

## Bremsen

Brakes

Freins

Freni

Frenos

Bromsar

Remmen

## 34 Brakes

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## Specifications

Brakes	
Model	320/6 320/6 A
34 00 ... General	323 i 323 i A *)
Leak test (excl. brake booster)	
Force at pedal	N (lb.ft)
Brake fluid <sup>2)</sup> , reference	790 (177.9) $\triangleq$ $\approx$ 50 bar (712 lb/in <sup>2</sup> ) brake line pressure <sup>1)</sup>
	BMW DOT 4 Ate-DOT 4 "SL" Pentosin-Super DOT 4 Castrol Disc Brake Fluid DOT 4
34 11 ... Front brakes (disc brakes)	
Brake pads <sup>3)</sup>	
Ref.	Energit 382 FF
Color code	blue-blue-white
Pattern	with slot
Min. lining material thickness	mm (in)
	2 (0.08)

\*) Version for Sweden

1) Pressure drop max. 8% after 2 minutes

2) Must be renewed once a year

3) Use only brake pads of same makes with same batch number for both front wheel brakes or both rear wheel brakes



## Specifications

## Brakes

Model	320/6 320/6 A	323 i 323 i A *)
34 11 . . . Front brakes (disc brakes) (continued)		
Fixed caliper <sup>1)</sup> Width of shaft for pads	mm (in)	56 (2.20)
Piston diameter	mm (in)	48 (1.89)
Piston offset	°	20 <sup>2)</sup>
Brake disc Diameter	mm (in)	255 ± 0.2 (10.039 ± 0.06) 255 ± 0.2 (10.039 ± 0.06), ventilated
Thickness	mm (in)	12.7 – 0.27 (5.00 – 0.011) 22 – 0.20 (0.866 – 0.008)
Max. thickness tolerance within rubbed area	mm (in)	0.02 (0.0008) 0.02 (0.0008)
Minimum thickness <sup>3)</sup>	mm (in)	11.7 (0.461) 21 (0.827)
Max. residual imbalance	gcm	50 30
Max. lateral runout <sup>4)</sup> with brake disc installed	mm	0.2 (0.008) 0.2 (0.008)
Max. lateral runout <sup>4)</sup> with brake disc removed	mm	0.05 (0.002) 0.05 (0.002)

\*) Version for Sweden

1) Use only calipers of same make on any axle

2) on Ate fixed caliper

3) Each face of disc may be remachined to max. 0.5 mm (0.02 in) undersize provided minimum thickness is maintained. Always machine both discs on the axle to the same extent

4) measured at maximum diameter of rubbed area on disc

## Specifications

## Brakes

Model	320/6 320/6 A	323 i 323 i A*)
3421 . . . Rear wheel brakes (drum brakes)		
Brake drum Internal diameter	mm (in) 250 (9.843)	—
1st oversize when machining	mm (in) 250 + 0.5 (9.843 + 0.020)	—
2nd oversize when machining	mm (in) 250 + 1 (9.843 + 0.040)	—
Max. permissible ovality	mm (in) 0.05 (0.002)	—
Max. imbalance	gcm 150	—
Brake linings Ref.	Energit 336	—
Lining width	mm (in) 40 ± 0.5 (1.574 ± 0.020)	—
Lining thickness	mm (in) 5 – 0.3 (0.197 – 0.012)	—
Min. lining thickness	mm (in) 3 (0.118)	—
Wheel brake cylinder Piston diameter	mm (in) 19.05 (0.75)	—

\*) Version for Sweden

## Specifications

### Brakes

Model	320/6 320/6 A	323 i 323 i A *)
3421 ... Rear wheel brakes (disc brakes)		
Brake pads <sup>1)</sup> Ref.		
Color code	-	Textar T 260 FF
Pattern	-	yellow-green-yellow without rain slot
Min. lining material thickness mm (in)	-	2.0 (0.08)
Caliper Ref.	-	F 27
Shaft width for brake pads mm (in)	-	40 (1.57)
Piston diameter mm (in)	-	27 (1.06)
Brake disc Diameter mm (in)	-	258 -0.2 (10.16 - 0.008)
Thickness mm (in)	-	10 -0.2 (0.39 - 0.008)
Max. thickness tolerance within rubbed area mm (in)	-	0.02 (0.0008)

\*) Version for Sweden

<sup>1)</sup> Use only brake pads of same make and same batch number on both front and on both rear brakes

## Specifications

## Brakes

Model	320/6 320/6 A	323 i 323 i A *)
3421 ... Rear wheel brakes (disc brakes) – continued		
Brake disc Minimum thickness <sup>1)</sup>	mm (in)	9 (0.354)
Max. residual imbalance	gcm	50
Max. lateral runout <sup>2)</sup> with brake disc installed	mm (in)	0.2 (0.008)
Max. lateral runout <sup>2)</sup> with brake disc removed	mm (in)	0.05 (0.002)
3431 ... Brake master cylinder		
Tandem master cylinder Ref.	THZ Ø 20.64 × 20/14 stroke	THZ Ø 20.64 × 20/14 stroke
Piston diameter	mm (in)	20.64 (0.8126)
Tandem master cylinder (for RHD cars) Ref.	THZ Ø 20.64 × 20/14 stroke	THZ Ø 20.64 × 20/14 stroke
Piston dia.	mm (in)	20.64 (0.8126)

\*) Version for Sweden

1) Each rubbed surface may be remachined to max. 0.5 mm (0.02 in) undersize, provided that minimum thickness is maintained. Always remachine both discs on the axle.

2) measured at maximum diameter of rubbed area.

## Specifications

### Brakes

Model	320/6 320/6 A	323 i 323 i A *)
<b>34 32 . . . Brake lines (brake fluid low level warning switch)</b>		
Brake fluid low level warning switch (with threaded union and float) Make		Ate
Distance from float end to gasket      mm (in)	56 + 3 (2.205 + 0.118)	
Distance from lower float marker point (fluid level at switching point) to gasket      mm (in)	49 (1.929)	
Distance from upper float marker point (fluid level at switching point) to gasket      min. mm (in)	46 (1.811)	
<b>34 33 . . . Brake booster servo</b>		
Brake unit Ref.	Ate T 52/225	
Brake unit (for RHD cars) Ref.	Ate T 52/225	

\*) Version for Sweden



## Specifications

## Brakes

Model	320/6 320/6 A	323 i 323 i A*)
34 33 . . . Brake booster servo (continued)		
Check valve Make		Ate
Direction of installation (arrow)		towards engine
34 34 . . . Brake force limiter		
Brake force limiter Make	Ate	-
Type	BRMS/18	-
Piston diameter mm (in)	18 (0.709)	-
Changeover pressure (ref. No.) bar (lb/in <sup>2</sup> )	25 (356)	-
Identification (color or number on end)	"25"	-
34 41 . . . Parking brake (handbrake)		
Brake drums Intl. dia. mm (in)	-	160 + 0.16 0 0 (6.299 + 0.006)
Max. ovality permitted mm (in)	-	0.1 (0.004)

\*) Version for Sweden



## Specifications

### Brakes

Model	320/6 320/6 A	323 i 323 i A *)
34 14 ... Parking brake (handbrake)		
Brake linings <sup>1)</sup> Ref.	—	Energit 338 HH
Lining width mm (in)	—	25 ± 0.2 (0.984 ± 0.008)
Tightening torques		
34 00 ... General		
Bleed valve at caliper	Nm kpm lb.ft	3.5 ... 5.2) 0.36 ... 0.51 <sup>2)</sup> 2.6 ... 3.7
Bleed valve at wheel cylinder	Nm kpm lb.ft	2.5 ... 4.0 0.25 ... 0.41 1.8 ... 3.0
34 11 ... Front brakes (disc brakes)		
Caliper to stub axle	Nm kpm lb.ft	80 ... 95 8.2 ... 9.7 59 ... 70
Brake disc to wheel hub (M 8 retaining bolt)	Nm kpm lb.ft	30 ... 33 3.1 ... 3.4 22 ... 25

\*) Version for Sweden

<sup>1)</sup> Always use linings of the same make

<sup>2)</sup> For Girling make of caliper, 4 ... 6 Nm (0.41 ... 0.61 kpm, 3.0 ... 4.4 lb.ft)

## Trouble-shooting – rear axle

Fault	Cause	Remedy
Knock when moving away	Drive flanges loose at splines	Renew drive flanges – 33 11 091
Knock when accelerator is released or depressed	Excessive torsional backlash Drive flanges loose at splines Defective half-shaft Excessive play in sliding section of propeller shaft	Adjust backlash – 33 12 551 see Item 1 Renew half-shaft – 33 21 000 Install sliding section with Locitte No. 75 (green) for joint components
Noise on traction or overrun	Excessive or too little torsional backlash	Adjust backlash – 33 12 551
Drumming noise	Propeller shaft Defective rear axle beam rubber mounting	see 'Trouble-shooting – propeller shaft' Renew rubber mounting – 33 33 071
Loss of oil	Leaking radial sealing rings Blocked vent Incorrect oil grade <sup>1)</sup>	Renew radial sealing rings Clean vent Renew final drive oil content
Vibration	Road wheels out of balance Defective half-shaft Propeller shaft	Balance wheels, renew rims if necessary Renew half-shaft – 33 21 000 see 'Trouble shooting – propeller shaft'
Banging, rumbling noises	Damper not transmitting force correctly Top rubber damper mounting defective Bottom rubber damper mounting defective Rubber mounting at rear axle beam defective	Renew dampers – 33 52 100 Renew rubber mounting – 33 52 200 Renew damper – 33 52 100 Renew rubber mounting – 33 33 071
Grinding sound when cornering only	Defective wheel bearings	Renew wheel bearings – 33 41 151

<sup>1)</sup> See specifications

## Specifications

## Brakes

Model	320/6 320/6 A	323 i 323 i A *)
Tightening torques, continued		
3421 ... Rear wheel brakes (drum brakes)		
Brake drum to drive flange (M 8 retaining bolt)	Nm kpm lb.ft  15 ... 18 1.5 ... 1.8 10.8 ... 13.0	- - -
Wheel cylinder to brake backplate	Nm kpm lb.ft  9 ... 10 0.9 ... 1.0 6.5 ... 7.2	- - -
Brake backplate to semi-trailing arm (with Loctite 270)	Nm kpm lb.ft  60 ... 67 6.1 ... 6.8 44 ... 49	- - -
3421 ... Rear wheel brakes (disc brakes)		
Brake disc to rear wheel shaft (M 8 retaining bolt)	Nm kpm lb.ft  - - -	15 ... 18 1.5 ... 1.8 10.8 ... 13.0
Caliper to semi-trailing arm	Nm kpm lb.ft  - - -	60 ... 67 6.1 ... 6.8 44 ... 49
Shield plate to semi-trailing arm	Nm kpm lb.ft  - - -	43 ... 48 4.4 ... 4.9 32 ... 35

\*) Version for Sweden

## Specifications

Brakes			
Model		320/6 320/6 A	323 i 323 i A *)
Tightening torques, continued			
34 31 ... Brake master cylinder			
Retaining nut, master cylinder/brake booster (LHD cars)	Nm kpm lb.ft		16 ... 20 1.6 ... 2.1 11.6 ... 15.2
Retaining nut, master cylinder/brake booster (RHD cars)	Nm kpm lb.ft		21 ... 29 2.1 ... 2.9 15.2 ... 21.0
34 32 ... Brake lines			
Brake line to caliper (fixed)	Nm kpm lb.ft		13 ... 16 <sup>1)</sup> 1.3 ... 1.6 <sup>1)</sup> 9.4 ... 11.6 <sup>1)</sup>
Brake line to wrapround caliper	Nm kpm lb.ft	— — —	15 ... 18 1.5 ... 1.8 10.8 ... 13.0

\*) Version for Sweden

1) 8 ... 11 Nm (0.8 ... 1.1 kpm, 5.8 ... 8.0 lb.ft) on Girling caliper



## Specifications

### Brakes

Model	320/6 320/6 A		323 i 323 i A *)
Tightening torques, continued			
34 32 . . . Brake lines, continued			
Brake line to wheel cylinder	Nm kpm lb.ft	12 ... 16 1.2 ... 1.6 8.7 ... 11.6	— — —
Collar screw on brake pipes	Nm kpm lb.ft	13 ... 16 1.3 ... 1.6 9.4 ... 11.6	
Brake hoses	Nm kpm lb.ft	13 ... 16 1.3 ... 1.6 9.4 ... 11.6	
34 33 . . . Brake booster servo			
Brake unit at pedal pivot mount	Nm kpm lb.ft	22 ... 24 2.2 ... 2.4 15.9 ... 17.4	
Piston rod (M 10) for brake unit	Nm kpm lb.ft	25 ... 27 2.5 ... 2.7 18.1 ... 19.5	
34 34 . . . Brake force limiter			
Brake force limiter M 10 × 1 mm unions)	Nm kpm lb.ft	12 ... 16 1.2 ... 1.6 8.7 ... 11.6	— — —

\*) Version for Sweden

## Specifications

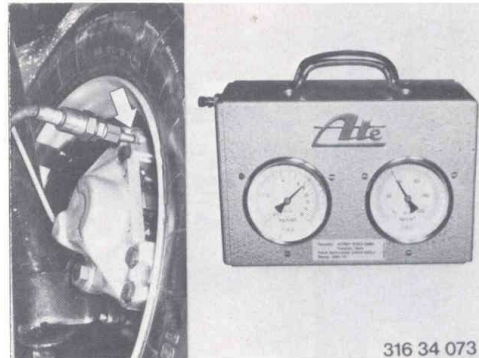
### Brakes

Model		320/6 320/6 A	323 i 323 i A *)
Tightening torques, continued			
34 41 . . . Parking brake			
Handbrake lever to handbrake cable			
a) M 6 clamp nut	Nm kpm lb.ft	1.6 . . . 1.8 0.16 . . . 0.18 1.2 . . . 1.3	
b) M 6 locknut	Nm kpm lb.ft	8 . . . 9 0.8 . . . 0.9 5.8 . . . 6.5	
Handbrake lever to body, M 10			
	Nm kpm lb.ft	15 . . . 20 1.5 . . . 2.0 10.8 . . . 14.5	
*) Version for Sweden			



**34 00 019 Foot brake – checking high pressure, low pressure and front pressure**

**High pressure and leak test:**  
Remove the bleed screw on the brake caliper. Insert the connecting nipple for the pressure tester, and connect the tester. Bleed the pressure tester.



Operate the brake pedal to apply a force<sup>1)</sup> to the brake circuit. The service brake gauge should indicate pressure<sup>1)</sup> in the hydraulic circuit.

After 2 minutes, pressure should not have dropped by more than max. 8%.

**Warning:** The high pressure leak test must be performed with the engine stopped.



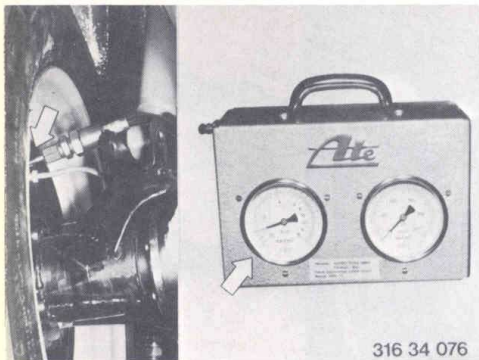
**Low pressure test:**

Release the pedal prop until the test pressure in the brake circuit is 2 to 5 bar (28 to 71 lb/in<sup>2</sup>). The vehicle and the tester must not be moved or else the results will be incorrect. Pressure must remain constant during the 5-minute test period.

If severe pressure drop is noted, examine all rubber seals.



<sup>1)</sup> See specifications



#### Front pressure test (BMW 320 only):

Remove and install the bolt holding the spring-shock absorber to the semi-trailing arm. Support the semi-trailing arm.

Remove the bleed screw at the wheel brake cylinder.

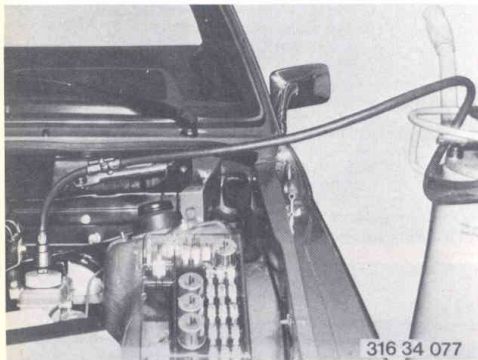
Connect the nipple and the pressure tester. Bleed the pressure tester.

Depress the brake pedal several times, then release.

Pressure should drop to 1.2 ... 0.5 bar (17.1 ... 7.1 lb/in<sup>2</sup>)

The input pressure should not drop below 0.5 bar (7.1 lb/in<sup>2</sup>) during the 5-minute test period.

When installing: Note correct tightening torque<sup>1)</sup>.



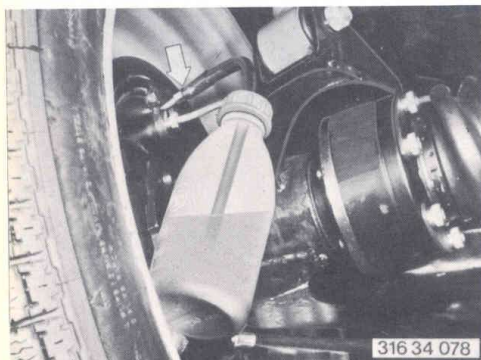
#### 34 00 046 Brakes – bleeding

Brake fluid<sup>1)</sup> must be renewed every year. It is hygroscopic and absorbs moisture from the air through the vent hole in the fluid reservoir. This reduces the boiling point of the brake fluid to only 160 ... 180°C (320 ... 355°F).

**Warning:** Never allow brake fluid to touch the paintwork of the car, or the paint surface will be damaged.

Connect the bleed unit to the brake fluid reservoir.

**Warning:** Pressure must not build up beyond 2 bar (28.5 lb/in<sup>2</sup>).



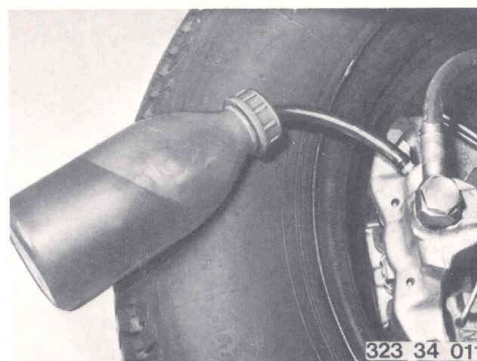
#### Rear wheel brake 320:

Push the bleed hose with fluid trap bottle onto the bleed screw. Open the bleed screw. When no further air bubbles emerge, close the bleed screw.

<sup>1)</sup> See specifications

**BMW 323 only:**

Push the bleed hose with fluid trap bottle on to the bleed screw. Open the bleed screw. When no further air bubbles emerge, close the bleed screw.



**Front wheel brake:**

Push the bleed hose with fluid trap bottle onto the bleed screw. Open the bleed screw. When no further air bubbles emerge, close the bleed screw.



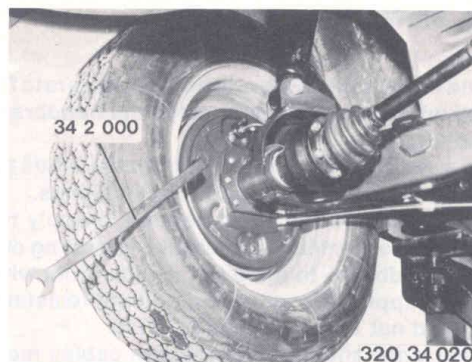


**34 10 014 Handbrake – adjusting**  
**A) BMW 320**

The handbrake must be adjusted when the lever can be pulled up by more than 6 notches. Raise and support the rear of the vehicle.

Release the handbrake completely.

Using special wrench BMW 34 2 000, turn the left adjusting cam anticlockwise and the right cam clockwise until the wheels lock, turning the wheels all the time. Next slacken the cam bolts by 1/8th turn until the wheel can just be rotated freely.



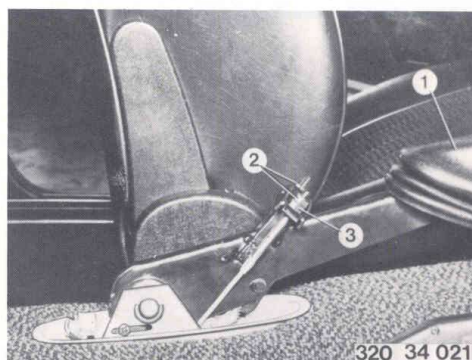
Push up the rubber cap (1) on the handbrake lever.

Slacken the lock nut (2).

Apply the handbrake by 6 notches from the fully released position.

Installation instructions: Tauten each brake cable at the adjusting nut (3) to 1.6 ... 1.8 Nm (1.2 ... 1.3 lb/ft) torque.

Finally, check that the rear wheels turn freely when the handbrake is released. Check that both handbrake cables are adjusted to the same length by turning the rear wheels by hand with the handbrake lever partly applied.



## B) BMW 323i

### Note:

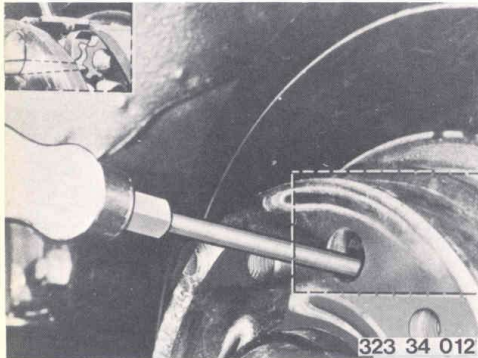
The handbrake system is entirely separate from the service brake, and is subject only to a relatively low rate of wear, since the handbrake is not normally applied when the vehicle is in motion.

As a result, the coefficient of friction tends to fall, for instance on account of corrosion in the brake drums or dirt on the brake linings.

This results in the effort needed to apply the handbrake effectively rising in proportion.

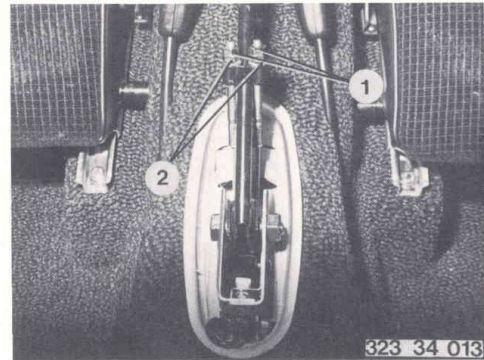
To ensure maximum handbrake operating efficiency, it is normally sufficient before adjusting the handbrake to drive the vehicle from where it is parked to the workshop with the handbrake applied (lever pulled up until resistance is felt, plus one further notch). The distance should not exceed 400 m (1300 ft).

Check first that both handbrake cables move freely.



Detach and attach the rear wheels – 36 10 340. The handbrake requires adjustment when the lever can be pulled up by more than 6 notches. Release the handbrake fully. Turn the brake discs until the adjusting nut can be seen through the large inspection hole. Turn the adjusting nut with a screwdriver blade to press the handbrake shoes against the drum until the brake disc can no longer be turned. Then slacken the adjusting nut by 4 ... 6 teeth until the brake disc can again be turned freely.

**Push up the rubber cap at the handbrake lever and slacken the locknut (1).**



**Adjusting procedure:** apply handbrake from fully-released position to 6th notch on ratchet. Apply a preload of 1.6 ... 1.8 Nm (0.16 ... 0.18 kpm, 1.2 ... 1.3 lb.ft) to each brake cable by means of adjusting nut (2). Tighten locknut (1) to 8 ... 9 Nm (0.08 ... 0.9 kpm, 5.8 ... 6.5 lb.ft) torque.

Finally, check that the rear wheels can turn freely when the handbrake is released. To check that the two cables are uniformly adjusted, turn the rear wheels by hand with the handbrake applied lightly.



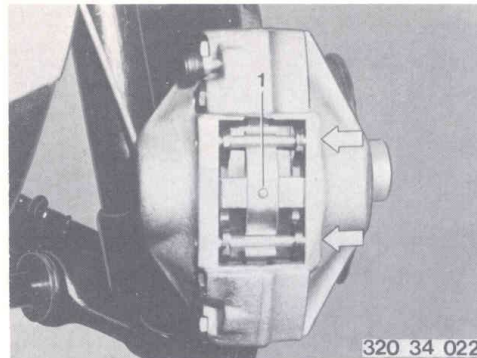
### 34 11 000 Brake pads – removing and installing

Detach and attach front wheels – 36 10 340.

#### A) Ate caliper

Drive out retaining pins and remove cross spring (1).

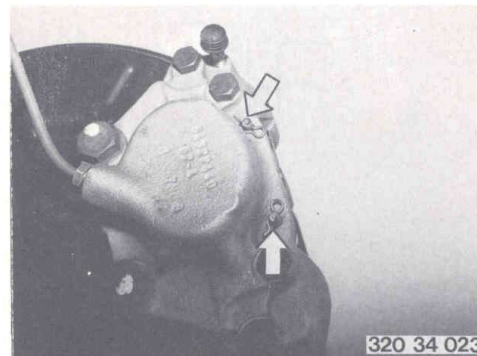
*When installing:* Check condition of cross spring (1) and retaining pins and renew if necessary.



#### B) Girling caliper

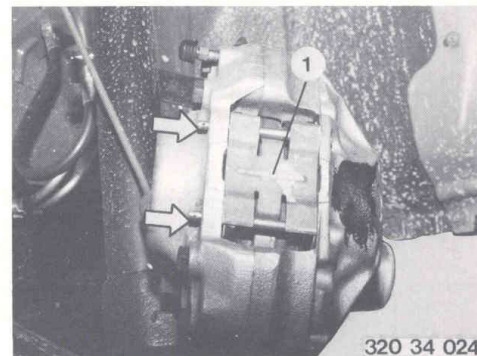
Bend up keeper eye and pull out.

*When installing:* Renew the keeper eye. Bend over the straight side of the eye only.



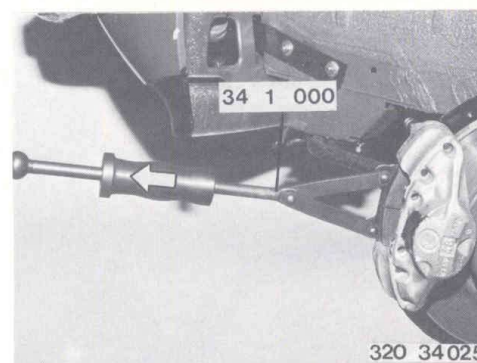
Drive out retaining pins. Take off cross spring (1).

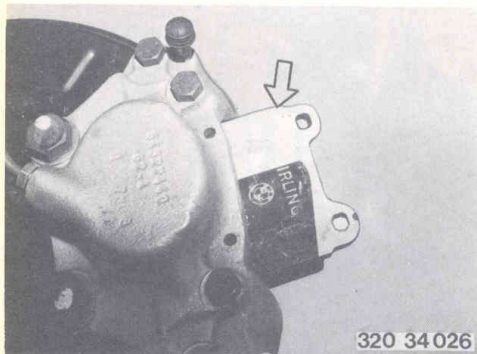
*When installing:* check condition of cross spring and retaining pins, and renew if necessary.



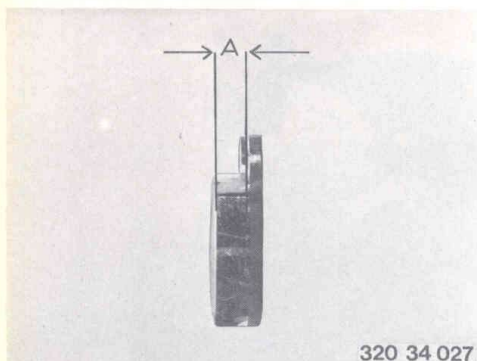
Pull out brake pads or drive out with 34 1 000 extractor.

*Warning:* Mark brake pads in relation to caliper. Do not interchange the pads if worn on one side only.

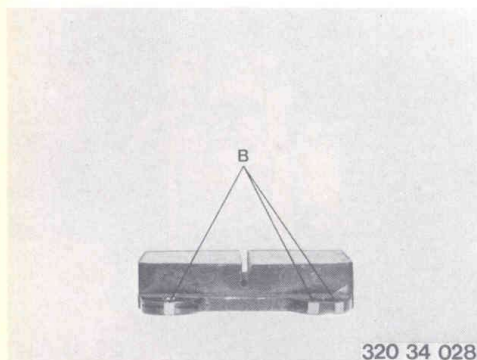




*When installing: note correct position of shield plates on Girling calipers.*



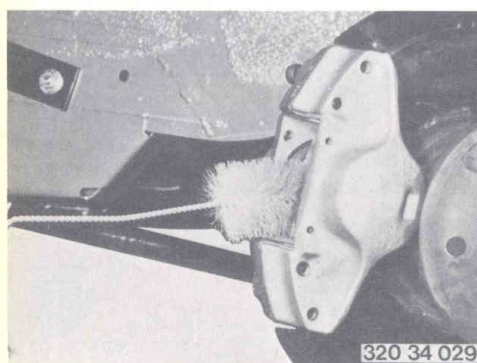
*When installing: note minimum thickness (A)<sup>1)</sup>.*



**When renewing:**

**Note: Brake pads must always be renewed at both calipers of an axle.**

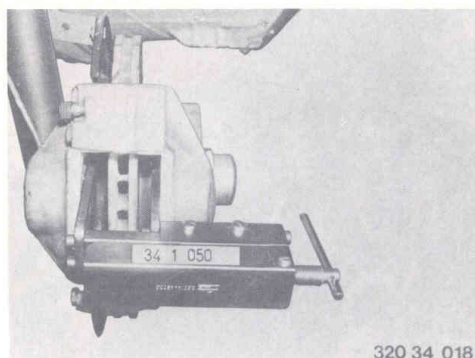
**Note color code<sup>1)</sup> (B) and make<sup>1)</sup>.**



**Clean out the guide face or seat in the housing cavity with a cylindrical brush. Never use a solvent containing mineral oil. New brake pads must move freely in the calipers.**

<sup>1)</sup> See specifications

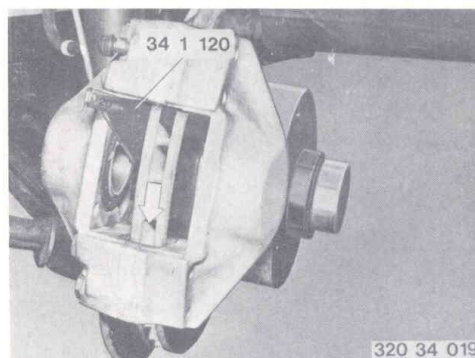
Press the piston fully back into the fixed brake caliper with piston resetting pliers 34 1 050.  
*Warning:* note brake fluid rise in reservoir.



320 34 018

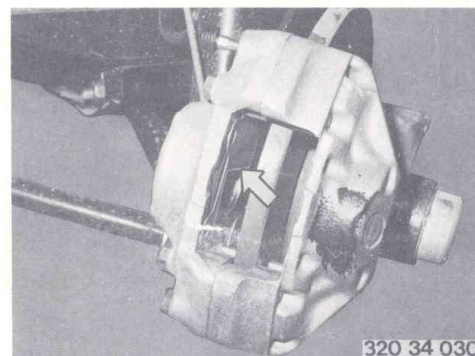
A) 'Ate' fixed caliper:  
 Check 20° setting of piston with piston gauge 34 1 120.

The 20° cutaway on the piston must face the brake disc entry side.  
 For the consequences of incorrect adjustment, see 'Trouble-shooting – brakes'.



320 34 019

B) 'Girling' fixed caliper:  
 The steps on the piston should be located so that the shield plates are at the milled recesses on the pistons. If necessary, use the shield plate as a setting gauge.



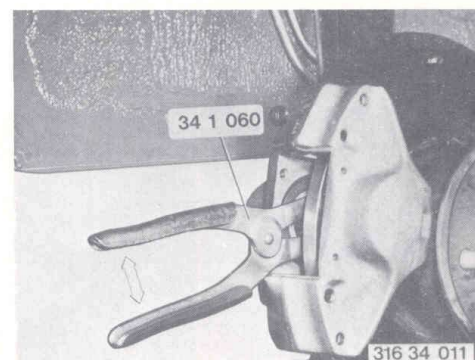
320 34 030

The piston is reset to its 20° position with piston turning pliers 34 1 060.

*When installing:* after installing the brake pads, depress the brake pedal a number of times so that the pads are forced against the brake disc. Restore the brake fluid in the reservoir to the maximum mark.

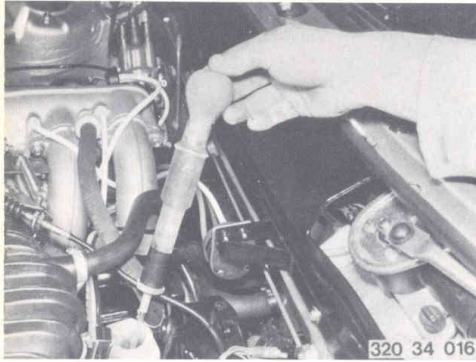
*Warning:* brake pads must normally be run in for the first 600 km (app. 400 miles). Avoid emergency brake applications from high speeds if at all possible.

If this precaution is neglected, the brake pads will fail to achieve their most favorable wear rates and friction characteristics.



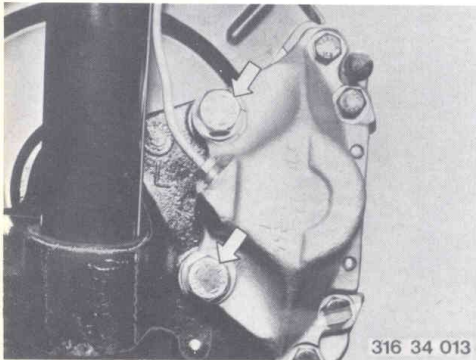
316 34 011





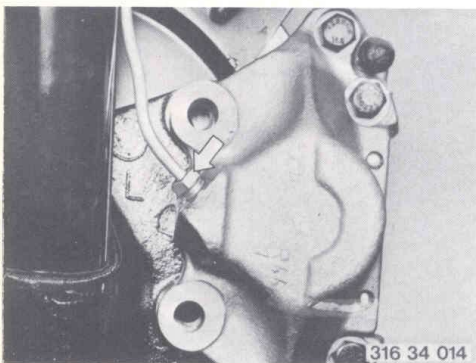
### 34 11 020 Brake caliper – removing and installing

Remove and install front wheel – 36 10 300. Extract brake fluid from the reservoir with a siphon, which should only be allowed to come into contact with brake fluid.



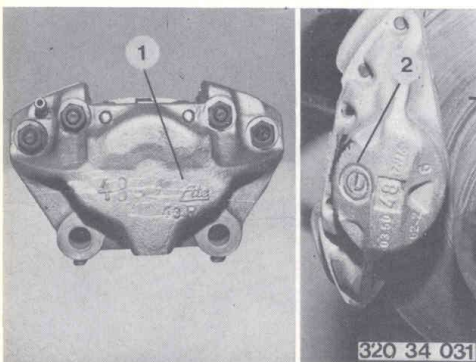
Remove the retaining bolts.

*When installing:* Note correct tightening torque<sup>1)</sup>.



Detach the brake pipe.

*When installing:* Bleed the brakes – 34 00 046. Note correct tightening torque<sup>1)</sup>.



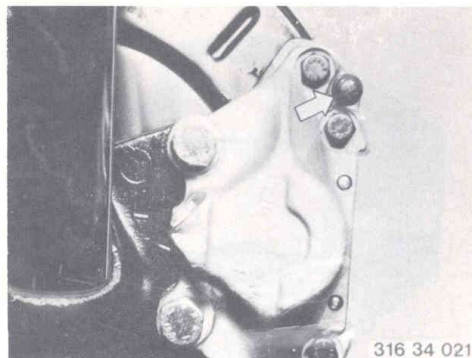
**Warning:** note correct make of caliper when installing:

- 1) Ate caliper
- 2) Girling caliper

Use only calipers of the same make on any axle.

<sup>1)</sup> See specifications

*When installing: do not confuse left and right calipers. The bleed valves are always on top.*



316 34 021

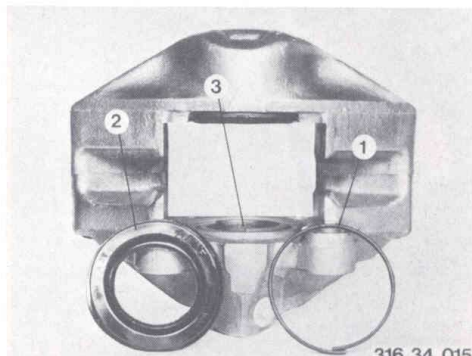
**34 11 072 Front brake caliper – reconditioning – Use repair pack –**

**Remove and install front brake pads – 34 11 000.**

**Remove and install front brake caliper – 34 11 020.**

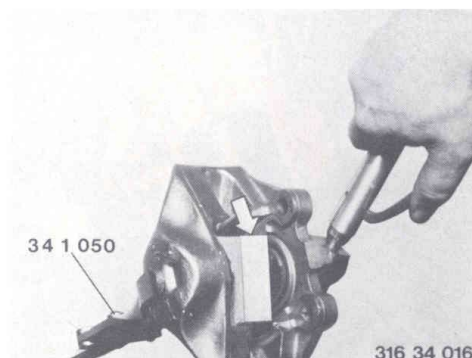
**Detach clamp ring (1) and rubber dust cap (2) from piston (3).**

*When installing: Coat the inside of rubber cap (2) with brake cylinder paste.*



316 34 015

**Hold one piston with piston resetting tongs 34 1 050. To protect the piston, insert a hardwood or compressed fiber pad approx. 8 mm (0.32 in.) thick into the caliper opening. Press out the piston by applying compressed air to the connecting union.**

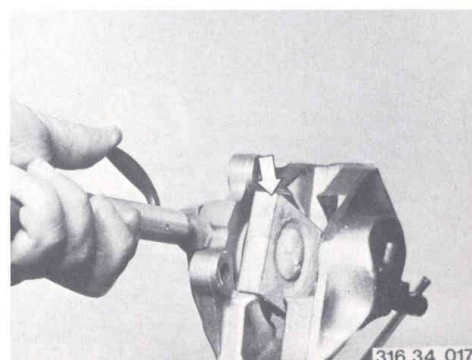


34 1 050

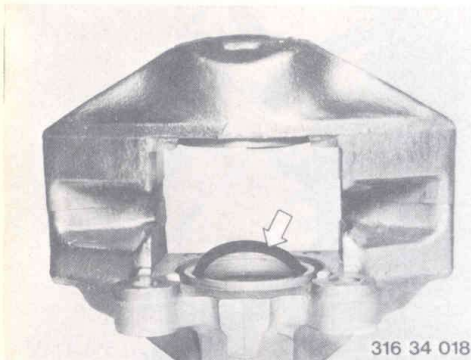
316 34 016

**Plug the empty piston bore with a sealing plate and press the second piston out of the caliper. Protect the piston with a suitable pad inserted into the caliper opening. The sealing plate and clamp ring can be made up in your own workshop.**

**Warning: Compressed air 10 atmg (140 lb./in<sup>2</sup>) will develop a force of approx. 1250 N (275 lb.f).**



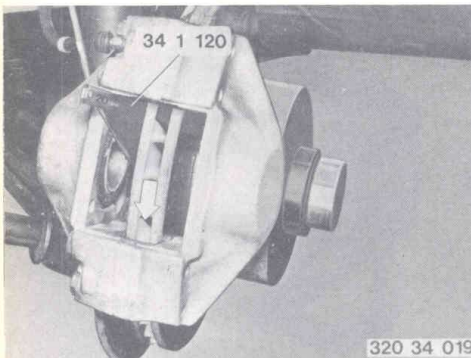
316 34 017



Carefully remove the sealing ring with a plastic needle. Clean the cylinder bores and other components, and dry with compressed air. Inspect the cylinder bores and pistons carefully for signs of damage.

It is not permitted to remove metal from the cylinder or piston by machining.

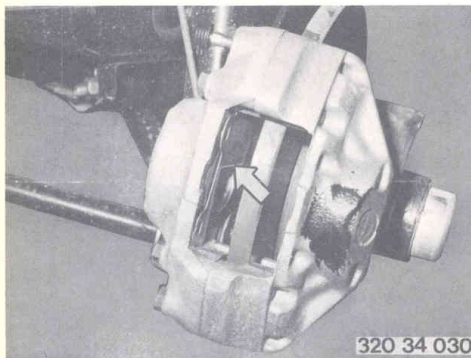
*When installing:* coat all components lightly with brake cylinder assembly paste, and install. Do not tilt the pistons.



Before installing the brake pads:

A) Ate fixed caliper:

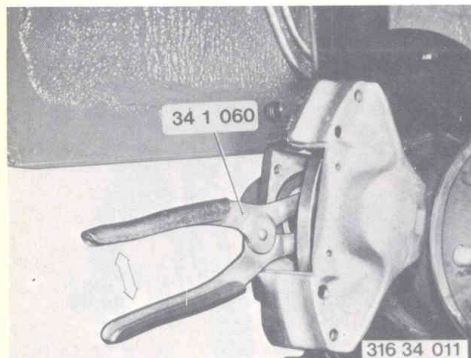
Check 20° piston setting with piston gauge 34 1 120. The 20° cutaway on the piston must face the incoming side of the brake disc.



B) Girling fixed caliper:

Adjust the steps on the pistons so that the shield plates are against the milled cutaways on the pistons.

If necessary, use the shield plates as a setting gauge.



Correct piston position with piston rotating pliers 34 1 060.

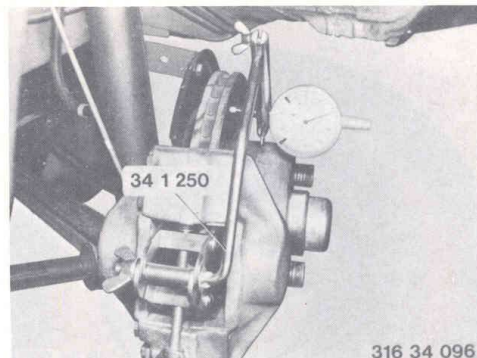


**34 11 199 Both front brake discs – checking for runout and thickness variation**

Before checking, wheel bearing play must be correct.

Remove and install front brake pads – 34 11 000.

Secure brake disc with 2 M 12×1.5 mm bolts. Attach dial gauge holder 34 1 250 and measure lateral brake disc runout<sup>1)</sup> with dial gauge.



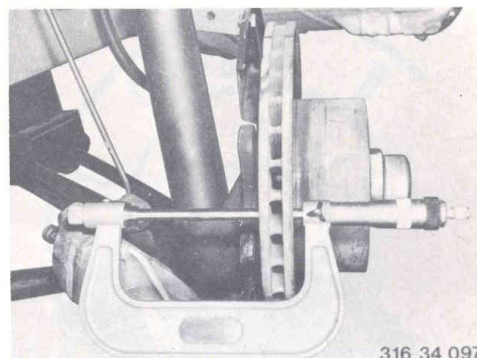
316 34 096

Detach angle from spring-damper unit.

Detach and attach brake caliper.

*Important:* brake line remains attached.

Measure thickness<sup>1)</sup> variation at approx. 8 points within the rubbed area with a micrometer.



316 34 097

**34 11 200 Front brake disc – removing and installing**

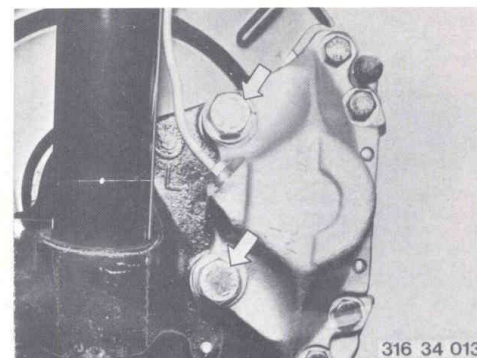
Remove and install front wheel – 36 10 300.

Detach angle from spring-damper strut.

Detach brake caliper and tie up.

The brake line remains attached.

When installing: note correct tightening torque<sup>1)</sup>.



316 34 013

Remove bolt and take off brake disc.

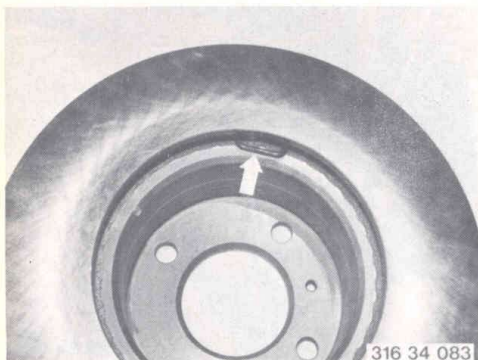
When installing: note correct tightening torque<sup>1)</sup>.

*Warning:* when a brake disc has to be renewed, always install a new brake disc on the other side of the same axle.



316 34 094

<sup>1)</sup> See specifications



**Warning:** ventilated brake discs have balance-weight clips. Never remove or reposition these clips.



### **34 11 250 Front shield plate – removing and installing**

Remove and install wheel hub – 31 21 100.

Remove bolts and take off shield plate.

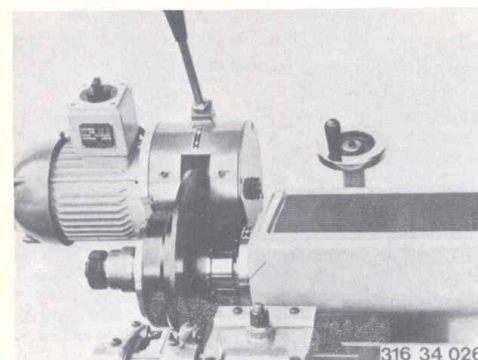
*When installing:* note correct tightening torque<sup>1)</sup>.



### **Ventilated brake discs:**

Unscrew and remove the shield plate.

*When installing:* note correct tightening torque<sup>1)</sup>. When renewing, make sure that shield plates with vent slots are installed.



### **34 11 667 Front brake discs – regrinding flat – brake discs removed –**

**Warning:** always grind both brake discs for any axle at the same time, on both sides.

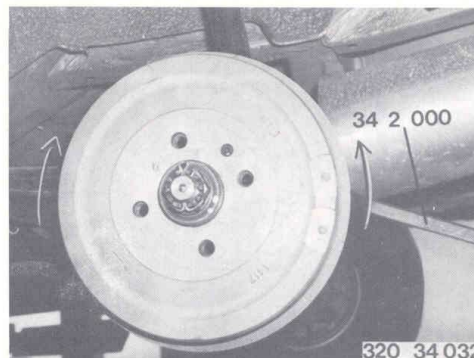
Note minimum specified thickness<sup>1)</sup>.

*When installing:* both brake discs on the axle must always be renewed at the same time.

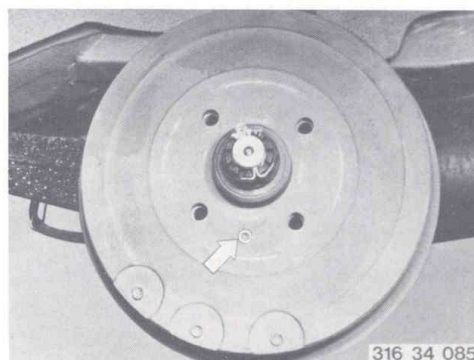
<sup>1)</sup> See specifications

### 34 21 000 Brake drum – detaching and attaching

Remove and install rear wheel – 36 10 320.  
If the brake drums are severely scored, slacken the brake shoe adjusting cam with 34 2 000 wrench and loosen the handbrake cables.  
When installing: Adjust handbrake – 34 10 014.

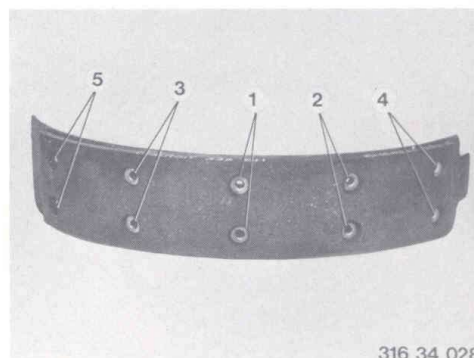


Loosen bolt and take off brake drum.  
When installing: Check brake drum for ovality<sup>1)</sup>, score marks and cracks (sound test).



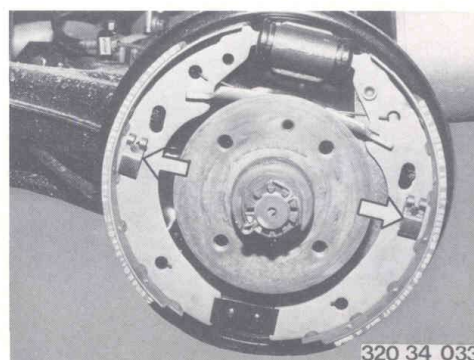
### 34 21 039 Rear brakes – relining

Detach and attach brake shoes – 34 21 040.  
Drill out or otherwise remove rivets and remove old brake linings.  
When installing: The lining must be correctly seated on the brake shoe and must not overlap at the sides.  
Insert rivets in the sequence 1 to 5.  
Always reline all four brake shoes at the same time using linings of the same make<sup>1)</sup>. Adjust handbrake – 34 10 014.



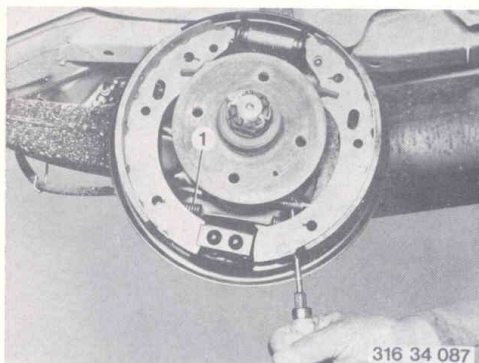
### 34 21 040 Brake shoes – detaching and attaching

Remove and install brake drum – 34 21 000.  
Detach holding-down springs.



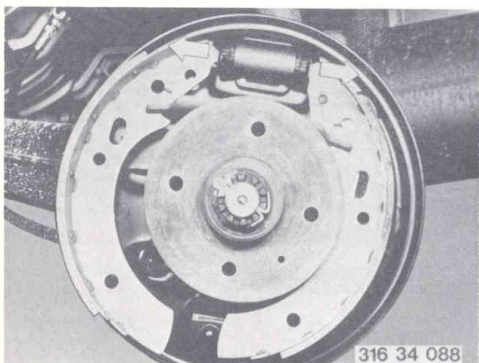
<sup>1)</sup> See specifications



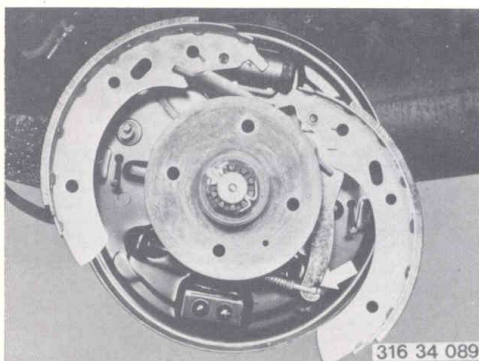


**Disconnect brake shoes and lower return spring (1).**

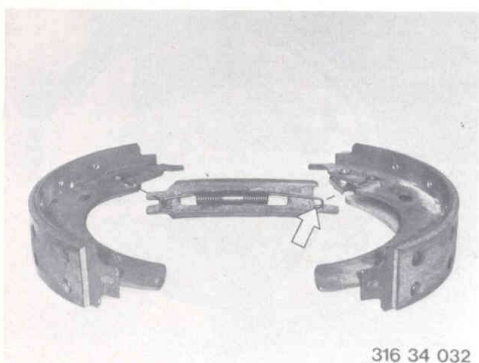
*When installing:* Note correct installed position of return spring. Check condition of return spring and renew if necessary.



**Pull the brake shoes out of the wheel brake cylinder.**



**Disconnect the handbrake cable.  
Take off the brake shoes.**



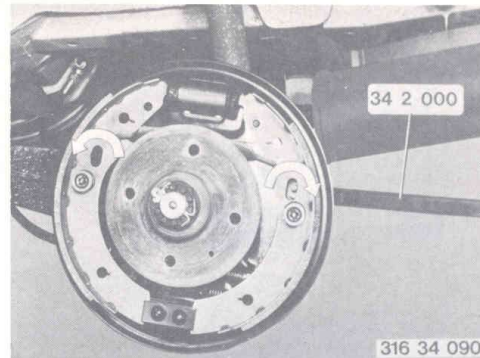
*When installing:* The longer end of the spring should be attached between the handbrake lever and the brake shoe. Note minimum lining thickness<sup>1)</sup>.

**Check condition of spring and renew if necessary.**

316 34 032 1) See specifications

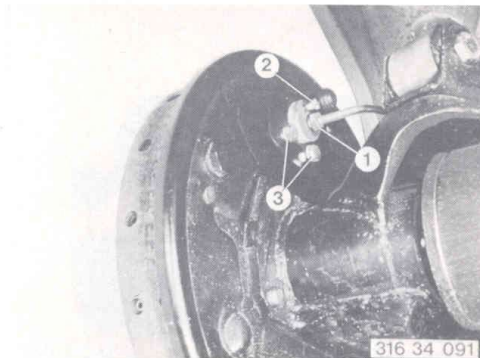
### 34 21 070 Wheel brake cylinder – removing and installing

Remove and install brake drum – 34 21 000.  
Using special tool 34 2 000, turn brake shoes until at the outermost limit of travel.



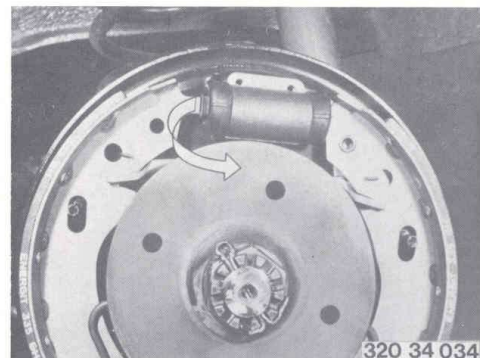
Detach brake pipe (1), bleed valve (2) and bolts (3) from wheel brake cylinder.

When installing: Note correct tightening torque<sup>1)</sup>.



Press the wheel brake cylinder to the right and pull out forwards at the same time.

When installing: Bleed the brakes – 34 00 046.  
When renewing the wheel brake cylinder, make sure that the correct diameter ) is installed.



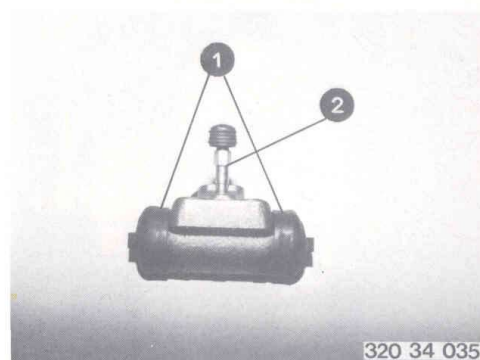
### 34 21 102 Wheel brake cylinder – reconditioning

Remove and install the wheel brake cylinder – 34 21 070.

Note: Use a repair pack.

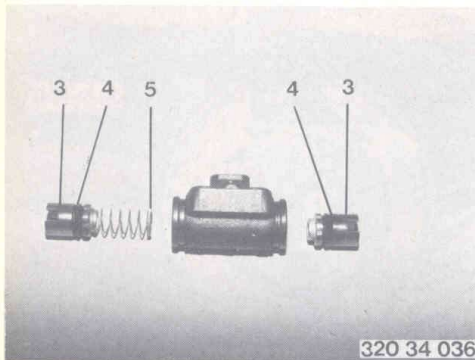
Strip the wheel brake cylinder.

Note dust caps (1) and bleed valve (2).

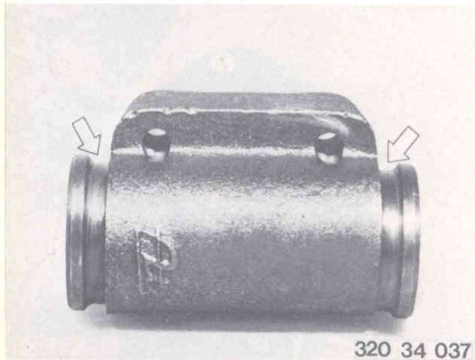


1) See specifications

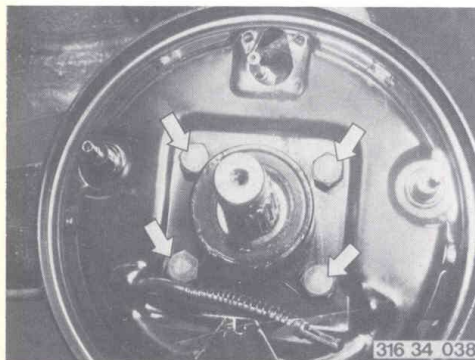




**Note piston (3), sleeves (4) and coil spring (5).**  
*When installing:* Always use new sleeves.  
 To simplify assembly and provide protection against corrosion, apply an extremely thin layer of brake cylinder paste to all parts.



**Warning:** The grooves and bore of the wheel brake cylinder must be free from rust and undamaged.



#### 34 21 171 Rear brake backplate – renewing

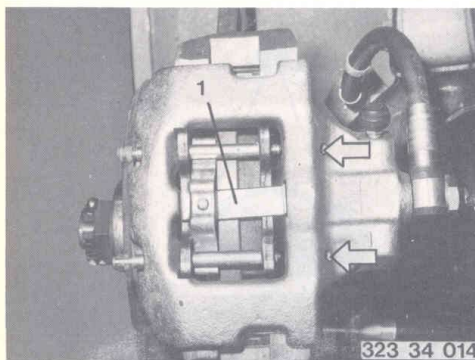
Remove and install brake shoes – 34 21 040.  
 Remove and install wheel brake cylinder – 34 21 600.

Detach and attach drive flange – 33 41 000.  
 Remove bolts and take off brake backplate.  
 Pull handbrake cable out of backplate.

*When installing:* Note correct tightening torque<sup>1)</sup>.

Adjust handbrake – 34 00 014.

Bleed brakes – 34 00 46.



#### 34 21 200 Rear brake pads – removing and installing

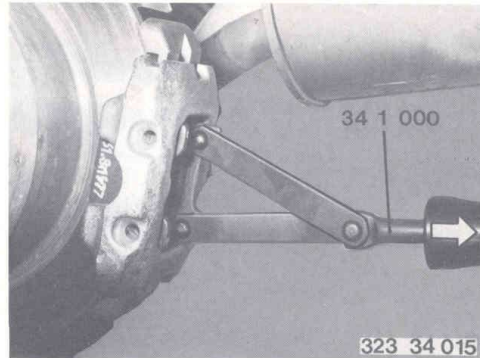
Remove and install rear wheels – 36 10 340.  
 Drive out pins and take off retaining spring (1).

*When installing:* check condition of pins and retaining spring (1) and renew if necessary.

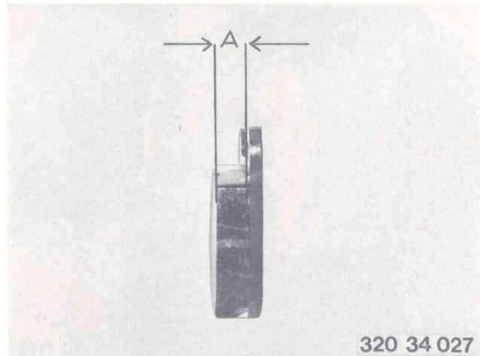
<sup>1)</sup> See specifications

Pull out or drive out brake pads with 34 1 000 extractor.

**Warning:** brake pads which have already worn into a definite pattern must be marked and installed in the same positions. Do not interchange pads if wear is one-sided.

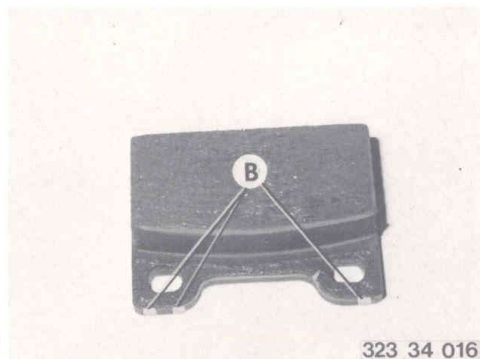


*When installing:* note minimum thickness A<sup>1)</sup>.

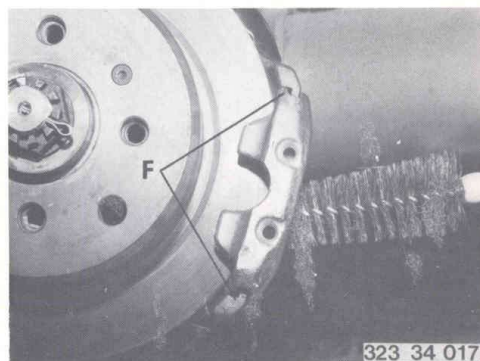


**When renewing:**

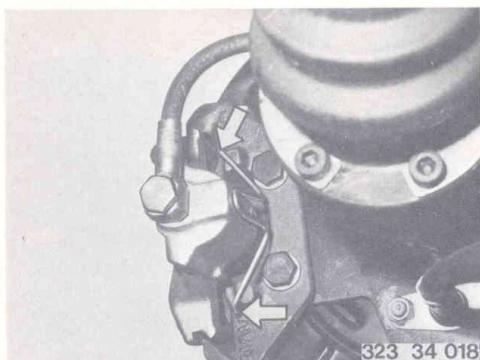
**Important:** always renew all brake pads at the same time on both wheels of any axle. Note correct color code B<sup>1)</sup> and make<sup>1)</sup>.



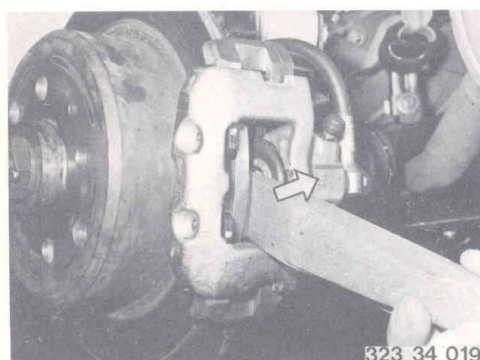
Clean the guide faces (F) and seat in the housing shaft with a cylindrical brush. Never use a solvent containing mineral oil. The caliper and the brake pads must move freely.



<sup>1)</sup> See specifications



The guide spring must be pushed fully in.  
Check spring and renew if necessary.



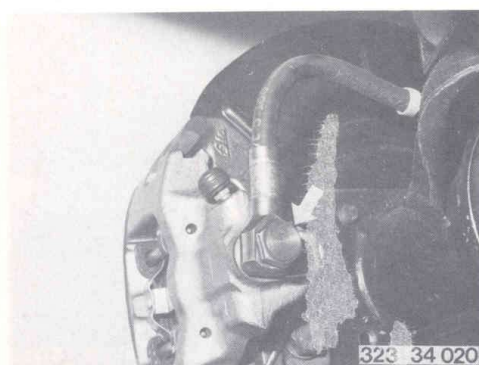
Install the outer brake pad.  
Press the piston back into the caliper with a  
hardwood wedge. Install the second brake  
pad.

*When installing:* operate the brake pedal sev-  
eral times so that the brake pads are pressed  
firmly against the disc.

Restore brake fluid level in the reservoir to the  
maximum mark.

*Important:* brake pads must be run in normally  
for up to 600 km (app. 400 miles). Avoid  
emergency brake applications from high  
speeds.

If this precaution is neglected, the brake pads  
will fail to achieve their optimum wear rates  
and friction characteristics.



#### 34 21 220 Rear brake caliper – removing and installing

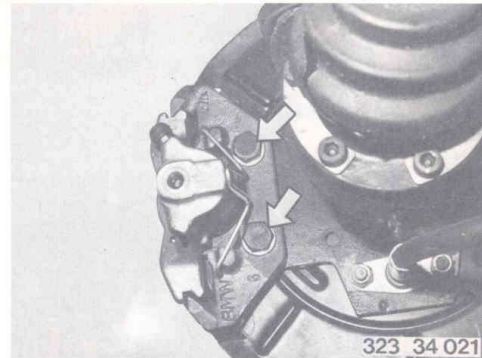
Remove and install rear wheel – 36 10 300.  
Disconnect and plug brake hose.

*When installing:* use new sealing rings.  
Note correct tightening torque<sup>1)</sup>.

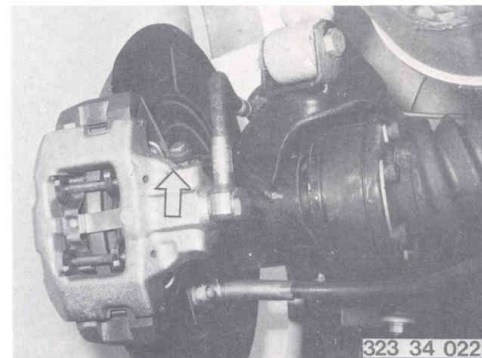
<sup>1)</sup> See specifications



Unscrew bolts and take off brake caliper.  
When installing: note correct tightening torque<sup>1)</sup>.  
Bleed brakes – 34 00 046.



When installing: the bleed valve must face upwards.

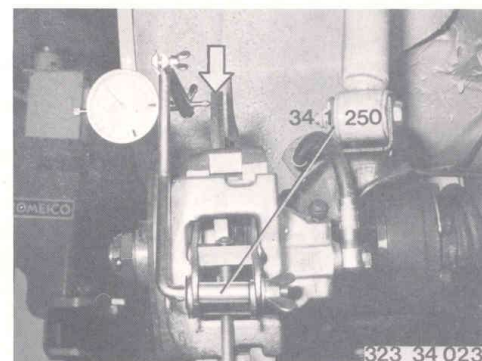


**34 21 299 Both rear brake disc – checking for runout and thickness variation**

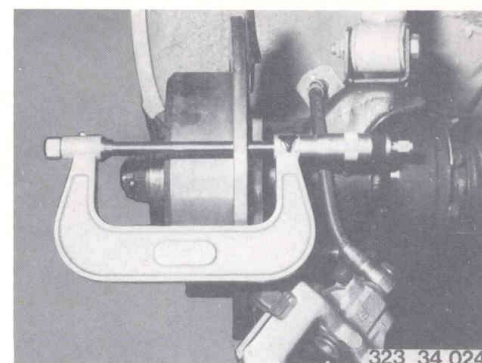
Wheel bearing play must first be to specification.

Remove and install rear brake pads – 34 21 200.

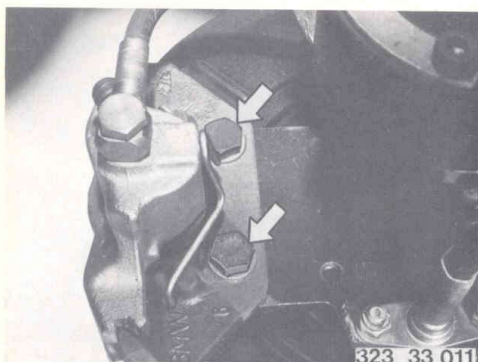
Secure brake disc with 2 M 12 × 1.5 mm bolts. Attach dial gauge holder 34 1 250 and measure brake disc lateral runout<sup>1)</sup> with dial gauge.



Detach and attach caliper. The brake line remains attached. Measure variation in thickness of brake disc within rubbed area at approx. 8 points with a micrometer.



<sup>1)</sup> See specifications



### **34 21 300 Rear brake disc – removing and installing**

Remove and install rear wheel – 36 10 300. Detach caliper. The brake line remains attached.

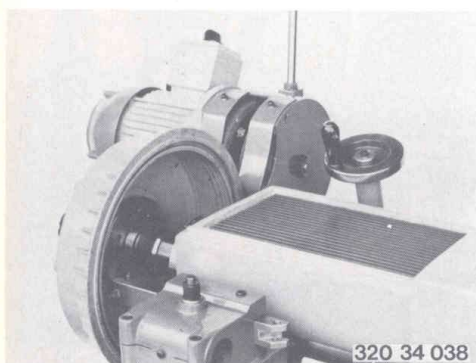
*When installing: note correct tightening torque<sup>1)</sup>.*



Remove the Allen screw and take off the brake disc.

*When installing: note correct tightening torque<sup>1)</sup>.*

*Important: when a brake disc has to be replaced, always renew the two brake discs on the axle at the same time.*



### **34 21 509 Brake drums – turning out – brake drum removed –**

Remachining is permitted, but both brake drums must be machined at the same time. Note oversize stages<sup>1)</sup> and maximum ovality<sup>1)</sup>. Adjust the handbrake – 34 10 014.

<sup>1)</sup> See specifications



### 3431 000 Tandem brake master cylinder – removing and installing

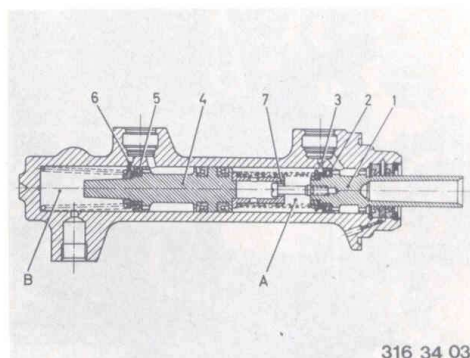
#### *Operating principle:*

When the brake pedal is pressed down, pistons (1) and (4) are moved forward. Primary sleeves (2) and (5) pass over the compensating passages (3) and (6). The same pressure is then present in chambers A and B.

Chamber A acts on the rear brakes.

Chamber B acts on the front brakes.

If one brake circuit should fail, pedal travel will be greatly increased. If brake circuit 2 fails, pressure builds up in chamber A so that piston (1) presses piston (4) in pressureless chamber B against the housing of the tandem master cylinder and enables the first brake circuit to operate. If circuit 1 fails, piston (1) in pressureless chamber A is pressed against spring cap (7) and the second circuit is fully operative via chamber B.



316 34 039

Draw off brake fluid from reservoir with a siphon. Detach the hose for the clutch operating mechanism.

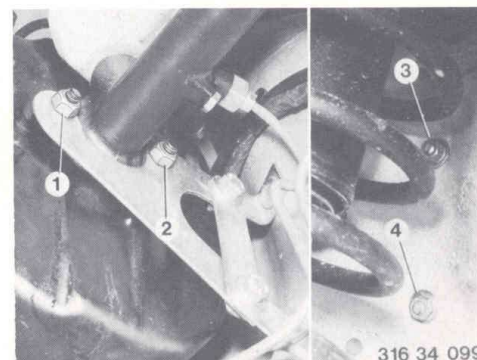
323i only: remove and install complete mixture regulator – 13 51 010.



320 34 016

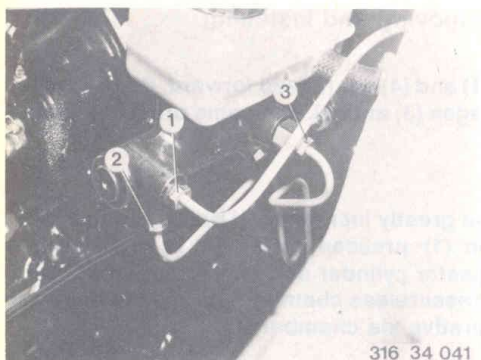
Detach nuts (1) and (2) holding tandem master cylinder to brake booster servo. Remove nuts (3) and (4) from support plate in wheel arch. Take off support plate:

When installing: note correct tightening torque<sup>1)</sup>.



316 34 099

<sup>1)</sup> See specifications



Detach the brake lines.

1 front right

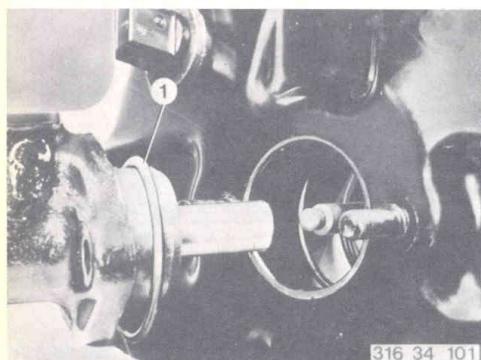
2nd brake circuit

2 front left

3 rear wheel brakes 1st brake circuit

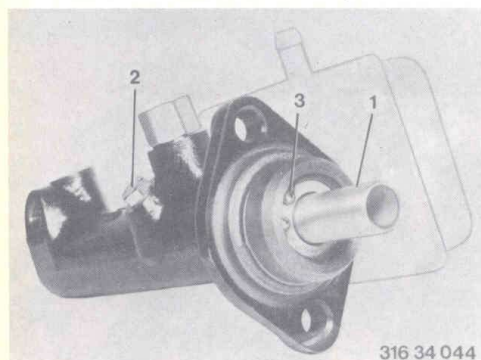
When installing: note correct tightening torque<sup>1)</sup>.

Bleed the brakes – 34 00 046.



When installing: check rubber ring (1).

Vacuum will not build up fully if the rubber ring does not make a perfect seal.



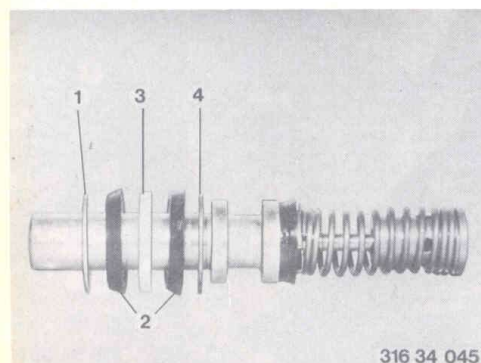
### 34 31 012 Tandem brake master cylinder – reconditioning

Note: use repair pack.

Remove and install the tandem master cylinder – 34 31 000.

Apply light pressure to piston (1) and unscrew stop bolt (2). Extract Seeger circlip (3) and pull out piston (1).

When installing: use a new copper sealing washer. Apply silicone grease to the piston shaft.

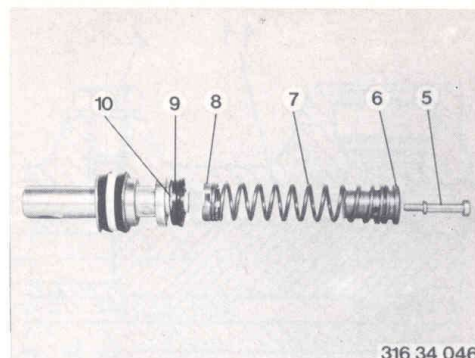


Installation sequence: install the bearing ring (1), secondary sleeves (2), intermediate ring (3) and bearing (4). Install secondary sleeves (2) facing in the same direction.

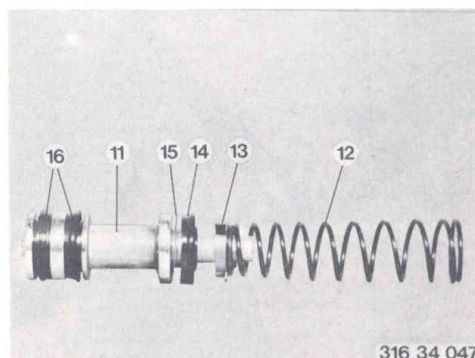
Pack the space between the secondary sleeves (2) and the intermediate ring (3) with silicone grease.

<sup>1)</sup> See specifications

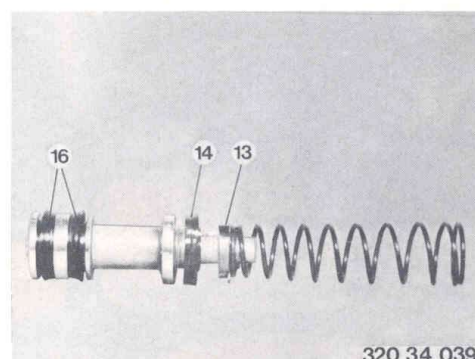
To renew primary sleeve (9), remove the connecting bolt (5). Pull off spring cup (6), spring (7), support ring (8), primary sleeve (9) and packing washer (10). When installing: make sure that the support ring (8) makes good contact against the primary sleeve (9).



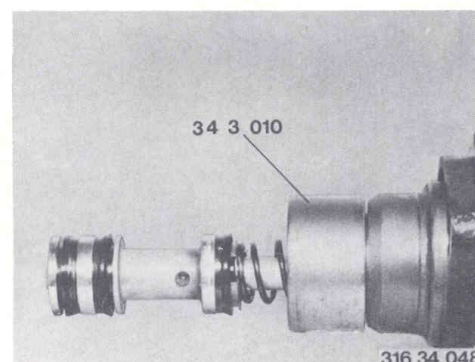
Drive out intermediate piston (11) by striking the housing lightly on a wooden underlay. Pull off spring (12), support ring (13), primary sleeve (14) and packing washer (15). Extract separating sleeves (16).



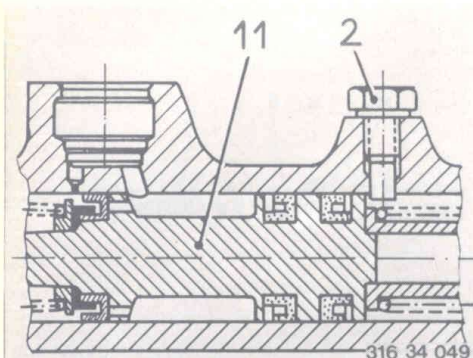
When installing: the separating sleeves (16) in the repair pack are marked with a colored ring. Install the separating sleeves (16) so that the two lips face in opposite directions. Note support ring (13): it must make good contact against the primary sleeve (14).



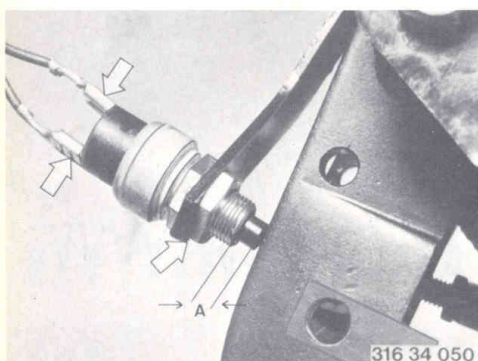
Clean all components. Do not re-use tandem master cylinder if there is any surface damage in the cylinder bore. Apply an extremely thin layer of 'Ate' brake cylinder paste to new components. To prevent damage to the sleeves, install the piston with tool 34 3 010.







**Warning:** note correct installed position of intermediate piston (11) and stop bolt (2).



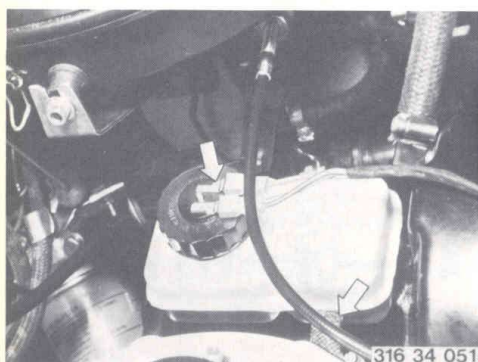
### 34 31 111 Stop light switch – renewing

Detach and attach the lower left facia trim 51 45 180.

Pull off the leads.

Unscrew the nut and remove the stop light switch.

*When installing:* Note correct tightening torque<sup>1)</sup>. Install the stop light switch with 5 to 6 mm (0.20 to 0.24 in) of the contact button (A) visible.



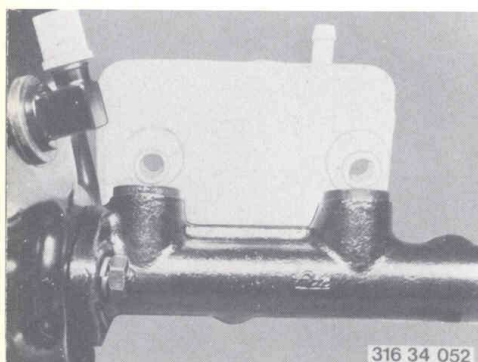
### 34 31 181 Brake fluid reservoir – renewing

Pull off the lead for the brake fluid telltale lamp.

Unscrew the cover.

Siphon off the brake fluid from the reservoir.

Detach the clutch mechanism supply hose.



Tilt the reservoir to one side and remove.

*When installing:* Press in the brake fluid reservoir until it is firmly seated.

Check correct installation.

Add brake fluid<sup>1)</sup>.

**Warning:** Do not operate brake pedal, or air will penetrate the brake system.

<sup>1)</sup> See specifications

**34 32 381 Front brake hose – renewing**

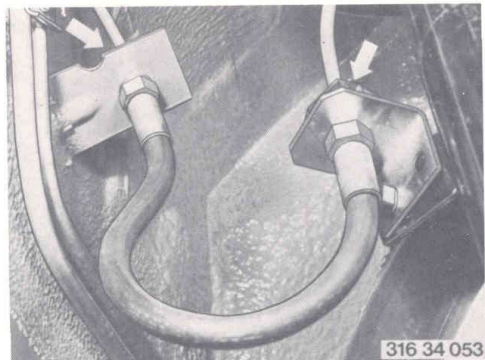
Siphon off brake fluid from reservoir.

Detach brake hose.

*When installing:* Note correct tightening torque<sup>1)</sup>.

Never twist brake hose during assembly.

Bleed brakes – 34 00 046.



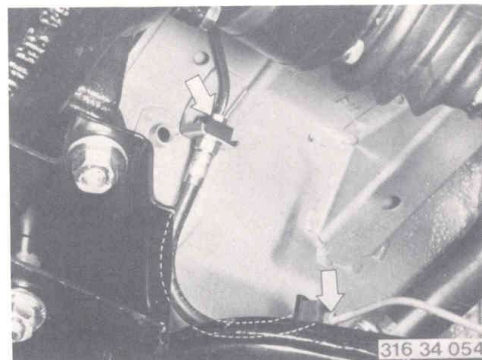
**34 32 451 Rear brake hose – renewing**

Draw off brake fluid at reservoir. Detach brake hose.

*When installing:* Note correct tightening torque<sup>1)</sup>.

Never twist brake hose during assembly.

Bleed brakes – 34 00 046.

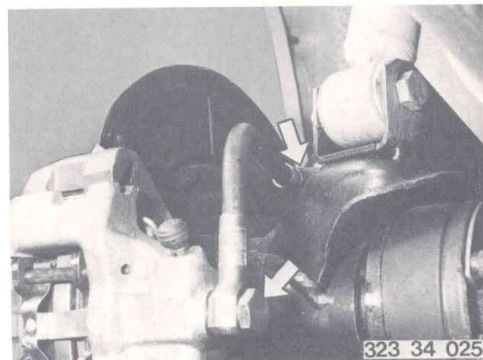


**321i only: detach brake hose.**

*When installing:* use new sealing rings.

Note correct tightening torque<sup>1)</sup>.

Bleed brakes – 34 00 046.



<sup>1)</sup> See specifications



### 34 33 000 Brake booster servo with tandem master cylinder – removing and installing

#### Checking operation:

With the engine stopped, depress the brake pedal 10 times. Keep the pressure applied to the brake pedal and start the engine. If the pedal drops, the system is in good working order. If the pedal does not drop, the check valve, vacuum hose or rubber ring between master cylinder and brake booster may be defective.

The engine may be developing too little vacuum (manifold depression) or the filter insert may be completely blocked.

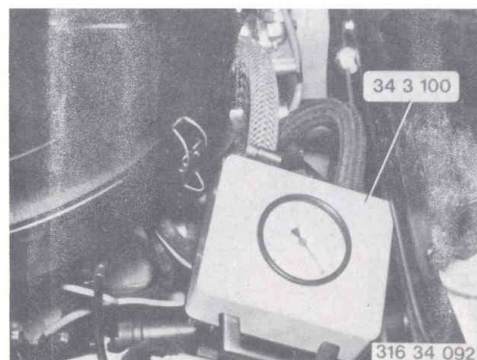
#### Checking engine vacuum (manifold depression) for brake booster:

Detach the vacuum hose at the check valve and install vacuum tester 34 3 100 between the brake booster and the check valve. Measure vacuum developed when accelerator is released at the engine speed of  $3000 \text{ min}^{-1}$  (engine at normal operating temperature).

Minimum value:  $-0.65 \text{ bar}$  vacuum (gauge).

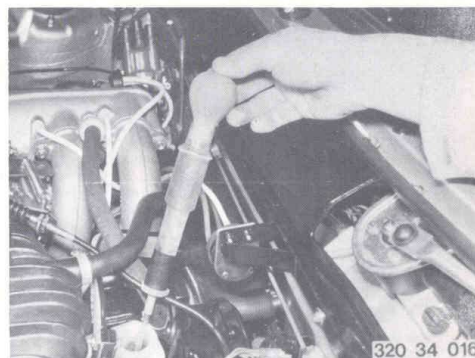
Repeat the measurement several times.

Minimum value at specified engine idling speed, with engine at normal operating temperature:  $-40 \text{ bar}$  (gauge).



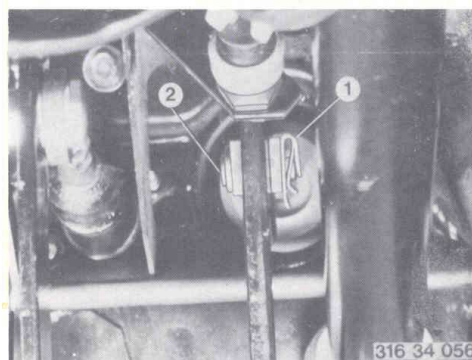
Draw off the brake fluid from the reservoir with a siphon.

On 323i only: remove and install complete mixture regulator – 13 51 010.

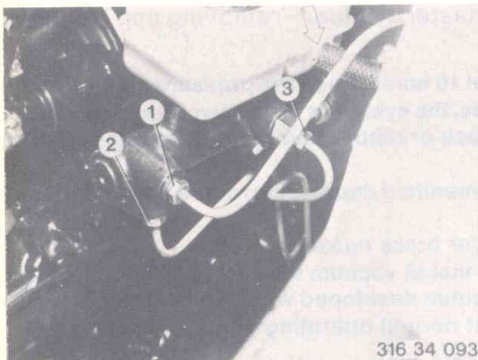


Extract bayonet clip (1) and remove pin (2) at piston rod.

When installing:  $5 \dots 6 \text{ mm}$  ( $0.20 \dots 0.24 \text{ in}$ ) of the contact knob for the brake light switch must be visible at A<sup>2</sup>.



<sup>2</sup>) see 'Brake light switch – renewing', 34 31 111



**Detach the brake lines.**

**1 = front right**

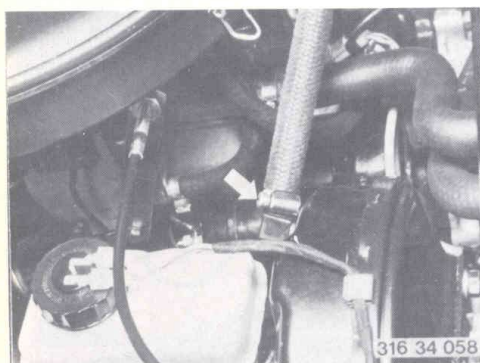
**2 = front left**

**3 = rear wheel brakes**

**Pull off hose for clutch.**

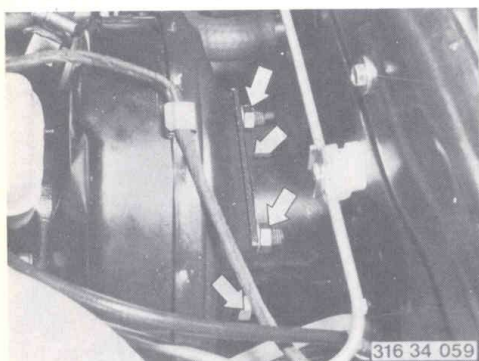
*When installing: note correct tightening torque<sup>1)</sup>.*

**Bleed the brakes – 34 0046.**



**Detach vacuum hose from brake booster.**

*When installing: renew clip for hose if necessary.*



**Unscrew brake booster from mount.**

*When installing: note correct tightening torque<sup>1)</sup>.*

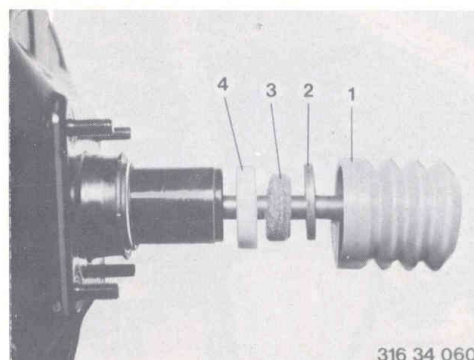


**Detach support plate from inside wheel arch.  
Pull brake booster with tandem master cylinder out forwards.**

<sup>1)</sup> See specifications

If the filter element in the brake unit is blocked with dirt, remove cap (1), holder (2), muffler (3) and filter (4).

When installing: clean muffler (3) and filter (4).



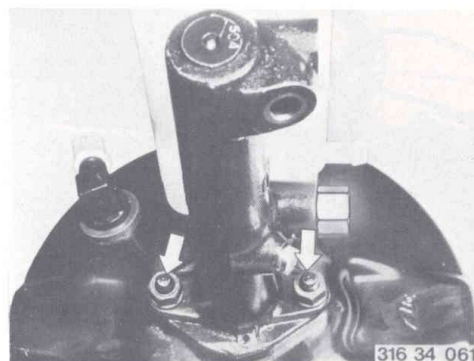
#### 34 33 001 Brake unit – renewing

Remove and install brake unit with tandem master cylinder – 34 33 000.

Separate the tandem master cylinder from the brake unit.

When installing: Note correct tightening torque<sup>1)</sup>.

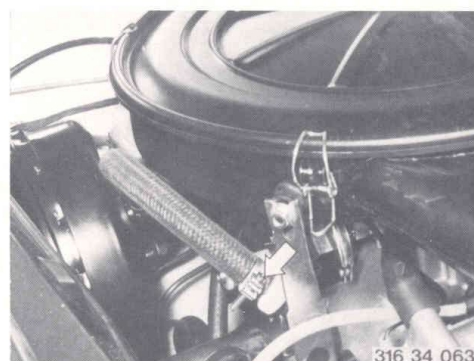
Check condition of rubber ring between brake master cylinder and brake unit, renew if necessary.



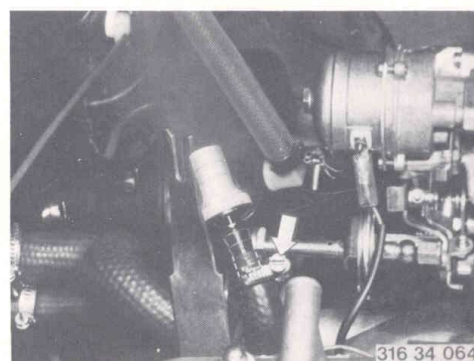
#### 34 33 051 Brake unit check valve – renewing

Detach vacuum hose at check valve.

When installing: renew hose clip.

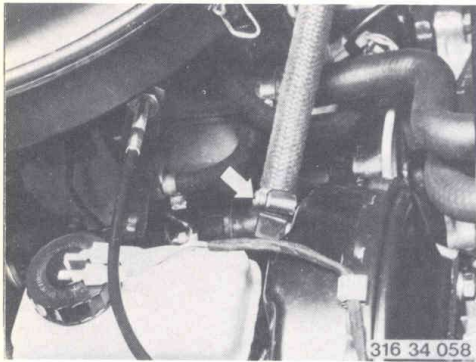


Release clip and take off check valve.  
Installed position: The arrow or the black side faces the intake manifold. Use a new clip.



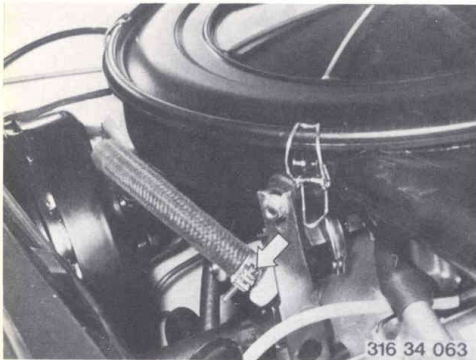
<sup>1)</sup> See specifications





**34 33 071 Brake unit vacuum hose – renewing**

**Detach the vacuum hose at the brake unit.**  
*When installing: renew clip.*



**Detach the vacuum hose at the check valve.**  
*When installing: renew clip.*

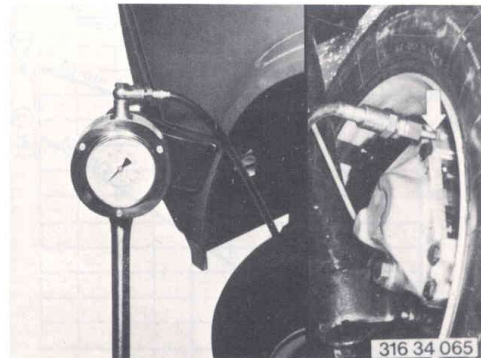


### 34 34 099 Brake force limiter – checking operation

**BMW 320 only – operating principle:**

During a brake application, the hydraulic pressure in circuit 2 reaches the front brakes in full, but the pressure in circuit 1 (rear axle) is reduced by a preset amount in the brake force limiter. If brake circuit 2 (front axle) should fail, a check piston comes into action to ensure that the full hydraulic pressure can then reach circuit 1, and the brake force limiter is rendered ineffective.

**Connect a high pressure gauge to the front wheel brake bleed union.**

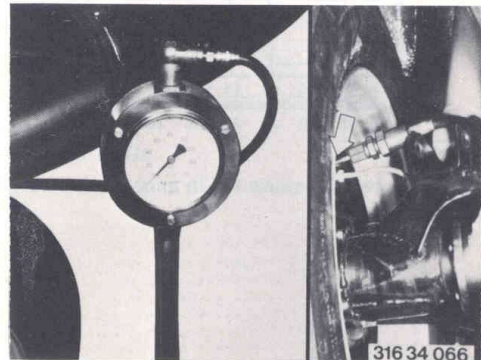


**Remove the spring-damper strut retaining bolt at the semi-trailing arm.**

**Connect a second high pressure gauge to the rear wheel brake bleed union.**

**Bleed the high pressure gauges.**

*When installing: note correct tightening torque<sup>1)</sup>.*



<sup>1)</sup> See specifications

Depress the brake pedal firmly at least 5 times. Hold the pedal down with a pedal prop. Up to a pressure of 25 bar (355 lb/in<sup>2</sup>) both high pressure gauges must show the same reading. Above 25 bar the pressure at the rear wheel brake cylinder must drop as shown in the graph.

$P_{VA}$  = front axle pressure

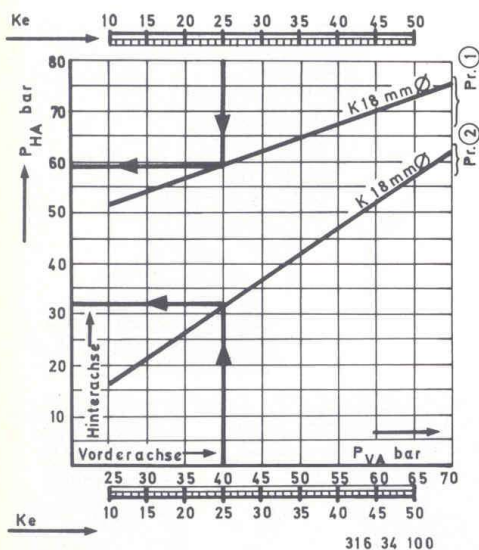
$K_e$  = coefficient  $K$  = piston dia.

Note coefficient<sup>1</sup> (and piston<sup>1</sup>).

$P_{HA}$  = rear axle pressure

$P_r$  = test

1 Test pressure  $P_{VA}$  100 bar (1422 lb/in<sup>2</sup>)



2 Select a test pressure  $P_{VA}$  in accordance with the coefficient.

Example 1

Coefficient 25

Piston dia. 18 mm (0.71 in)

Test pressure  $P_{VA}$  100 bar (1422 lb/in<sup>2</sup>)

Test pressure  $P_{HA}$  59 ± 3 bar (839 ± 43 lb/in<sup>2</sup>)

Example 2

Coefficient 25

Piston dia. 18 mm (0.71 in)

Test pressure  $P_{VA}$  40 bar (569 lb/in<sup>2</sup>)

Test pressure  $P_{HA}$  32 ± 2 bar (455 ± 28 lb/in<sup>2</sup>)

If necessary, determine the mean value from three measurements.

If the measured values deviate from the specified values, renew the brake force limiter.

1) See specifications

34-34/2

See specifications

34-34/2

### 34 34 100 Brake force limiter – removing and installing

**BMW 320 only:**

Draw off the brake fluid and detach lines (1... 4).

1 = Input, front brake

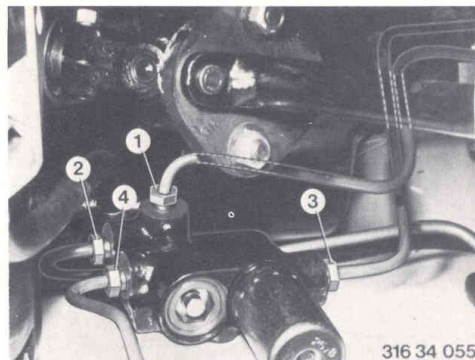
2 = Output, front brake

3 = Input, rear brake

4 = Output, rear brake

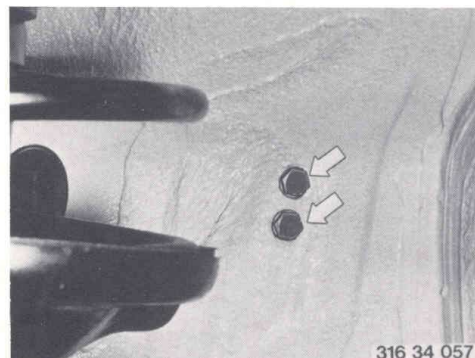
When installing: note correct tightening torque<sup>1)</sup>.

Bleed the brakes – 34 00 046.



Remove bolts from front left wheel arch.

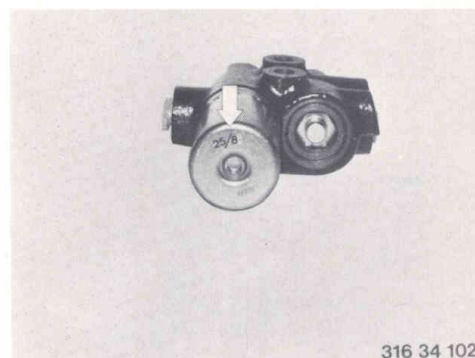
When installing: note correct tightening torque<sup>1)</sup>.



When renewing the brake force limiter, note correct coefficient<sup>1)</sup> and piston diameter<sup>1)</sup>.

25 = Coefficient

8 = Piston dia. 18 mm (0.71 in)



<sup>1)</sup> See specifications

### 34 41 000 Handbrake lever – removing and installing

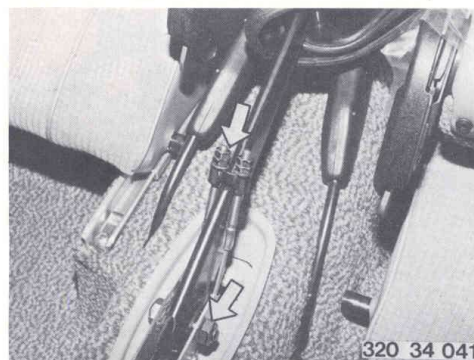
Push off the rubber cap.

Detach the handbrake cables.

Loosen the nut and pull out the bolt.

When installing: Note correct tightening torque<sup>1)</sup>.

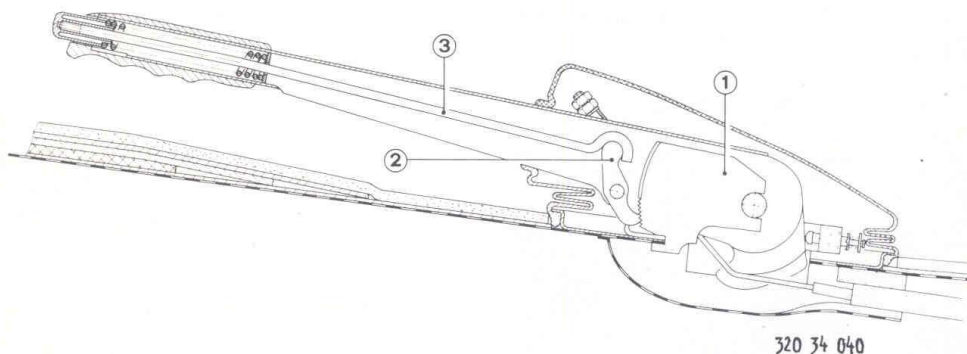
Adjust handbrake – 34 10 014.



### 34 41 011 Ratchet sector – renewing

Remove and install the handbrake lever – 34 41 000.

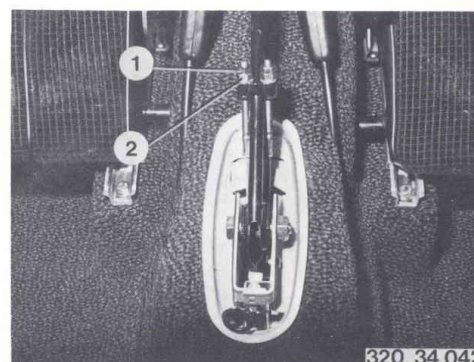
Warning: Note correct installed position of sector (1), pawl (2) and thrust rod (3).



### 34 41 100 Handbrake cable – removing and installing

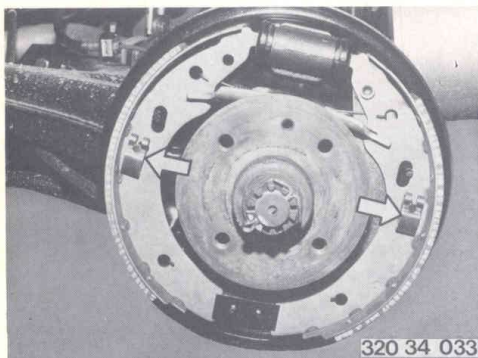
Push the rubber cap away from the handbrake lever.

Loosen lock nut (1) and nut (2) on handbrake cable.

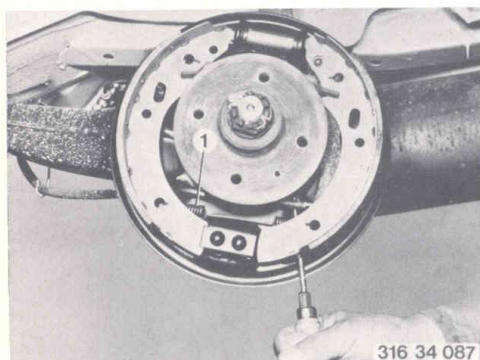


<sup>1)</sup> See specifications

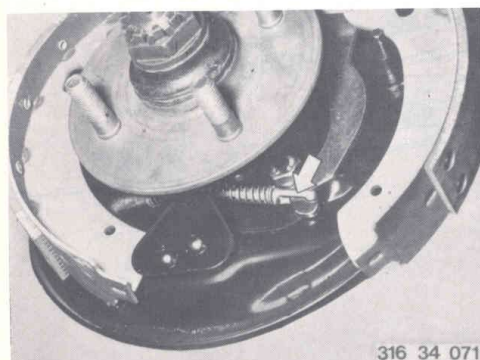




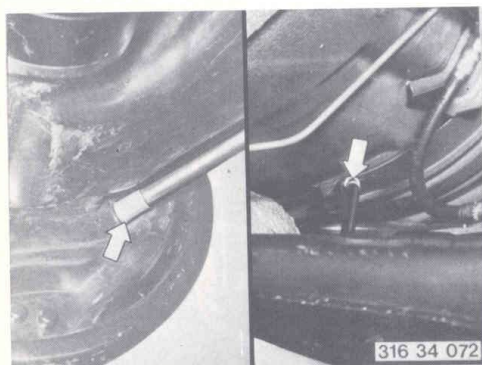
**A) Drum brake:**  
 Detach (attach) brake drum – 34 21 000.  
 Detach and hold-down springs.



**Detach brake shoes and spring (1).**  
*When installing: check condition of brake shoe spring and renew if necessary.*



**Disconnect the handbrake cable.**



**Pull the handbrake cable out of the reaction strut.**  
*When installing: Make sure that both handbrake cable reaction struts are located inside the protective tube and the brake backplate. Adjust the handbrake – 34 10 014.*

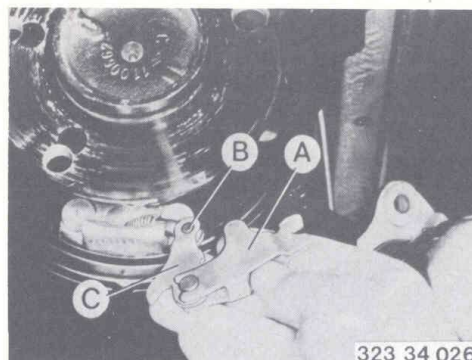
**B) Disc brake:**  
Remove and install the handbrake shoes – 34 41 200.

A – pull out to right.

Press out pin B.

C – pull to left.

*When installing:* apply a thin coat of Molykote G paste to the sliding faces and the pin.

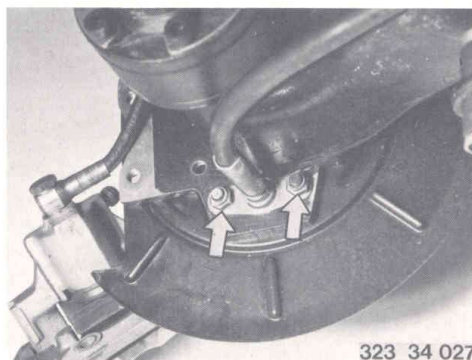


Detach the handbrake cable support.

Pull out the handbrake cable.

*When installing:* note correct tightening torque<sup>1)</sup>.

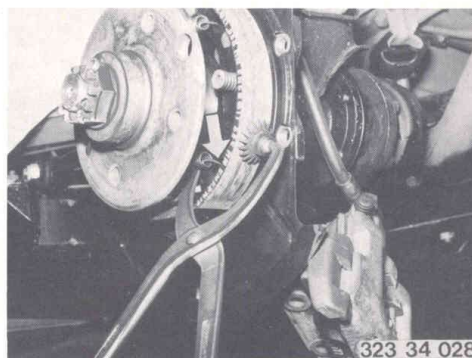
Adjust handbrake – 34 10 014.



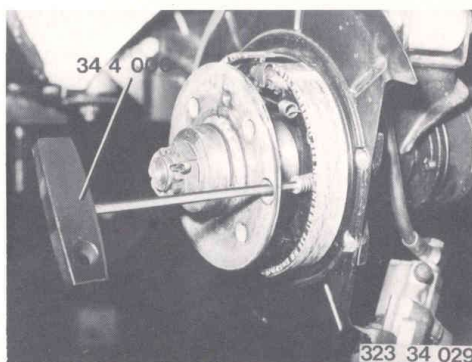
**34 21 200 Handbrake shoes – removing and installing**

Remove and install rear brake disc – 34 21 300. Disconnect lower return spring, using brake spring pliers.

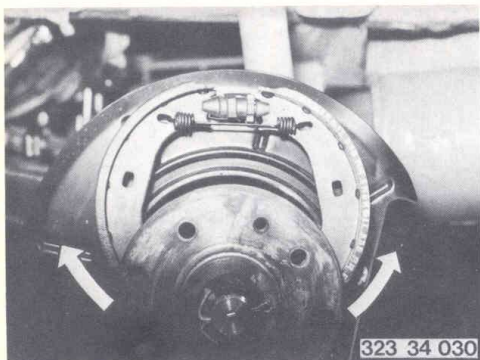
*When installing:* check condition of return spring and renew if necessary.



Turn retaining spring through 90° with wrench 34 4 000, and disconnect.



<sup>1)</sup> See specifications



**Pull the handbrake cables apart at the bottom end and remove upwards.**

***When installing: check adjusting nut for free movement and renew if necessary.***

### Trouble-shooting – brakes

Fault	Cause
Brakes pull to one side	<ul style="list-style-type: none"> <li>a) Incorrect tire pressures</li> <li>b) Unevenly worn tires</li> <li>c) Oil on linings</li> <li>d) Incorrect lining material</li> <li>e) Dirt in caliper shafts</li> <li>f) Rear axle out of alignment</li> <li>g) Corrosion in brake calipers or wheel cylinders</li> <li>h) Dampers (shock absorbers) not working effectively</li> <li>j) Outer edge of brake lining touching radius of brake drum</li> <li>k) Brake shoes distorted – poor lining contact pattern</li> <li>l) Brake drum runout</li> <li>m) Brake shoes not in contact with brake carrier plate</li> <li>n) One caliper has worn brake pads</li> <li>o) Lining material glazed over</li> <li>p) 20 ° setting of piston step incorrect</li> </ul>
Brakes overheat seriously when car is in motion	<ul style="list-style-type: none"> <li>a) Blocked compensating bore in master cylinder</li> <li>b) No play between thrust rod and master cylinder piston</li> <li>c) Use of incorrect brake fluid has caused rubber components to swell</li> <li>d) Blocked vent hole in reservoir</li> <li>e) Incorrect wheel bearing play</li> <li>f) Corroded brake calipers</li> <li>g) Broken spreader spring</li> <li>h) Handbrake not fully released</li> </ul>



### Trouble-shooting – brakes, continued

Fault	Cause
Poor braking action despite high pedal pressure brake pedal travel – normal – short – long	a) Brake linings oiled up or singed; lining type not to specification b) Brake booster not working – engine not producing sufficient vacuum c) One brake circuit has failed – leakage or damage
Brake pedal is soft and springy, and can be depressed fully	a) Air in brake circuit b) Too little fluid in reservoir – as a) c) Brake fluid overheated – boiling has caused vapor to form in brake fluid if its moisture content was too high or brakes were used very hard d) Automatic pad wear compensation not operating correctly
Brake is bled and correctly adjusted, but pedal can still be depressed too far	a) Damaged primary sleeve in master cylinder b) Leaking separating sleeves on floating piston of tandem master cylinder c) Leak in brake system
Uneven pad wear	a) Brake pad type not to specification b) Dirt in caliper shafts, protective caps damaged c) Corrosion on caliper or in wheel cylinders d) Rubber ring for piston adjustment has swollen e) 20° setting of step in piston not correctly located

### Trouble-shooting – brakes, continued

Fault	Cause
Brake pads worn at an angle	<ul style="list-style-type: none"> <li>a) Cross-spring not exerting sufficient pressure</li> <li>b) Wheel bearing play excessive</li> <li>c) Brake disc not aligned with caliper mount</li> <li>d) Corrosion in caliper or wheel brake cylinders</li> <li>e) Brake disc worn at an angle</li> <li>f) Brake pads below minimum thickness</li> <li>g) 20° setting of step in piston is incorrect</li> </ul>
Brake pads binding, sticking to disc	<ul style="list-style-type: none"> <li>a) Dirt in caliper shafts, damaged protective caps</li> <li>b) Cross-spring pressure inadequate</li> <li>c) Corrosion in caliper or wheel brake cylinders</li> <li>d) Blocked compensating bore in master cylinder</li> </ul>
Brakes squeak or chatter	<ul style="list-style-type: none"> <li>a) Lining material not to specification</li> <li>b) Dirt in fixed caliper shafts</li> <li>c) Cross-spring pressure inadequate</li> <li>d) Brake disc not aligned with caliper mount</li> <li>e) Brake disc runout</li> <li>f) Excessive thickness variation inside rubbed area</li> <li>g) Brake drums out of round</li> <li>h) Brake drum runout</li> <li>i) Dirt and dust in brake drums</li> <li>j) Ends of linings not chamfered away sufficiently</li> <li>k) Loose lining rivets</li> <li>l) Lining loose on shoe</li> <li>m) Rust rim on brake discs</li> <li>n) 20° setting of piston step is incorrect</li> </ul>

### Trouble-shooting – brakes, continued

Fault	Cause
Brakes tend to lock or chatter	<ul style="list-style-type: none"> <li>a) Lining ends not chamfered away</li> <li>b) Projecting lining rivets</li> <li>c) Brake drum runout</li> <li>d) Brake shoe return spring too weak</li> </ul>
Excessive free travel at brake pedal	<ul style="list-style-type: none"> <li>a) Excessive wheel bearing play</li> <li>b) Brake disc not aligned with caliper mount</li> <li>c) Brake disc runout</li> <li>d) Excessive thickness variation within rubbed area</li> <li>e) Brake system leaking</li> <li>f) Air in brake system</li> <li>g) Brake shoes not adjusted to take up wear</li> </ul>
Piston seized in caliper	<ul style="list-style-type: none"> <li>a) Dirt in caliper shaft, protective caps damaged</li> <li>b) Brake disc not aligned with caliper mount</li> <li>c) Piston corroded in caliper or wheel brake cylinder</li> <li>d) Rubber ring for piston adjustment is swollen</li> </ul>
Pulsating effect at brake pedal	<ul style="list-style-type: none"> <li>a) Wheel bearing play too large</li> <li>b) Brake disc not aligned with caliper mount</li> <li>c) Brake disc runout</li> <li>d) Excessive thickness variation at rubbed area of disc</li> <li>e) Brake drum out of round</li> </ul>
Inadequate handbrake action	<ul style="list-style-type: none"> <li>a) Oil on brake linings</li> <li>b) Excessive clearance between brake shoes and drum</li> <li>c) Excessive slack in cables</li> <li>d) Cables incorrectly adjusted</li> <li>e) Corroded linkage</li> </ul>