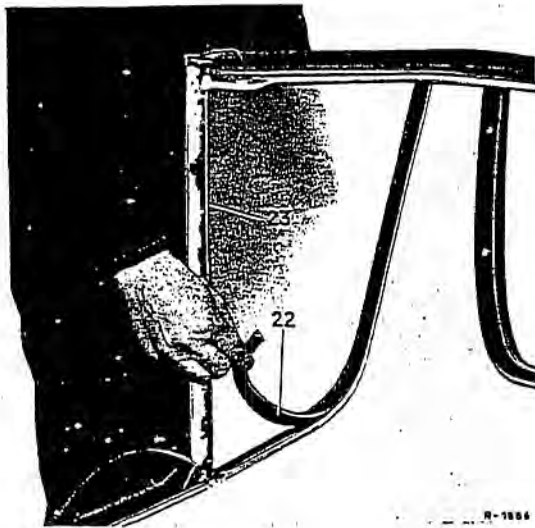


Fig. 79-10/5

22 Window reveal molding  
23 Window reveal molding

7. Carefully lift the window glass (9) together with the rubber molding (8) over the ledge of the sealing rail (18) by means of a wooden or plastic wedge. Start at the point marked B (Fig. 79-10/6).

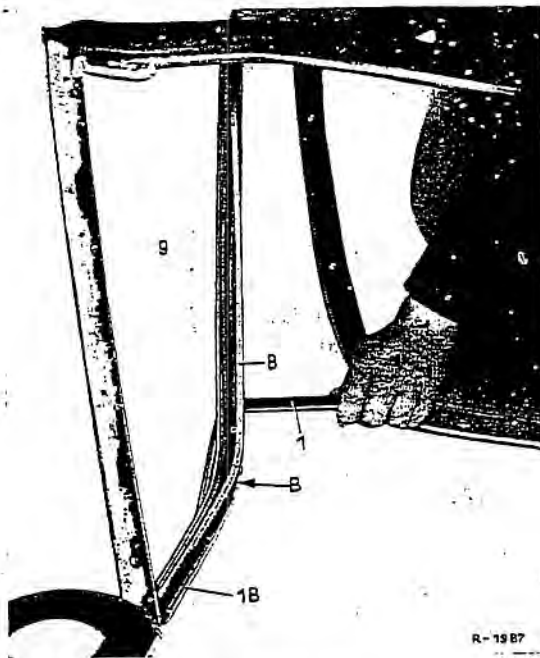


Fig. 79-10/6

1 Plastic wedge  
8 Rubber molding  
9 Window glass  
18 Sealing rail

8. Remove the window glass (9) together with the rubber molding (8) downward (Figs. 79-10/7 and 8).

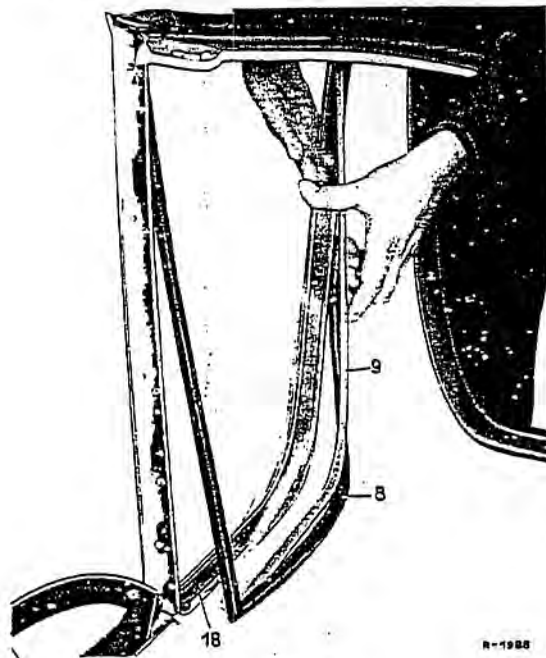


Fig. 79-10/7

8 Rubber molding  
9 Window glass  
18 Sealing rail

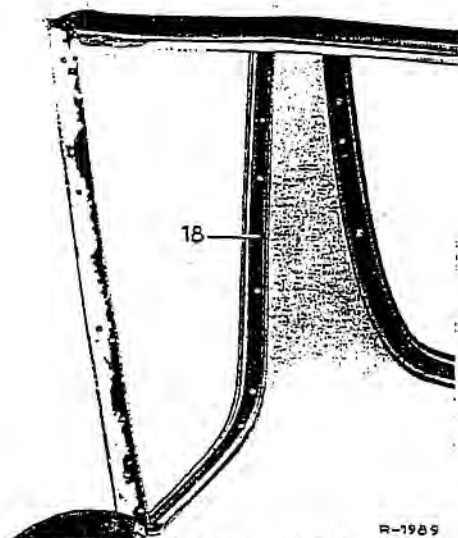


Fig. 79-10/8

18 Sealing rail

**Installation:**

9. Install the rubber molding (8) on the window glass (9) and apply a little adhesive to facilitate installation.

10. Install the window glass (9) together with the rubber molding (8) from below, push it upward as far as it will go, and lift it over the ledge of the sealing rail (18) by means of a flat wooden or plastic wedge applied at the point marked B (Figs. 79-10/8, 7 and 6).

11. If the rubber molding (8) should have been displaced during the operation move it into its proper position. Push the window glass toward the outside as far as it will go and install the window reveal moldings (22) and (23) (Fig. 79-10/5).

12. Screw on the interior ornamental molding (25) (Fig. 79-10/4).

13. Screw on the sealing rail (19). Coat the weatherstrip (16) with Dekalin adhesive at the corner A and press it into the sealing rail (19). Use Dekalin adhesive also to stick down the end of the weatherstrip (16) (Fig. 79-10/3).

14. Insert the locking handle (30). Install the washers (32) and (33), the spacer ring (34), and the protective cap (35), and fix into position by means of the pin (36) (Figs. 79-10/2 and 1).

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## Heating and Ventilation – Group 83

Job No.

**Heating and Ventilation** (190 c, 190 Dc, 200, 200 D, 220 b, 220 Sb, 220 SEb, 230, 230 S, 300 SE) 83-1

- A. Removal and Installation of Connecting Duct for Rear Compartment Heating
- B. Removal and Installation of Heating Duct for Rear Compartment Heating
- C. Removal and Installation of Right Defroster Nozzle
- D. Removal and Installation of Heater Box with Heat Exchanger and Blower
- E. Removal and Installation of Left Defroster Nozzle
- F. Removal and Installation of Operating Assembly for Heat Exchanger, Defroster Nozzles, and Fresh-Air Flap

**Heating and Ventilation** (Model 230 SL)

83-2

- A. Operating Assembly for Fresh-Air Flaps, Mixed-Air Flaps, Heat Exchanger, and Distribution Box
- B. Removal and Installation of Distribution Box
- C. Removal and Installation of Radial Blower
- D. Removal and Installation of Heat Exchanger
- E. Removal and Installation of Right Defroster Nozzle
- F. Removal and Installation of Left Defroster Nozzle

**Heating and Ventilation** (Models 250 S, 250 SE, 300 SEb, 300 SEL)

83-3

- A. Removal and Installation of Connecting Duct for Rear Compartment Heating
- B. Removal and Installation of Heating Duct for Rear Compartment Heating
- C. Removal and Installation of Right Defroster Nozzle
- D. Removal and Installation of Center Defroster Nozzle
- E. Removal and Installation of Heater Box with Heat Exchanger and Blower
- F. Removal and Installation of Left Defroster Nozzle
- G. Removal and Installation of Operating Assembly for Heating and Ventilation

# Heating and Ventilation - Stage 8

17/2

1. The diagram shows a cross-section of a house with a central heating system.

1. Identify the components of the central heating system.
2. Explain how the system works.
3. Describe the advantages and disadvantages of this system.
4. Suggest two ways in which the system could be improved.

18/2

2. The diagram shows a cross-section of a house with a central heating system.

1. Identify the components of the central heating system.
2. Explain how the system works.
3. Describe the advantages and disadvantages of this system.
4. Suggest two ways in which the system could be improved.

19/2

3. The diagram shows a cross-section of a house with a central heating system.

1. Identify the components of the central heating system.
2. Explain how the system works.
3. Describe the advantages and disadvantages of this system.
4. Suggest two ways in which the system could be improved.

## Heating and Ventillation

Job No.

83-1

### A. Removal and Installation of Connecting Duct for Rear Compartment Heating

#### Removal:

1. Remove the left and right cover panels below the instrument panel (see Job No. 68-3).
2. Remove the left and right rubber mats from the front floor and the rubber mats from the front part of the transmission tunnel.
3. Screw out the oval head tapping screws (1) and the hexagon screws (2) on the connecting duct (3) (Fig. 83-1/1).
4. Remove the connecting duct (3) together with the seals (4) from the left defroster nozzle (8) and the right defroster nozzle (9) (Fig. 83-1/1).

nozzles fit snugly against the connecting duct (3).



Fig. 83-1/1

#### Installation:

5. Installation is the reverse of the removal procedure. Care should be taken to ensure that the rubber seals on the defroster

- |                           |                          |
|---------------------------|--------------------------|
| 1 Oval head tapping screw | 6 Heating duct           |
| 2 Hexagon screw           | 7 Seal                   |
| 3 Connecting duct         | 8 Left defroster nozzle  |
| 4 Seal                    | 9 Right defroster nozzle |
| 5 Oval head tapping screw | 10 Clips                 |

### B. Removal and Installation of Heating Duct for Rear Compartment Heating

#### Removal:

1. Remove the connecting duct for the rear compartment heating (see Section A).
2. Unscrew the oval head tapping screws (5) on the heating duct (6) for the rear compartment heating (see Fig. 83-1/1).

3. Pull the heating duct (6) together with the seals (7) out of the cross member and remove it (see Fig. 83-1/1).

#### Installation:

4. Installation is the reverse of the removal procedure.

### C. Removal and Installation of Right Defroster Nozzle

#### Removal:

1. Remove the connecting duct for the rear compartment heating (see Section A).
2. Open the clips (10) (see Fig. 83-1/2).

3. Remove the locking washer (23) on the air flap lever (24). Pull the wire cable (25) and the wire cable (26) off the air flap lever (24) (see Fig. 83-1/2).
4. Detach the wire cable sheaths (27) at the fixing clips (see Fig. 83-1/2).

83-1/1

5. Detach the short link from the motor crank of the windshield wiper motor (see Job No. 82-4, para 2).
6. Remove the defroster nozzle (9) downward (see Fig. 83-1/2).

**Installation:**

7. Installation is the reverse of the removal procedure.

**Note:** For attachment and adjustment of the defroster nozzle wire cables see Section F.

**D. Removal and Installation of Heater Box with Heat Exchanger and Blower**

**Removal:**

1. Remove the right defroster nozzle (see Section C).
2. Open the clips (10) on the left defroster nozzle (8).

**Note:** It is not necessary to remove the left defroster nozzle.

3. Detach the wire cables (11) at the regulating valves (12 and 13) (Fig. 83-1/2).
4. Detach the wire cable (14) for the fresh-air flap (see Fig. 83-1/2).
5. Use a socket wrench to unscrew the two fixing screws (15) on the cowl and the fixing screw (16) on the water tank (see Fig. 83-1/2).

**Note:** Push the left defroster nozzle (8) toward the left to be able to get at the left fixing screw (15) on the cowl.

6. Pull the blower motor connector out of the heater box.
7. Drain the cooling water (collect it if it contains additives). The drain cocks are located under the radiator to the right and on the crankcase to the left.
8. Detach the water hoses (18) from the return pipe (19) (see Fig. 83-1/3).

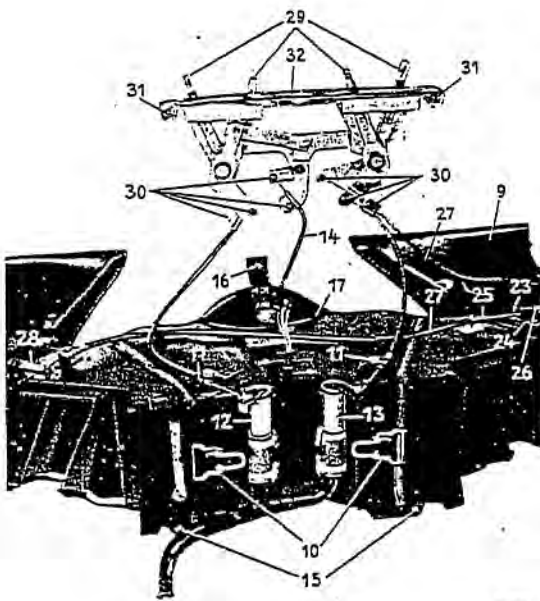


Fig. 83-1/2

View from below

- |                                    |                      |
|------------------------------------|----------------------|
| 8 Left defroster nozzle            | 23 Locking washer    |
| 9 Right defroster nozzle           | 24 Air flap lever    |
| 10 Cover                           | 25 Wire cable        |
| 11 Wire cable for regulating valve | 26 Wire cable        |
| 12 Left regulating valve           | 27 Wire cable sheath |
| 13 Right regulating valve          | 28 Air flap lever    |
| 14 Wire cable for fresh-air flap   | 29 Control lever     |
| 15 Fixing screw                    | 30 Fixing screw      |
| 16 Fixing screw                    | 31 Fixing nut        |
| 17 Heater box                      | 32 Escutcheon        |

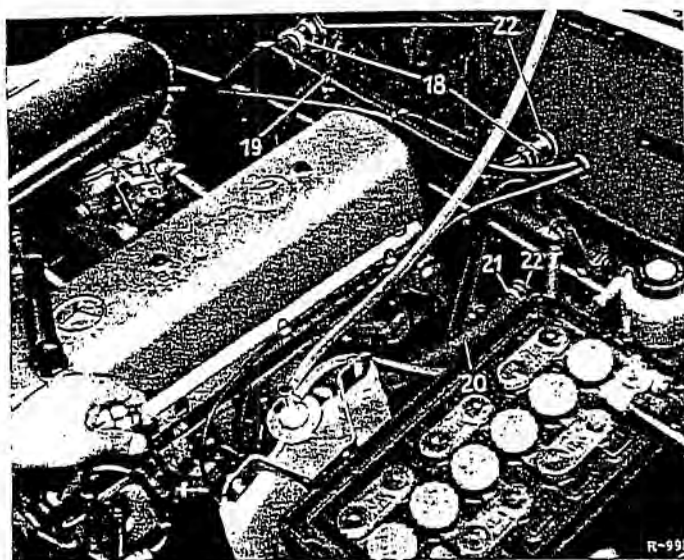


Fig. 83-1/3

- |                              |                   |
|------------------------------|-------------------|
| 18 Water hose on return pipe | 21 Feed pipe      |
| 19 Return pipe               | 22 Rubber grommet |
| 20 Water hose on feed pipe   |                   |



9. Detach the water hose (20) from the feed pipe (21) (see Fig. 83-1/3).
10. Remove the rubber grommets (22) from the cowl (see Fig. 83-1/3).
11. Remove the heater box (17) with the heat exchangers and the blower toward the rear (see Fig. 83-1/2).

**Installation:**

12. Installation is the reverse of the removal procedure.

**Note:** For attaching and adjusting the wire cable for the fresh-air flap and for the regulating valves see Section F.

### E. Removal and Installation of Left Defroster Nozzle

**Removal:**

1. Remove the right defroster nozzle (see Section C).
2. Remove the heater box with heat exchanger and blower (see Section D).
3. Unscrew the control knob and the escutcheon of the choke control. Pull the choke control out of the instrument panel toward the front and push it into the engine compartment.

4. Detach the wire cable (25) from the air flap lever (28) and the wire cable sheath (27) from the fixing clip (see Fig. 83-1/2).

5. Remove the defroster nozzle (8) downward (see Fig. 83-1/2).

**Installation:**

6. Installation is the reverse of the removal procedure.

**Note:** For attaching and adjusting the wire cable for the defroster nozzle see Section F.

### F. Removal and Installation of Operating Assembly for Heat Exchanger, Defroster, Nozzles and Fresh-Air Flap

**Removal:**

1. Remove the left and right panels underneath the instrument panel.
2. Use a screwdriver to pull out the control levers (29) for the wire cables of the regulating valves, the defroster nozzles and the fresh-air flap.
3. Loosen the fixing screws (30) of the wire cables and wire cable sheaths on the operating assembly. Pull out the wire cables together with the sheaths (see Fig. 83-1/2).
4. Remove the blower switch.

5. Unscrew the two fixing nuts (31) for the escutcheon (32). Remove the escutcheon (32) toward the rear and remove the operating assembly toward the front (see Fig. 83-1/2).

**Installation:**

6. Installation is the reverse of the removal procedure.

When attaching the wire cables make sure that they are connected correctly and in such a way that the regulating valves, the air flaps in the defroster nozzles and the fresh-air flap can be closed **completely**. (Check by operating the cables a number of times).

## Heating and Ventilation on Model 230 SL

### A. Removal and Installation of Operating Assembly for Fresh-Air Flaps, Mixed-Air Flaps, Heat Exchanger, and Distribution Box

#### Removal:

1. Remove the glove compartment (see Job No. 68-1).
2. Remove the clock (see Job No. 54-12).
3. Take out the reading light (2) from the center padding (1) and disconnect the cable (Fig. 83-2/1).

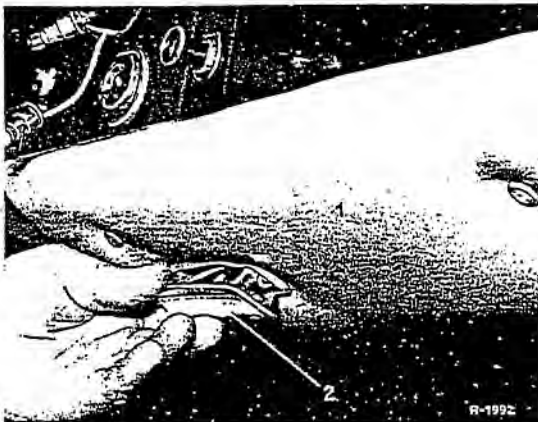


Fig. 83-2/1

- 1 Center padding
- 2 Reading light

4. Unscrew the center padding (1) and remove.
5. Slightly lift off the cover (1) with the model number at the upper edge by means of a flat wooden wedge (2), pushing it upward at the same time and remove (Fig. 83-2/2). Pull out the electric plug (4) from the cigar lighter (3) (Fig. 83-2/4).
6. Unscrew the center cover of the instrument panel and remove together with the ornamental molding (2) and the cigar lighter (3) (Figs. 83-2/3 and 4).

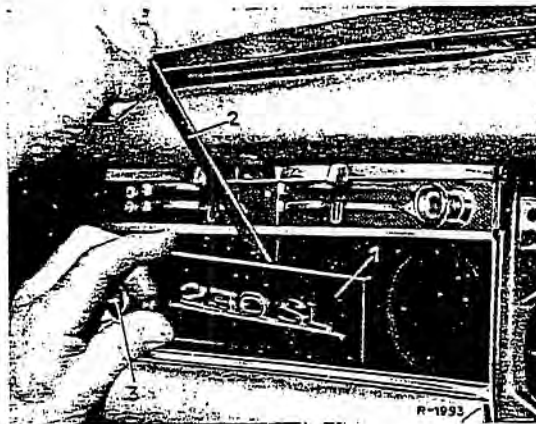


Fig. 83-2/2

- 1 Cover with model number
- 2 Flat wooden or plastic wedge
- 3 Cigar lighter

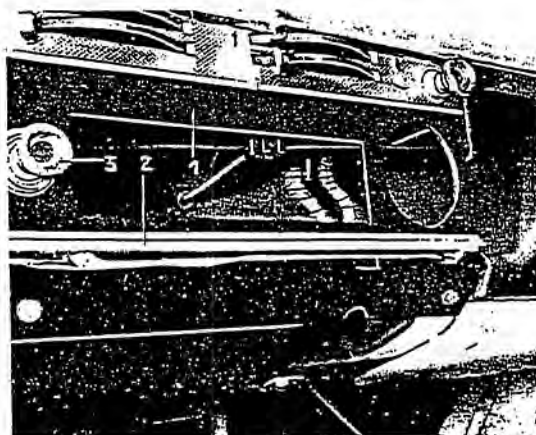


Fig. 83-2/3

- 1 Center cover instrument panel
- 2 Ornamental molding
- 3 Cigar lighter

7. Disconnect the control cable (1) for the right mixed-air flap from the operating disk (2). In the same way disconnect the control cable for the left mixed-air flap from the operating disk (3) (Fig. 83-2/5).

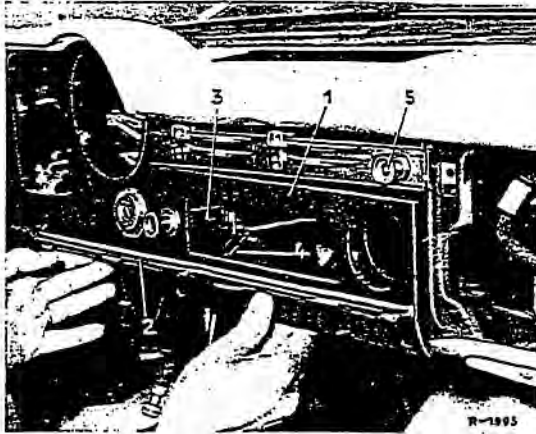


Fig. 83-2/4

- 1 Center cover instrument panel
- 2 Ornamental molding
- 3 Cigar lighter
- 4 Plug
- 5 Blower rotary switch

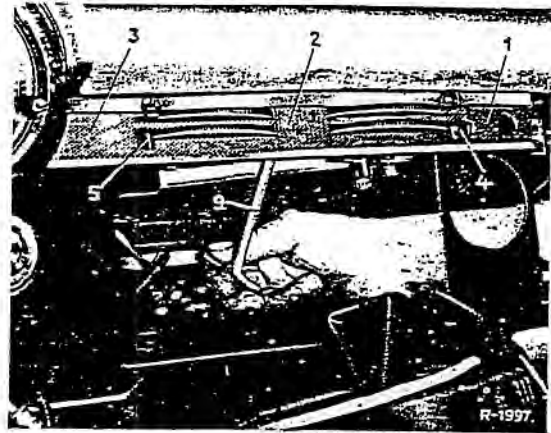


Fig. 83-2/6

- 1 Right escutcheon
- 2 Center escutcheon
- 3 Left escutcheon
- 4 Operating disk for the right mixed-air flap
- 5 Operating disk for the left mixed-air flap and heat exchanger
- 9 Articulated wrench

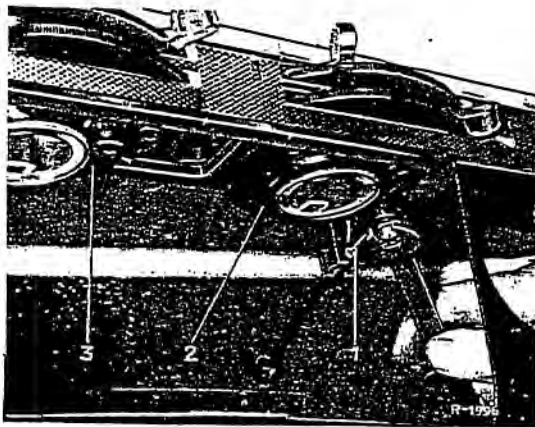


Fig. 83-2/5

- 1 Control cable for right mixed-air flap
- 2 Operating disk for right mixed-air flap
- 3 Operating disk for left mixed-air flap and heat exchanger

10. Remove the three-part escutcheon (1, 2 and 3) from the right toward the left in the sequence 1, 2, 3. The three parts of the escutcheon are locked by a tooth system (Figs. 83-2/7 and 8).

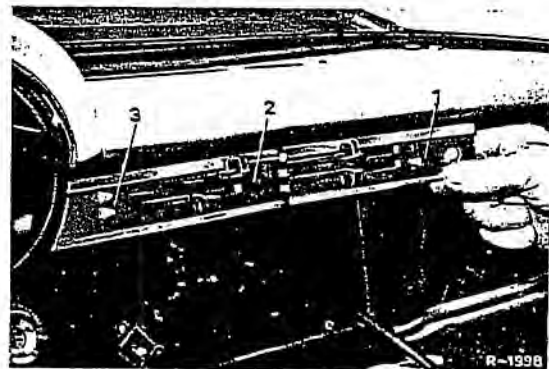


Fig. 83-2/7

- 1 Right escutcheon
- 2 Center escutcheon
- 3 Left escutcheon

8. Remove the blower switch (5) (Fig. 83-2/4).
9. Unscrew the three-part escutcheon (1, 2 and 3) for the operating system.

**Note:** In order to unscrew the nuts with an articulated wrench (9) the red operating disks (4) and (5) for the mixed-air flaps are always moved into the opposite end position, i. e. to screw off the two outside nuts move the operating disks inward and to unscrew the center nuts move them outward (Fig. 83-2/6).

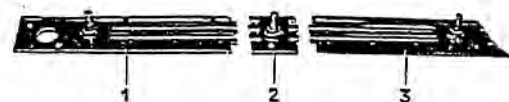


Fig. 83-2/8

- 1 Right escutcheon
- 2 Center escutcheon
- 3 Left escutcheon

11. Tilt the operating system (1) downward and disconnect the control cable (2) for the distribution box and the control cable (3) for the fresh-air flap from the operating disks (4) and (5) (Fig. 83-2/9).

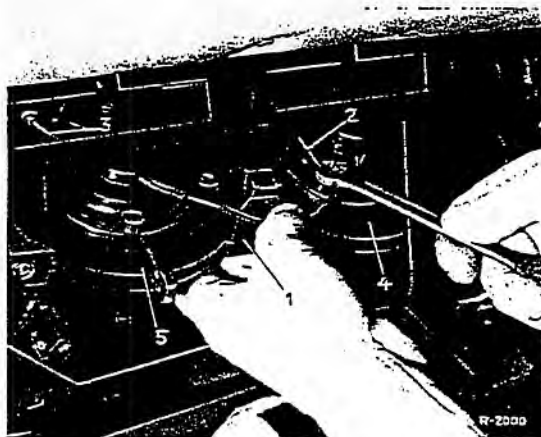


Fig. 83-2/9

- 1 Operating system
- 2 Control cable for distribution box
- 3 Control cable for fresh-air flap
- 4 Operating disk for distribution box
- 5 Operating disk for fresh-air flap

12. After disconnecting the cable remove the operating system from the instrument panel (Fig. 83-2/10).

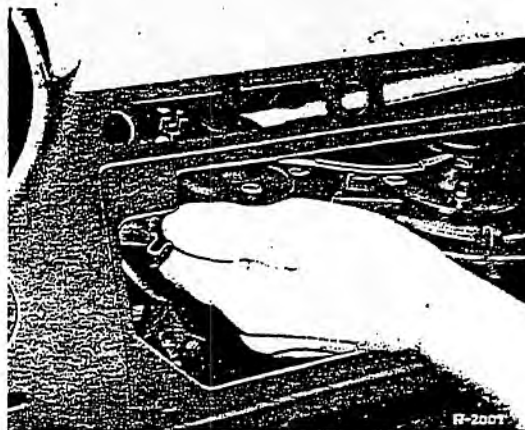


Fig. 83-2/10

**Installation:**

13. Installation is the reverse of the removal procedure.

## B. Removal and Installation of the Distribution Box

### Removal:

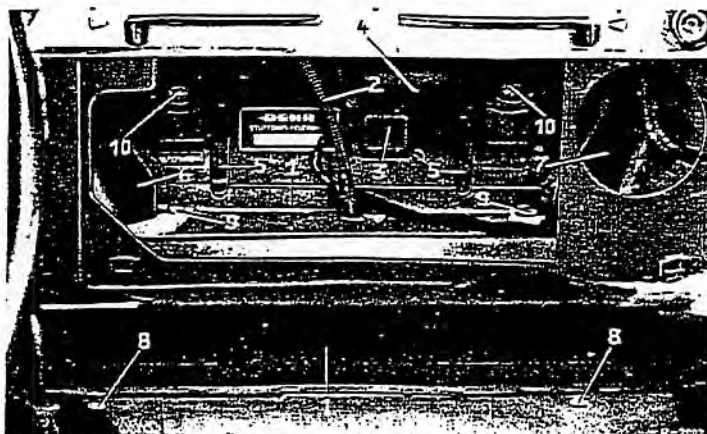


Fig. 83-2/11

- 1 Distribution box
- 2 Operating wire cable
- 3 Electric plug
- 4 Radial blower
- 5 Retaining spring
- 6 Left defroster nozzle
- 7 Right defroster nozzle
- 8 Fixing screw for distribution box
- 9 Fixing screw for defroster nozzle
- 10 Fixing screw for radial blower

1. Disconnect the control cable (2) for the distribution box from the operating disk (4) (Fig. 83-2/9). In order to do this carry out the operations described in Section A, paras 1 to 6 and 8 to 11.
2. Remove the cover (3) under the center of the instrument panel (see Fig. 68-1/1).
3. Unscrew the left (6) and the right (7) defroster nozzles from the distribution box (screws (9) shown in Fig. 83-2/11).
4. Unscrew the distribution box (1) from the radial blower (4) (screws (10) shown in Fig. 83-2/11).
5. Slide the distribution box (1) downward and out of the retaining springs (5) and remove together with the control cable (2) (Fig. 83-2/11).

### Installation:

6. Installation is the reverse of the removal procedure.

## C. Removal and Installation of Radial Blower

### Removal:

1. Remove the distribution box (1) (see Section B, paras 1 to 5). Do not detach the control cable (2) but suspend the distribution box from the control cable and move it toward the left (Fig. 83-2/12).

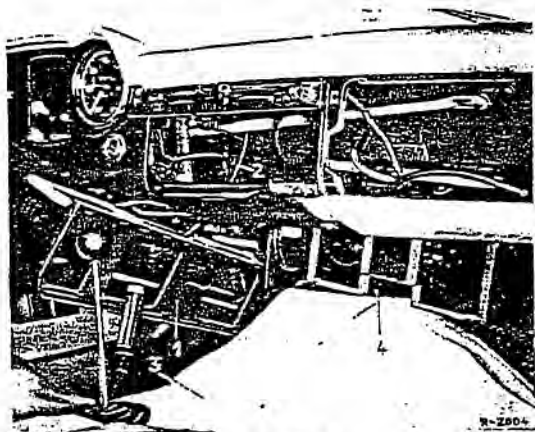


Fig. 83-2/12

- |                    |                                 |
|--------------------|---------------------------------|
| 1 Distribution box | 3 Carpet on transmission tunnel |
| 2 Control cable    | 4 Radial blower                 |

2. Pull out the plug (3) from the blower (4) (Fig. 83-2/11).
3. Unscrew the left and right cap (2) from the radial blower (4) and remove (screws (1) shown in Fig. 83-2/13).

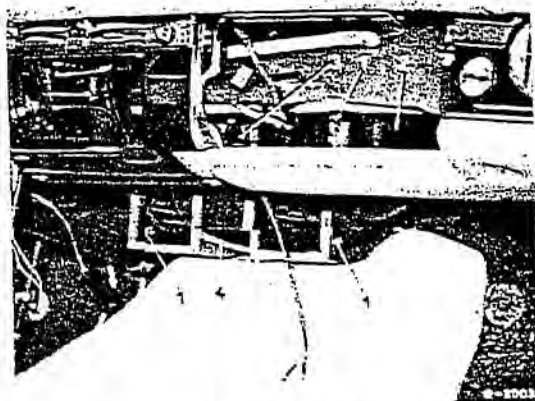


Fig. 83-2/13

- |                        |                 |
|------------------------|-----------------|
| 1 Fixing screw for cap | 3 Electric plug |
| 2 Right cap            | 4 Radial blower |

4. Remove connecting hose (15) for side window defrosting. Take out the right defroster nozzle (Fig. 83-2/20).

5. Remove the water drain hose from the right water tank (Fig. 83-2/14).

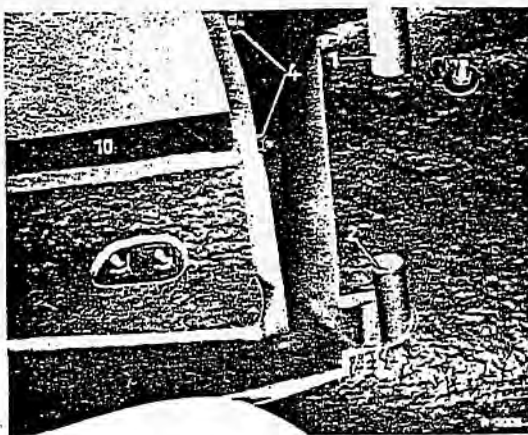


Fig. 83-2/14

- |                                   |
|-----------------------------------|
| 1 Pipe union for water drain hose |
| 2 Pipe union for water drain hose |
| 4 Fixing screw for heat exchanger |
| 10 Heat exchanger                 |

6. Unscrew the fixing bracket (1) for the blower (4) from the transmission tunnel (Fig. 83-2/15).

**Caution!** The nut must be held steady from below. It is accessible as follows:  
A helper stands to the left of the engine compartment and reaches down into the transmission tunnel with his left hand.  
Be careful when the engine is hot!

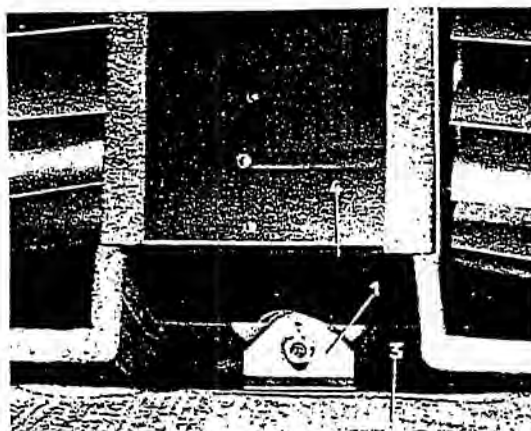


Fig. 83-2/15

- |                                 |
|---------------------------------|
| 1 Fixing bracket                |
| 3 Carpet on transmission tunnel |
| 4 Radial blower                 |

7. Unscrew the two top fixing screws (10) from the top of the radial blower left and right (Fig. 83-2/11).
8. Slightly loosen the carpet (3) on the center transmission tunnel on the right side and carefully take out the blower (4) toward the right (Fig. 83-2/12).

**Installation:**

9. Installation is the reverse of the removal procedure.

**D. Removal and Installation of Heat Exchanger**

**Removal:**

1. Drain the cooling water. Detach the feed and return hoses from the heat exchanger. Remove radial blower (see Section C).
2. Remove the ornamental grille of the scoop from the cowl.
3. Unscrew the scoop (1) left and right from the cowl. Then loosen the four center screws (2) and lift out the scoop upward (Fig. 83-2/16).

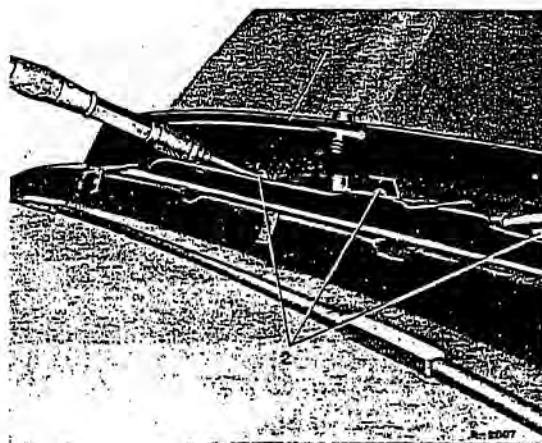


Fig. 83-2/16

- 1 Scoop
- 2 Fixing screw

4. Unscrew the right or left hinge (1) of the fresh-air flap (6). Lift the fresh-air flap (6) out of the opposite mounting (3) and detach the control cable (4) in the center (Fig. 83-2/17).
5. Remove the fresh-air cleaner (7) (Fig. 83-2/18).

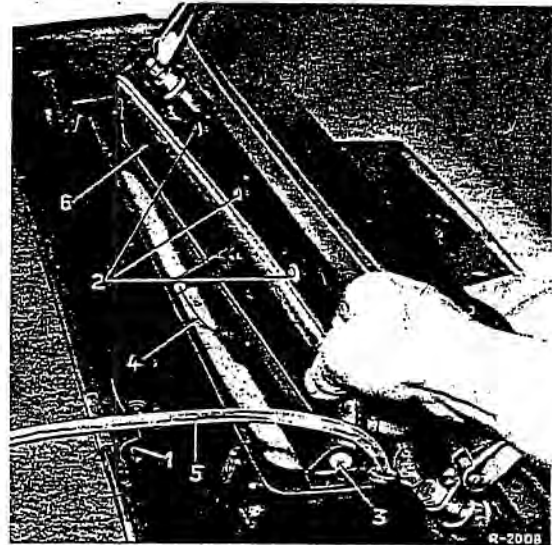


Fig. 83-2/17

- 1 Fresh-air flap hinge
- 2 Fixing screw for scoop
- 3 Bearing bushing for fresh-air flap
- 4 Control cable for fresh-air flap
- 5 Windshield washer hose
- 6 Fresh-air flap

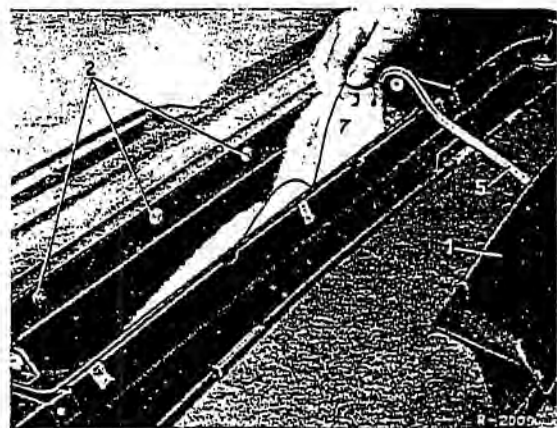


Fig. 83-2/18

- 1 Scoop
- 2 Fixing screws for scoop
- 5 Windshield washer hose
- 7 Air cleaner

6. Open the right mixed-air flap and detach the ball cup (9) of the operating linkage for the heat exchanger at the mixed-air flap (8) — not at the heat exchanger itself — and put it on top of the heat exchanger (Fig. 83-2/19).

7. Unscrew the heat exchanger (10) at the left and at the right and remove downward (Fig. 83-2/14).  
Do not damage the hose unions!

**Installation:**

8. Installation is the reverse of the removal procedure.

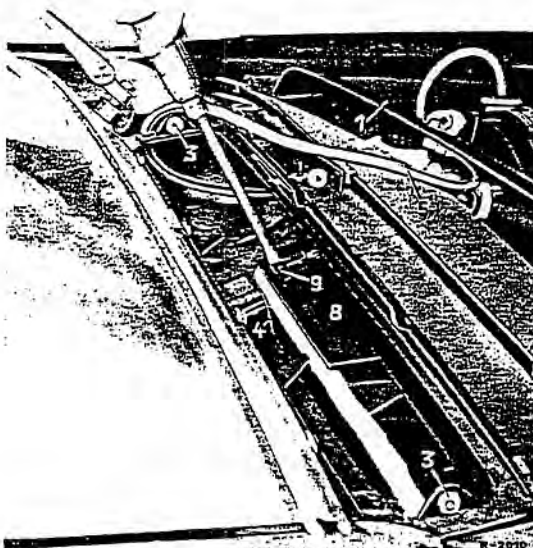


Fig. 83-2/19

- |                                      |   |
|--------------------------------------|---|
| 1 Scoop                              | 5 Hose                                  |
| 3 Bearing bushing for fresh-air flap | 8 Left mixed-air flap                   |
| 4 Control cable for fresh-air flap   | 9 Ball cup for operating heat exchanger |

**E. Removal and Installation of Right Defroster Nozzle**

**Removal:**

1. Remove glove compartment (see Job No. 68-1).
2. Remove the distribution box (see Section B).
3. Remove the connecting hose (15) for side window defrosting (Fig. 83-2/20).
4. Detach the drive rod (16) from the drive crank of the wiper motor.

**Caution:** Do not change the drive rod adjustment!

5. Take out the right defroster nozzle (7).

**Installation:**

6. Installation is the reverse of the removal procedure. When installing the defroster nozzle pay attention to the rubber mounting in the instrument panel!

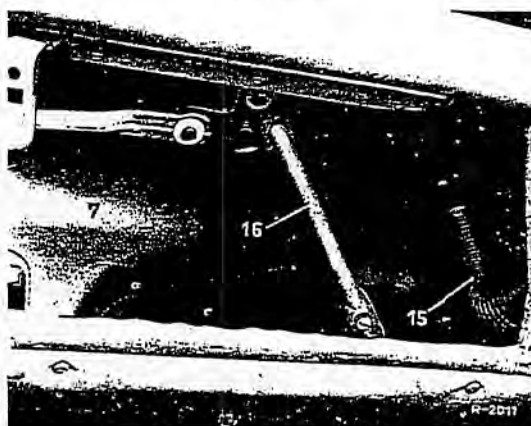


Fig. 83-2/20

- |   |
|---|
| 7 Right defroster nozzle                      |
| 15 Connecting hose for side window defrosting |
| 16 Windshield wiper drive rod                 |

**F. Removal and Installation of Left Defroster Nozzle**

**Removal:**

1. Remove the glove compartment (see Job No. 68-1).
2. Remove the distribution box (see Section B).
3. Remove support and pedals (see Job No. 29-1, Section B).

4. Remove the connecting hose for side window defrosting.
5. Take out the defroster nozzle downward.

**Installation:**

6. Installation is the reverse of the removal procedure.



# Heating and Ventilation

Job No.

83-3

Models 250 S, 250 SE, 300 SEb, 300 SEL

## A. Removal and Installation of Connecting Duct for Rear Compartment Heating

### Removal:

1. Remove the mats from the front floor and the tunnel.
2. Remove the right cover panel below the instrument panel.
3. Detach the foam rubber from the heating ducts and turn out the screws (1) on the connecting duct (Fig. 83-3/1).
4. Pull the connecting duct (2) out of the guide on the heater box (3).

### Installation:

5. Installation is the reverse of the removal procedure; make sure that the connecting duct engages properly in the guides on the heater box.

**Note:** The foam rubber on the connecting duct (2) must not be damaged and must be correctly positioned to provide proper sealing of the air duct.

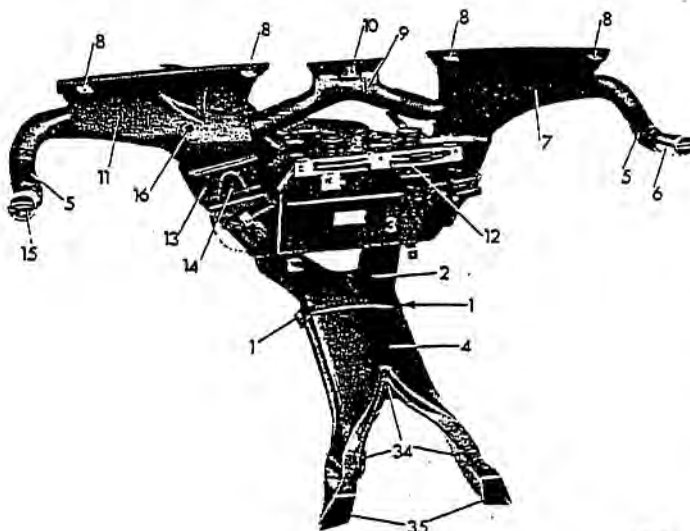


Fig. 83-3/1

- 1 Screw on connecting duct
- 2 Connecting duct
- 3 Heater box
- 4 Heating duct for rear compartment heating
- 5 Connecting hose
- 6 Right annular nozzle
- 7 Right defroster nozzle
- 8 Clips
- 9 Center defroster nozzle
- 10 Self-tapping screw
- 11 Left defroster nozzle
- 12 Cable plug
- 13 Rubber ring
- 14 Aperture
- 15 Left annular nozzle
- 16 Hole for speedometer cable
- 34 Oval head tapping screw
- 35 Seal

1-2850

## B. Removal and Installation of Heating Duct for Rear Compartment Heating

### Removal:

1. Remove the connecting duct for the rear compartment heating (see Section A).
2. Unscrew the oval head tapping screws (34) from the heating duct (4) (Fig. 83-3/1).
3. Pull the heating duct together with the seals (35) out of the cross member and remove.

### Installation:

4. Installation is the reverse of the removal procedure.

83-3/1

### C. Removal and Installation of Right Defroster Nozzle

#### Removal:

1. Remove the right cover panel below the instrument panel.
2. Remove the glove compartment (see Job No. 68-2).
3. Remove the upper padding from the instrument panel (see Job No. 68-3).
4. Remove the clips (8) for the right defroster nozzle (7) (Fig. 83-3/1).

5. Pull off the connecting hose (5) for the right annular nozzle (6) from the defroster nozzle (7).
6. Lift the defroster nozzle, pull it out of the connection with the center defroster nozzle (9) and remove downward.

#### Installation:

7. Installation is the reverse of the removal procedure.

### D. Removal and Installation of Center Defroster Nozzle

#### Removal:

1. Remove the right defroster nozzle (Section C).
2. Remove the loudspeaker cover.
3. Turn out the self-tapping screw (10) in the loudspeaker recess (Fig. 83-3/1).

4. Pull the defroster nozzle (9) out of the connection with the left defroster nozzle (11) and remove downward.

#### Installation:

5. Installation is the reverse of the removal procedure.

### E. Removal and Installation of Heater Box with Heat Exchanger and Blower

#### Removal:

1. Drain the coolant.
2. Detach the ground cable from the battery.
3. Disconnect the feed and return pipes of the heat exchanger in the engine compartment at the cowl.
4. Take off the steering wheel.
5. Remove the connecting duct for the rear compartment heating (see Section A).
6. Remove the right defroster nozzle (see Section C).
7. Remove the center defroster nozzle (see Section D).
8. Remove the model designation panel from the instrument panel. If a radio is installed remove the set together with the loudspeaker.

9. Remove the ashtray and ashtray housing.
10. Pull out the cable plug (12) for the blower (Fig. 83-3/1).
11. Disconnect the operating cables for the heating (see Section G, Paras. 8 and 9).
12. Turn out the screws (17) and (18) for the attachment of the heater box (Fig. 83-3/2).
13. Remove the two screws of the clips (8) on the left defroster nozzle (Fig. 83-3/1).
14. Disconnect the speedometer cable from the transmission and the instrument cluster (see Job No. 54-11 a) and pull it out of the left defroster nozzle upward.

**Note:** The speedometer cable runs through the hole (16) in the left defroster nozzle.

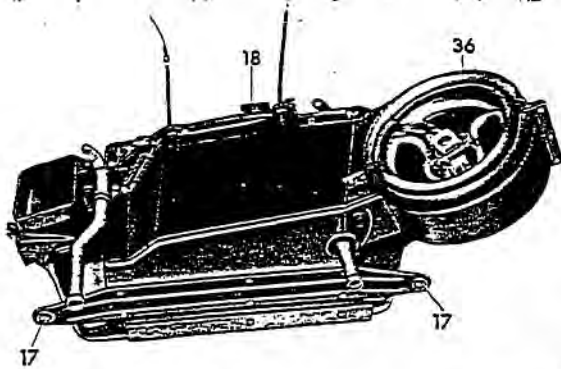


Fig. 83-3/2

- 17 Screws for attaching the heater box to the cowl
- 18 Screws for attaching the heater box to the instrument panel
- 36 Rubber seal

15. Lift the left defroster nozzle, fold up the rubber ring (13) at the front and slide the defroster nozzle with the aperture (14) over the steering lock (Fig. 83-3/1).

16. Take out the heater box toward the lower right, paying attention to the feed and return pipes of the heat exchanger.

**Note:** To prevent possible injuries put rubber caps on the wire cable ends after having removed the heater box.

**Installation:**

17. Installation is the reverse of the removal procedure; lightly grease the rubber grommets in the cowl before starting installation procedures. Lightly grease the rubber seal (36) before installation (Fig. 83-3/2). Make sure that the rubber seal fits properly to the blower connection. When fitting the screws (17 and 18) begin with the left screw because access is difficult.

For connection and adjustment of the wire cables for the operating assembly see Section G.

**F. Removal and Installation of Left Defroster Nozzle**

**Removal:**

**With heater box removed**

Remove the clip (8) from the left defroster nozzle and pull the nozzle out downward to the right, paying attention to the connecting hose (5) (Fig. 83-3/1).

**With heater box installed**

1. Remove the pedal system (Job No. 29) and the holder for the sleeve union on the left lower side of the instrument panel.
2. Remove the upper padding from the instrument panel (see Job No. 68-3, Section A).

3. Disconnect the speedometer cable at the transmission and at the instrument cluster (see Job No. 54-11 a) and pull it out upward from the left defroster nozzle.

**Note:** The speedometer runs through the hole (16) in the left defroster nozzle (Fig. 83-3/1).

4. Remove the clips (8) and the connecting hose (5) of the left defroster nozzle and pull out the nozzle downward to the left (Fig. 83-3/1).

**Installation:**

5. Installation is the reverse of the removal procedure.

**G. Removal and Installation of Operating Assembly for Heating and Ventilation**

**Removal:**

1. Remove the right panel below the instrument panel.
2. Remove the loudspeaker cover.

3. Remove the model designation panel from the instrument panel. If a radio is installed remove the radio together with the loudspeaker.

4. Remove the ashtray together with its housing.

5. Pull off the handles (20) (Fig. 83-3/3).

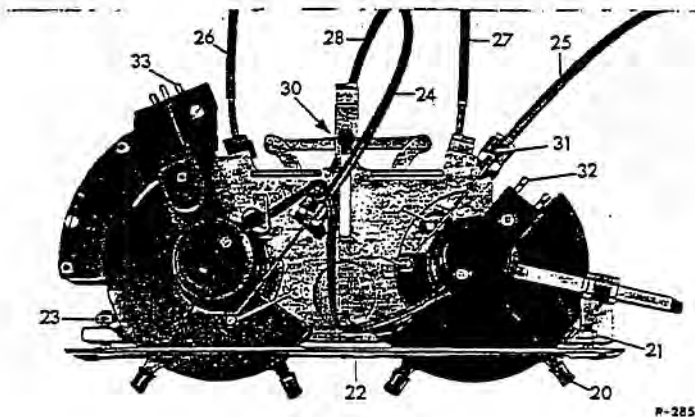


Fig. 83-3/3

- 20 Handle
- 21 Right nut
- 22 Escutcheon
- 23 Left nut
- 24 Operating cable for fresh-air flaps
- 25 Operating cable for air distribution flaps
- 26 Operating cable for left heater flap
- 27 Operating cable for right heater flap
- 28 Operating cable for faucet
- 29 Clamping screw for heater flap cables
- 30 Snap ring
- 31 Clip
- 32 Lighting cable plug
- 33 Blower cable plug

R-2853

6. Reach through the opening for the ashtray in the instrument panel and remove the right nut (21) of the escutcheon (22).
7. Move the left operating disk for the heating and the operating disk for the fresh-air flap as far as the right stop.
8. Reach through the opening for the radio in the instrument panel, remove the left nut (23) of the escutcheon and remove the escutcheon.
9. Adjust the operating disks to the position shown in Fig. 83-3/3.
10. Unscrew the screws (29) of the operating cables (26 and 27) for the heater flaps, holding them steady from below with a screwdriver. Remove the snap rings (30) from the other operating cables (24, 25, and 28) and detach all clips (31). Then pull out the operating cables.
11. Remove the operating assembly downward between the instrument panel and the heater box.



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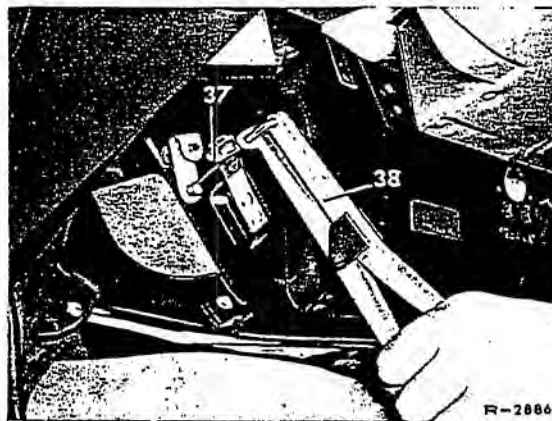
Fig. 83-3/4

19 Heater flap

**Installation:**

12. Installation is the reverse of the removal procedure.

**Note:** Adjust the wire cables (26 and 27) (Fig. 83-3/3) in such a way that the heater flaps (19) are fully closed (Fig. 83-3/4) while the operating levers are still approx. 10 mm away from the stop. With this adjustment the heater flaps will close the fresh-air duct with a certain initial tension. The clips (35) can be fixed with Pliers (38) 108 589 01 37 00 (Fig. 83-3/5).



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Fig. 83-3/5

- 37 Clip
- 38 Pliers 108 589 01 37 00

## Seats - Groups 91 to 97

Job No.

### Removal and Installation of Front Seats

91-1

A. Left Front Seat of Models 250 S, 250 SE, 300 SEb, 300 SEL

B. Left and Right Front Seats of Models 200, 200 D, 230, 230 S  
Right Front Seat of Models 250 S, 250 SE, 300 SEb, 300 SEL

### Removal and Installation of Rear Seat Cushion and Rear Seat Back

92-1

Models 200, 200 D, 230, 230 S, 250 S, 250 SE, 300 SEb, 300 SEL

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1903

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LAND OFFICE  
FOR THE YEAR  
1903

# Removal and Installation of Front Seats

91-1

Job No.

## A. Left Front Seat of Models 250 S, 250 SE, 300 SEb, 300 SEL

### Removal:

1. Move both seat adjusters forward as far as the stop (Fig. 91-1/1).

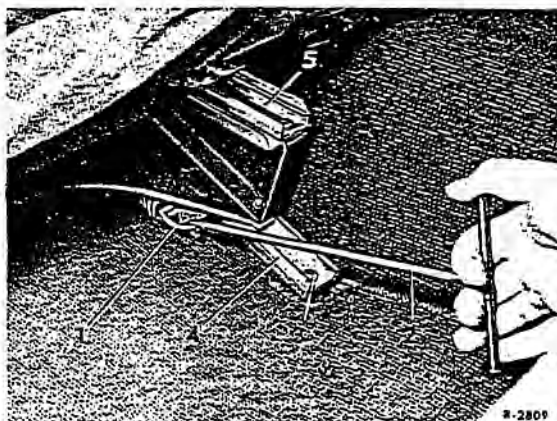


Fig. 91-1/1

- 1 Tension spring
- 2 Hook 100 589 01 59 00
- 3 Rear fixing screw
- 4 Lower rail
- 5 Upper rail

2. Detach the tension spring (1) by means of Hook 100 589 01 59 00 (2).
3. Turn out both rear fixing screws (3).
4. Move the seat adjusters rearward as far as the stop (Fig. 91-1/2).

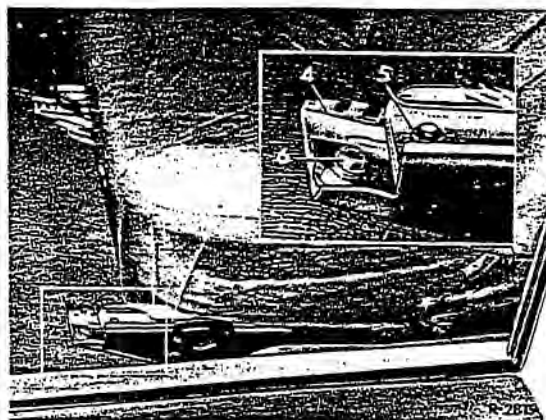


Fig. 91-1/2

- 4 Lower rail
- 5 Upper rail
- 6 Front fixing screw

5. Turn out both front fixing screws (6).
6. Now remove the seat together with the sliding seat guides.

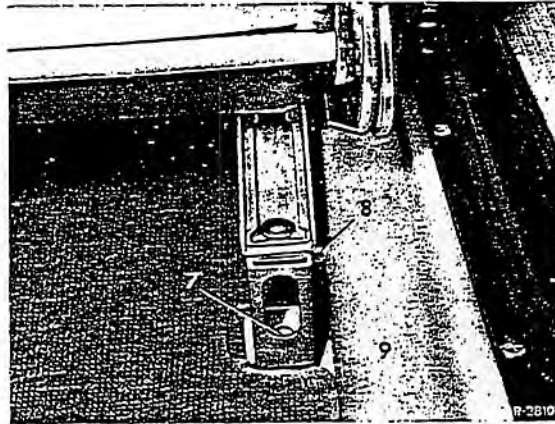
### Installation:

7. Installation is the reverse of the removal procedure. After installation check the seat for ease of movement in both adjustment ranges.

**B. Left and Right Front Seats of Models 200, 200 D, 230, 230 S  
Right Front Seat of Models 250 S, 250 SE, 300 SEb, 300 SEL**

**Removal:**

1. Push seat forward as far as it will go.
2. Turn out both rear fixing screws (7) and the side fixing screw (8) in the side member (9) (Fig. 91-1/3).
3. Push the seat back as far as it will go.
4. Turn out the front fixing screws.
5. Remove the seat.



**Fig. 91-1/3**

- 7 Rear fixing screw
- 8 Side fixing screw
- 9 Side member

**Installation:**

6. Installation is the reverse of the removal procedure. After installation check the seat for ease of movement in both adjustment ranges.



# Removal and Installation of Rear Seat Cushion and Rear Seat Back

Job No.

92-1

Models 200, 200 D, 230, 230 S, 250 S, 250 SE, 300 SEb, 300 SEL

## Removal:

1. Raise the rear seat cushion (1) at the front edge until the pressure-welded studs (2) disengage from the holes in the cross member.
2. Remove the rear seat cushion forward.
3. Remove both nuts from the threaded pins of the rear seat back from the trunk compartment.
4. Pull the rear seat back forward by its upper edge until the threaded pins disengage from the bores.

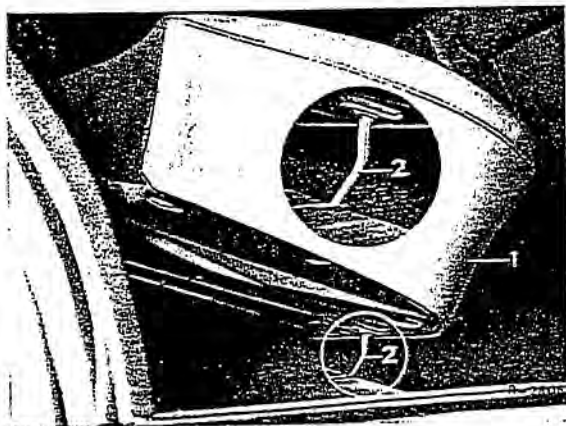


Fig. 92-1/1

- 1 Rear seat cushion
- 2 Pressure-welded studs

5. Press the rear seat back downward until it disengages from the lower hooks.

**Note:** On Models 200, 200 D, 230 and 230 S the lower edge of the rear seat back is not held by hooks but is screwed down as on the previous models.

## Installation:

6. Hang the rear seat back into the lower hooks from below and push the two threaded pins through the holes in the rear wall.

On Models 200, 200 D, 230 and 230 S the lower edge of the rear seat back is screwed to the rear wall (see Note under 5).

7. Screw the rear seat back to the threaded pins from the trunk compartment.
8. Put down the rear seat cushion in such a way that the pressure-welded studs engage the bores in the cross member (Fig. 92-1/1).
9. Push the front edge of the seat down until it rests completely on the cross member.
10. Push the rear edge of the seat cushion down until it rests on the floor assembly.

92-1

