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Brake – Hydraulic Components, Regulator, Booster

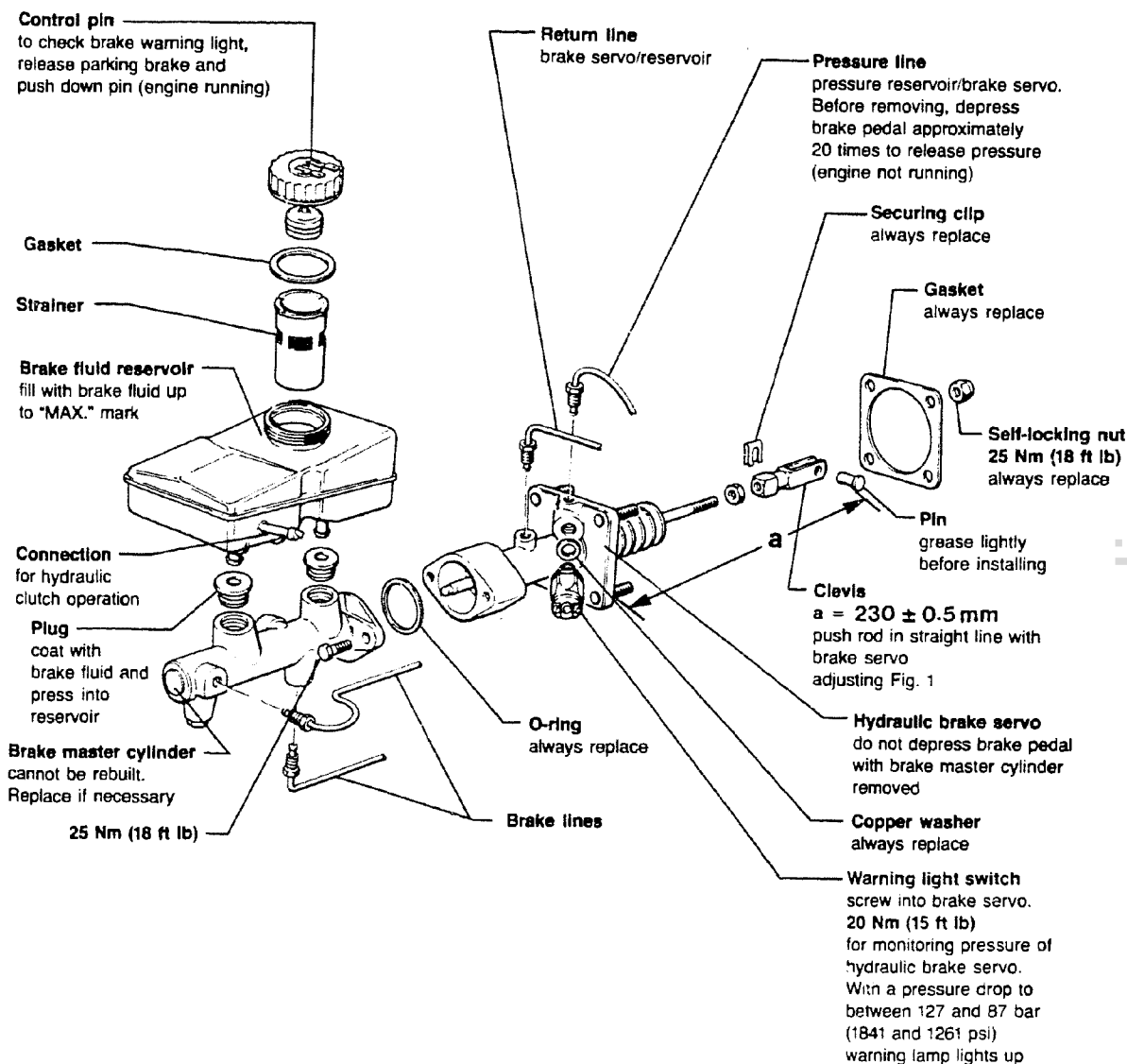
WARNING

Brake fluid is poisonous.

CAUTION

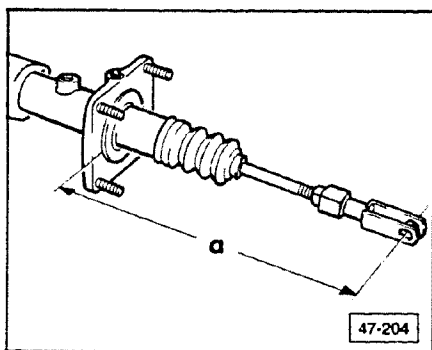
Brake master cylinder cannot be repaired; replace complete unit if necessary. "ATE" and "GIRLING" manufactured cylinders are interchangeable.

Brake fluid is corrosive to painted parts.



47-467

Brake – Hydraulic Components, Regulator, Booster



► Fig. 1 Clevis, adjusting

- $a = 230.0 \pm 0.5 \text{ mm}$

Note

Brake servo, Part No. 443 612 099 C, is now supplied with or without clevis. When replacing brake servo, transfer clevis from old brake servo to new servo and adjust to above measurement

When measuring, clevis and push rod must always be aligned with brake servo.

Brake pressure regulator, checking

Note

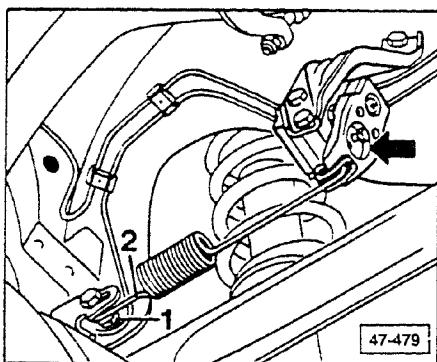
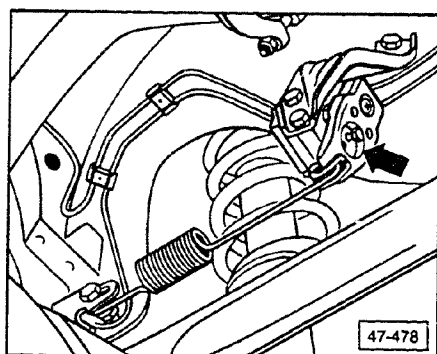
Brake pressure regulator is mounted on body (left rear) and operated by spring attached to rear axle.

- depress brake pedal once firmly (car must be on ground)
- release pedal suddenly and check that lever (arrow) on pressure regulator moves

Note

Brake system must be filled with fluid and free of air (properly bled).

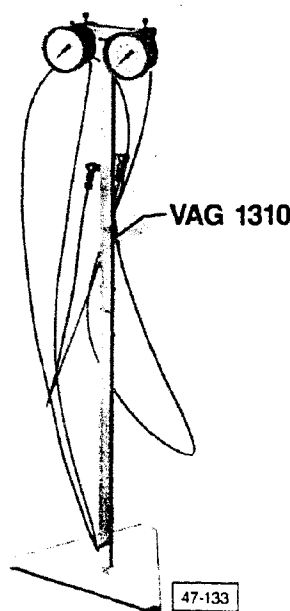
- lift vehicle off ground so that load is taken off rear axle
- press lever of brake pressure regulator toward rear
- loosen nut 1
- attach spring 2 without play and without tension to plastic roller
- tighten nut to 25 Nm (18 ft lb)



Brake system, checking for leaks

- connect gauge US 1016 to left front brake caliper and right rear wheel brake caliper
- depress brake pedal until front axle pressure gauge reads 100 bar (1450 psi), hold for 5 seconds
 - rear pressure reading must not vary more than 10 bar (145 psi) within 5 seconds
 - if results cannot be obtained replace brake pressure regulator
- remove pressure gauges
- bleed brakes

Brake – Hydraulic Components, Regulator, Booster



Brake pressure regulator, adjusting

Work sequence

- car must be empty
- car must be on wheels (Bosch ramp)
- fuel tank full
- remove bleeder screw and connect adaptor to left front wheel brake caliper and right rear wheel brake cylinder
- connect gauge
- bleed both hoses and gauges with bleeder valve on gauges
- have person (approximately 165 lbs) sit on driver's seat
- bounce car several times at rear
- depress brake pedal firmly several times
- depress brake pedal until gauge on front axle reads 50 bar (725 psi)
 - gauge for rear axle cylinder must read 32.5-42.5 bar (471-616 psi)
- increase brake pedal pressure until gauge on front axle reads 100 bar (1450 psi)
 - gauge for rear axle cylinder must read 54.0-71.5 bar (783-1037 psi)
- if pressure at rear axle is too high, release spring tension by loosening and moving bolt
- if pressure is too low, tighten spring tension

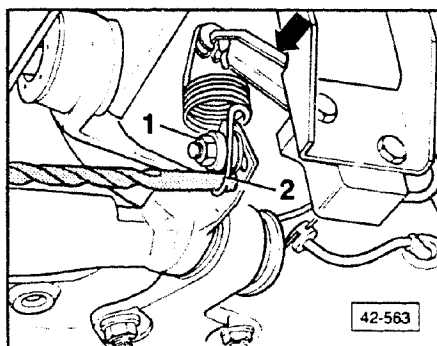
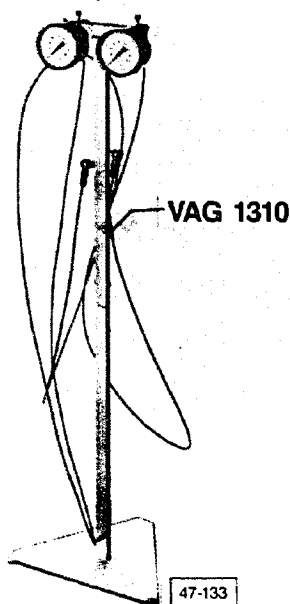
CAUTION

Do not adjust pressure regulator with brake pedal depressed.

Use following test sequence:

- take pressure readings
- release brake pedal
- adjust spring
- depress pedal again
- take pressure readings
- if pressure cannot be adjusted replace regulator
- disconnect pressure gauges and bleed brakes

Brake – Hydraulic Components, Regulator, Booster



Brake pressure regulator, adjusting

- car must be empty
 - car must be on wheels (Bosch ramp)
 - fuel tank full
 - remove bleeder screw and connect adaptor to left front wheel brake caliper and right rear wheel brake cylinder
 - connect gauge (use adapter **VAG 1310/4**)
 - bleed both hoses and gauges with bleeder valve on gauges
 - have person (approximately 165 lbs) sit on driver's seat
 - bounce car several times at rear
 - push brake pedal firmly several times
 - lift vehicle off ground so load is taken off rear axle
 - push brake pressure regulator-lever down until stop
 - loosen nut (1)
 - insert 10 mm diameter drill bit between spring (2) and plastic roller
 - tighten nut **25 Nm (18 ft lb)**
 - repeat pressure test (vehicle on ground)
 - push brake pedal until gauge on front axle reads 50 bar (725 psi)
 - gauge for rear axle cylinder must read **35.0-45.0 bar (507.5-652.5 psi)**
 - increase brake pedal pressure until gauge on front axle reads 100 bar (1450 psi)
 - gauge for rear axle cylinder must read **57.0-73.0 bar (826.5-1058.5 psi)**
- If pressure at rear axle **too low**
- increase brake regulator spring tension
- If pressure at rear axle **too high**
- reduce brake regulator spring tension
- If brake pressure readings cannot be obtained
- replace brake pressure regulator

Brake – Hydraulic Components, Regulator, Booster

CAUTION

Brake fluid must not come into contact with paintwork.

Brake fluid absorbs moisture from air and must be replaced every 2 years.

Only use new unused **DOT 4** brake fluid according to MOTOR VEHICLE SAFETY STANDARD 116. Do not add or mix **DOT 5** silicone type brake fluid with the brake fluid in car, as severe component corrosion may result. Such corrosion could lead to brake system failure.

Brake system, bleeding

Note

To bleed brake system, use bottle with transparent hose attached so that brake fluid can be checked for air bubbles. Do not re-use fluid removed from reservoir. Water and other contaminants in fluid can cause brake performance problems.

After removing and installing brake master cylinder, clutch slave cylinder must be bled before bleeding brake.

Bleeding sequence

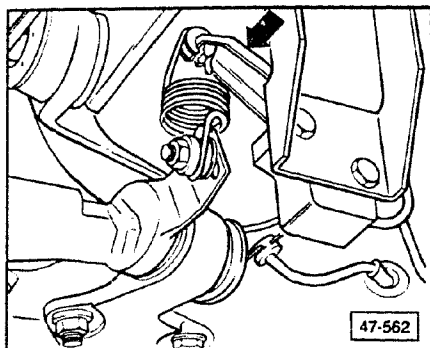
1. Right rear caliper
2. Left rear caliper
3. Right front caliper
4. Left front caliper

- after bleeding, fill reservoir to maximum mark

Brake fluid, changing

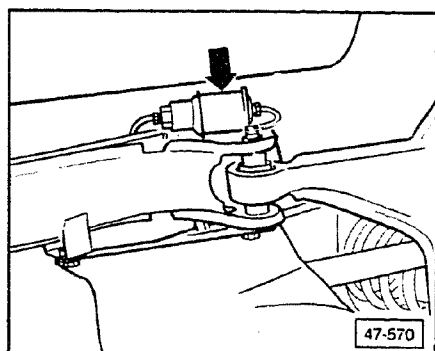
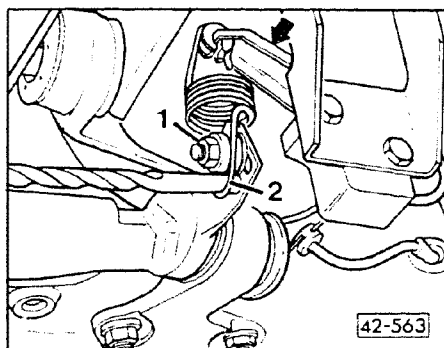
Brake caliper sequence	Brake fluid volume (amount that must be removed)
1. Right rear	500 cm ³
2. Left rear	500 cm ³
3. Right front	500 cm ³
4. Left front	500 cm ³

Brake – Hydraulic Components, Regulator, Booster



CAUTION

Do not adjust pressure regulator with brake pedal depressed



Brake pressure regulator, checking (also see page 47.6)

Note

Brake pressure regulator is mounted on body (left rear) and is operated by a spring attached to the left side of rear axle arm.

- push brake pedal once firmly (car must be on ground)
- release pedal suddenly and check that lever (**arrow**) on pressure regulator moves

Note

Brake system must be filled with fluid and free of air (properly bled).

Brake pressure regulator, adjusting

- lift vehicle off ground so load is taken off rear axle
- push brake pressure regulator lever down until stop
- loosen nut 1
- insert 7 mm diameter drill bit between spring 2 and plastic roller
- tighten nut to 25.0 Nm (18.0 lb ft)

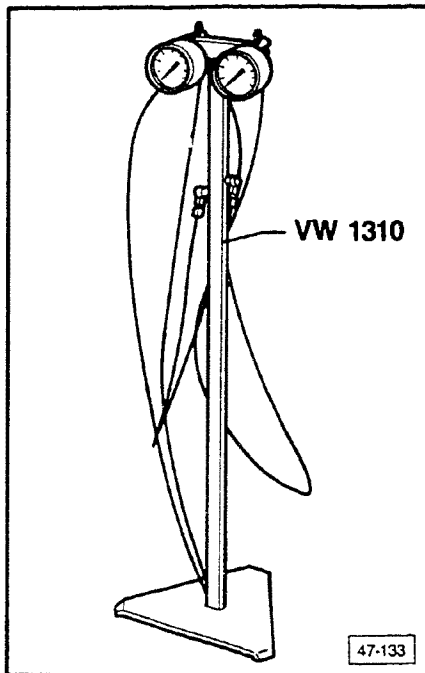
Note

A revised brake pressure regulator was gradually introduced in production. Adjustment of the new regulator is the same as for the earlier version except a 9.0 mm drill bit must be used between the spring and plastic roller.

Note

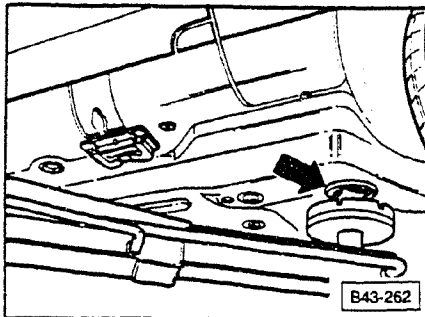
Brake pressure limiting valve (**arrow**) is sensitive to vehicle deceleration and prevents rear wheels from locking during cornering.

Brake – Hydraulic Components, Regulator, Booster

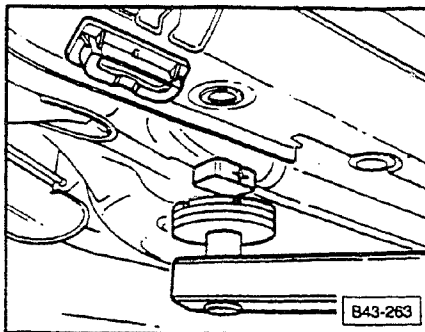


Brake pressure regulator, checking

- remove bleeder screws from rear brake calipers
- connect gauge (use adapter VW 1310/4)
- bleed both hoses and gauges with bleeder valve on gauges
- have person (approximately 165 lbs) sit on driver's seat
- apply parking brake



Lift point, front



Lift point, rear

- raise right side of vehicle 350 mm to 450 mm (measured at wheel house opening)
- push brake pedal until left rear gauge shows approximately **40 bar (580.0 psi)**
- check pressure on right rear gauge **20.0 ± 5.0 bar (290.0 ± 72.5 psi)**

If pressure readings are not as specified

- replace brake pressure regulator
- remove gauge
- install bleeder screws
- bleed brakes

Brake — Hydraulic Components, Regulator, Booster

CAUTION

To bleed brake system, use bottle with transparent hose attached so that brake fluid can be checked for air bubbles. Do not re-use fluid removed from reservoir. Water and other contaminants in fluid can cause brake performance problems.

After removing and installing brake master cylinder, clutch slave cylinder must be bled before bleeding brake.

CAUTION

Brake fluid must not come into contact with paintwork.

Brake fluid absorbs moisture from air and must be replaced every 2 years.

Only use new unused **DOT 4** brake fluid according to **MOTOR VEHICLE SAFETY STANDARD 116**. Do not add or mix **DOT 5** silicone type brake fluid with the brake fluid in car, as severe component corrosion may result. Such corrosion could lead to brake system failure.

Brake system, bleeding

Equipment

- brake filling and bleeding tool **US 1116**
- connect **US 1116**
- open and close bleed valves in prescribed sequence

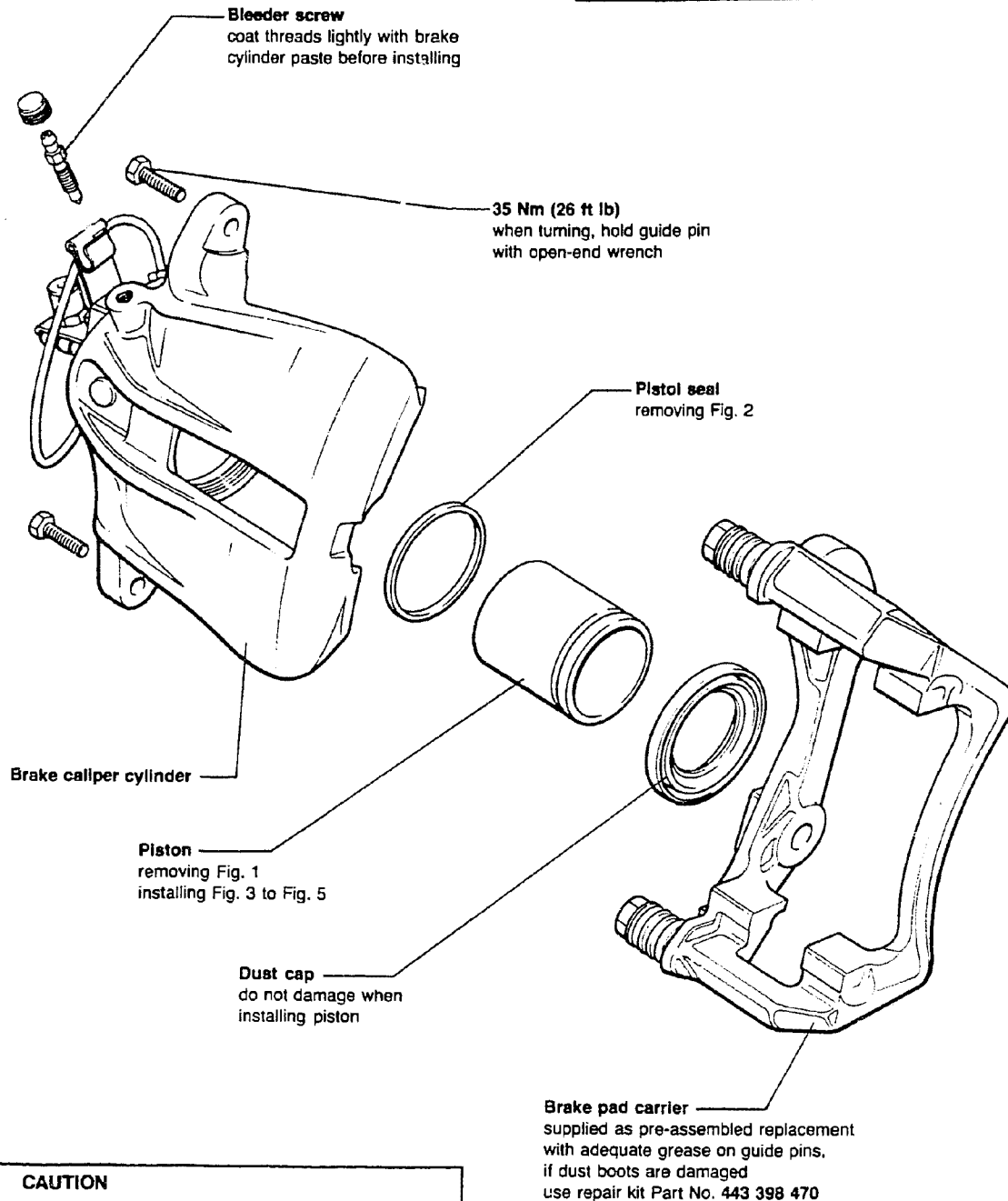
Bleeding sequence

1. brake caliper, right rear
 2. brake caliper, left rear
 3. brake caliper, right front
 4. brake caliper, left front
 5. re-bleed right rear brake caliper and assist bleeding process with repeated, forceful pumping of brake pedal
- after bleeding, fill reservoir to maximum mark

Brake – Hydraulic Components, Regulator, Booster

WARNING

Brake fluid is poisonous and corrosive to painted parts.



CAUTION

Use all parts in repair kit.
Coat seals and pistons lightly with VW brake cylinder paste or equivalent before installing

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Brake – Hydraulic Components, Regulator, Booster

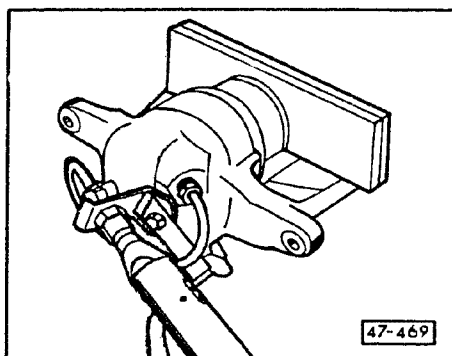


Fig. 1 Piston, removing

- blow out with compressed air

CAUTION

Place wooden block in cylinder housing to prevent damage to piston. Use only enough air pressure to force piston out. Piston may release suddenly.

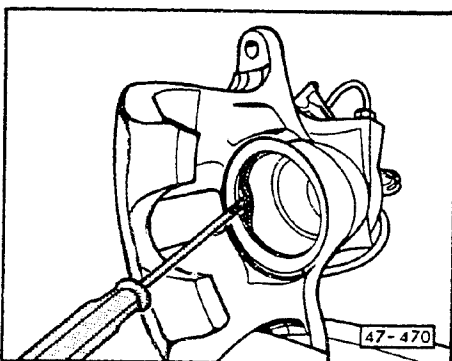


Fig. 2 Piston seal, removing

- pry out carefully without damaging piston bore

Note

If either piston or bore in brake caliper is corroded, pitted or scored, affected part must be replaced.

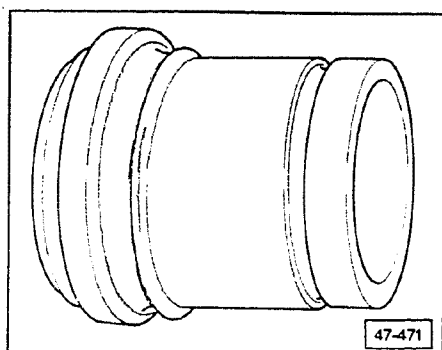


Fig. 3 Piston, installing

- slide dust cap on piston

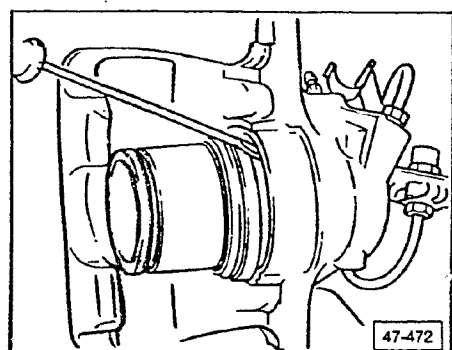
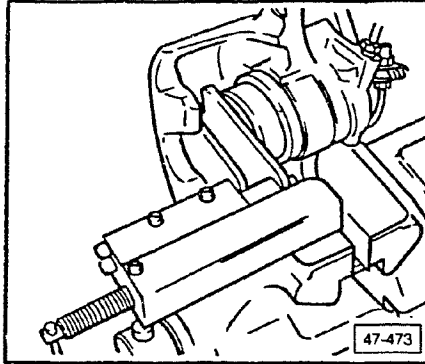


Fig. 4 Piston, installing

- lubricate piston and cylinder bore lightly with brake cylinder paste
- install piston and insert inner lip of dust cap into groove in brake cylinder

Brake – Hydraulic Components, Regulator, Booster



► Fig. 5 Piston, installing

- open bleeder screw
- press piston in as far as it will go

CAUTION

Outer lip of dust cap must slip into groove in piston.

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Brake – Hydraulic Components, Regulator, Booster

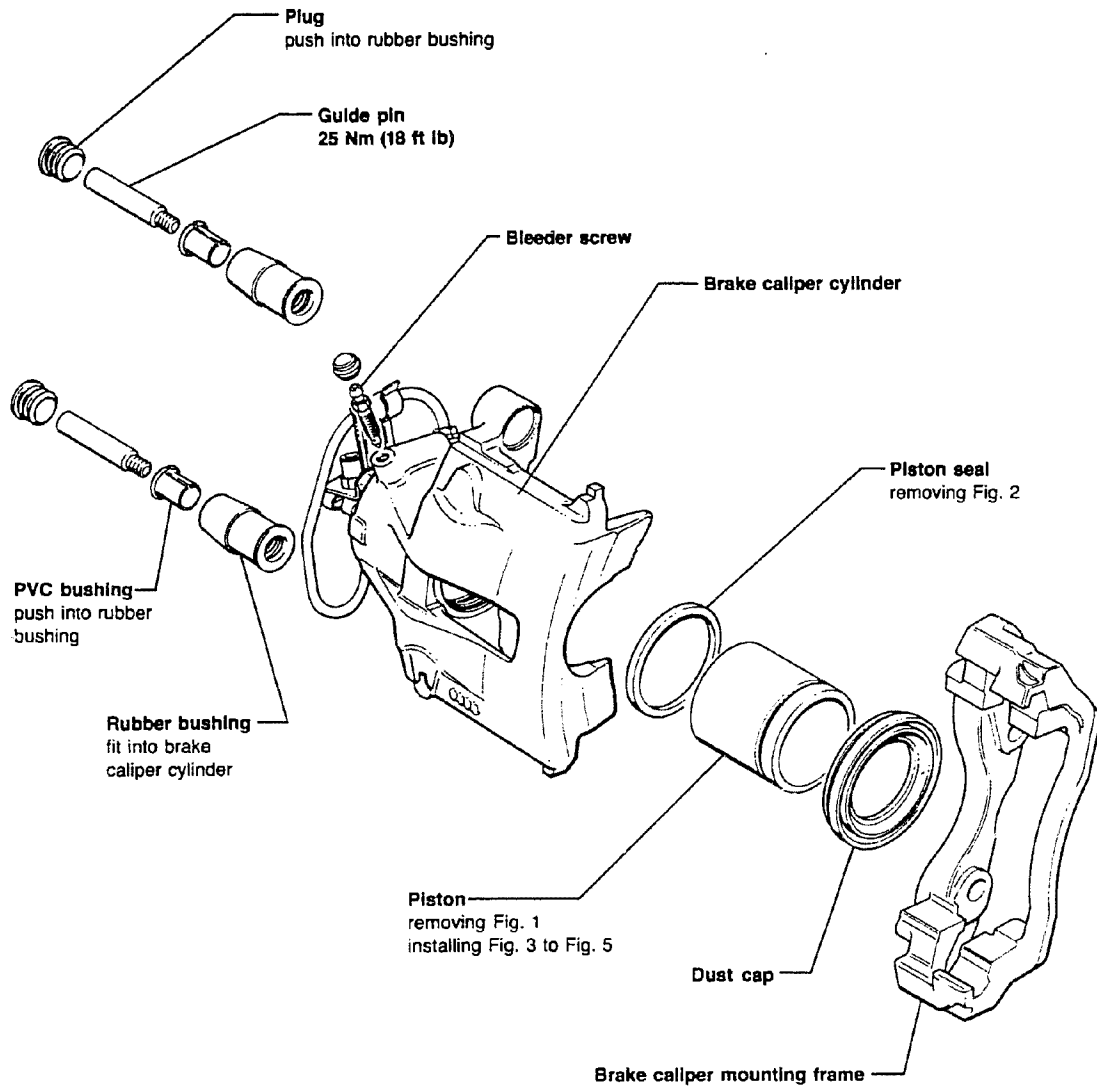
WARNING

Brake fluid is poisonous and corrosive to painted parts.

CAUTION

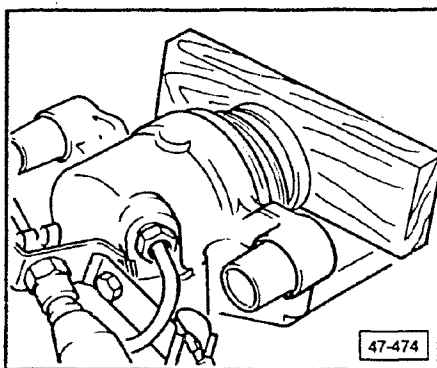
Use all parts in repair kit.

Coat seals and pistons lightly with VW brake cylinder paste or equivalent before installing.



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Brake – Hydraulic Components, Regulator, Booster

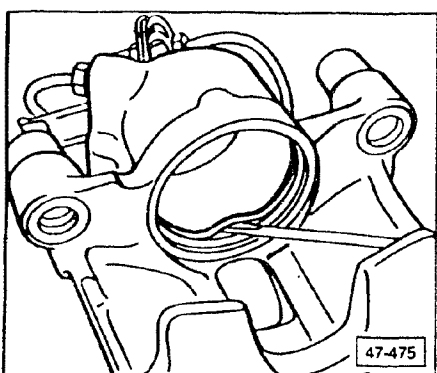


► Fig. 1 Piston, removing

- blow out with compressed air

CAUTION

Place wooden block in cylinder housing to prevent damage to piston. Use only enough air pressure to force piston out. Piston may release suddenly.

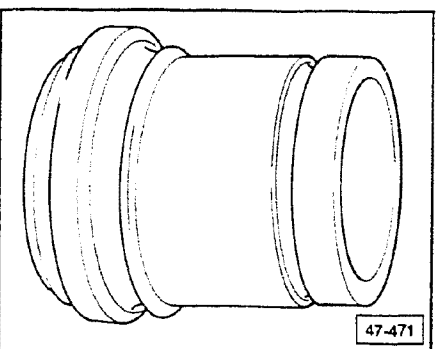


► Fig. 2 Piston seal, removing

- pry out carefully without damaging piston bore

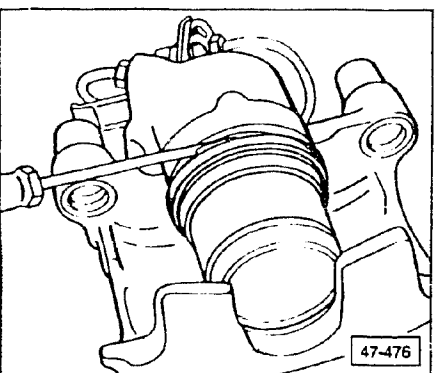
Note

If either piston or bore in brake caliper is corroded, pitted or scored, affected part must be replaced.



► Fig. 3 Piston, installing

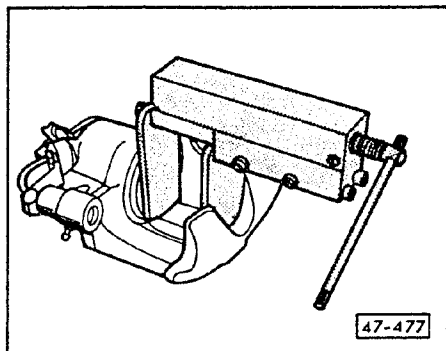
- slide dust cap on piston



► Fig. 4 Piston, installing

- lubricate piston and cylinder bore lightly with brake cylinder paste
- install piston and insert inner lip of dust cap into groove in brake cylinder

Brake – Hydraulic Components, Regulator, Booster



► Fig. 5 Piston, installing

- press piston in as far as it will go

CAUTION

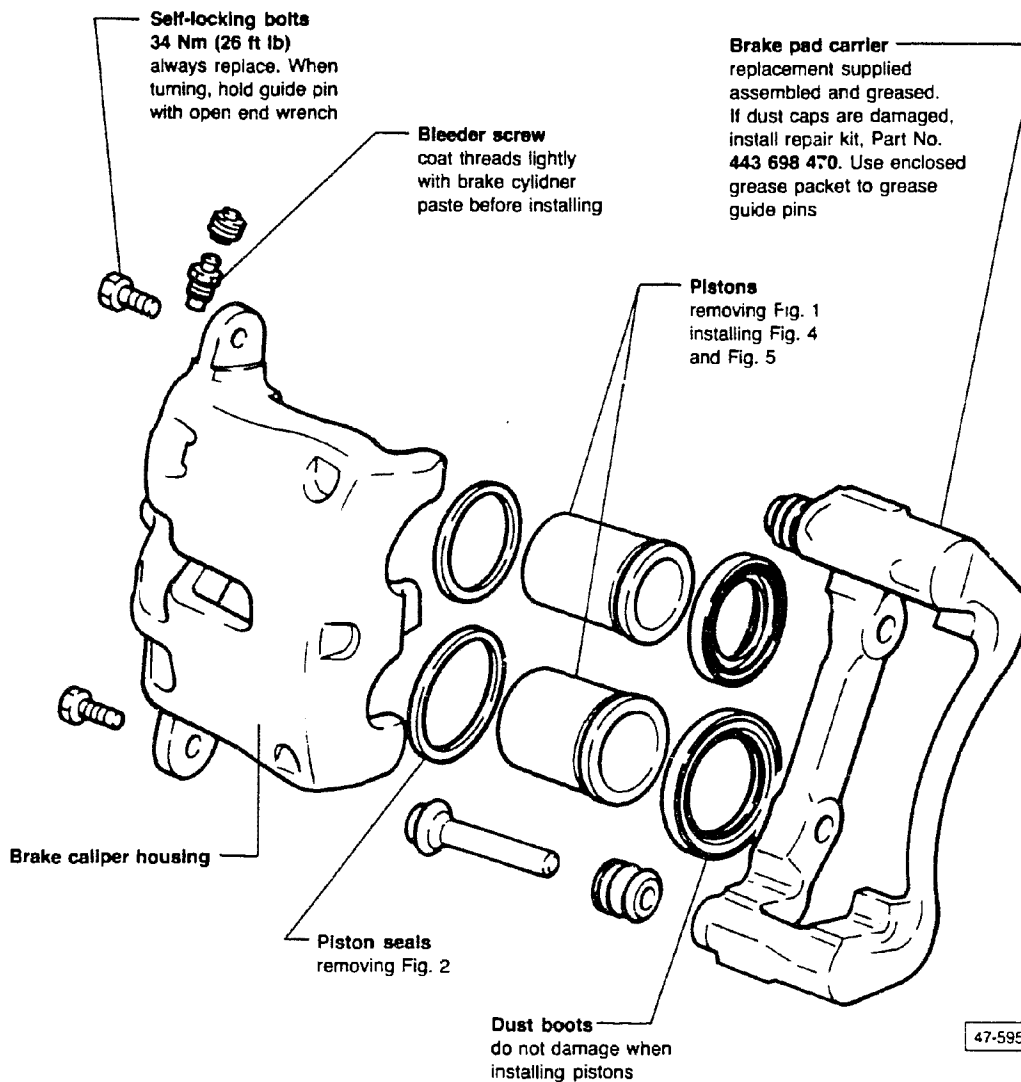
Outer lip of dust cap must slip into groove in piston.

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Brake – Hydraulic Components, Regulator, Booster

Note

All vehicles with 15" wheels have double-piston front brake calipers.



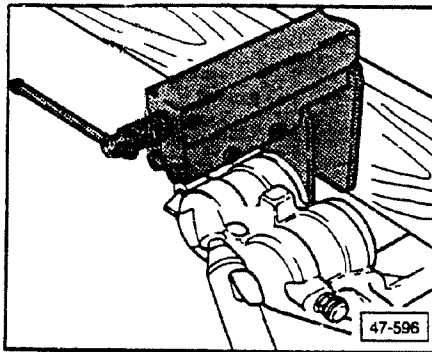
CAUTION

Use all parts in repair kit. Coat seals, pistons and cylinders lightly with VW brake cylinder paste or equivalent before installing.

WARNING

Brake fluid is poisonous and corrosive to painted parts.

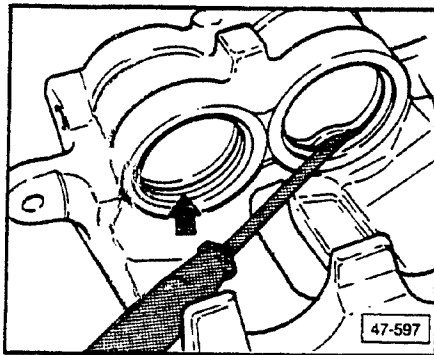
Brake – Hydraulic Components, Regulator, Booster



► Fig. 1 Brake caliper pistons, removing

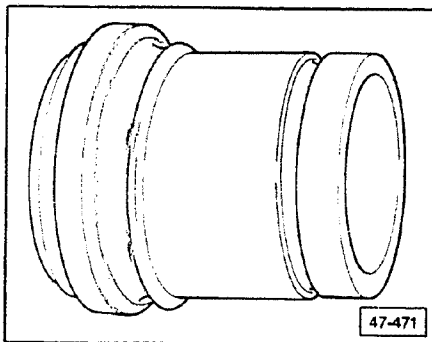
Note

Remove only one piston at a time. Place a wood block in caliper to avoid damaging pistons.

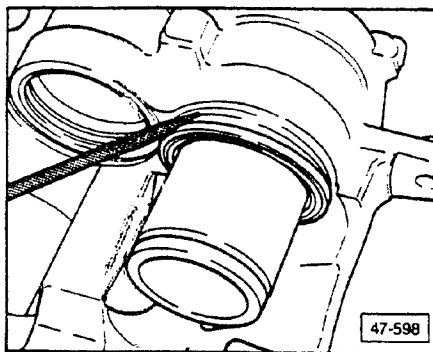


► Fig. 2 Piston seals, removing

- remove seals (arrow) carefully with screwdriver



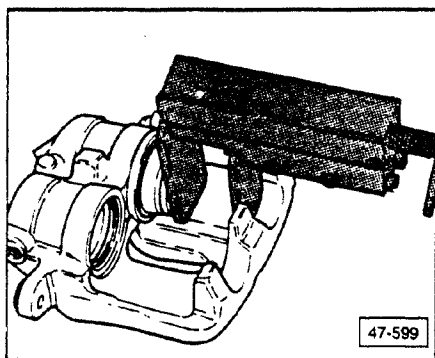
► Fig. 3 Dust boots on pistons, installing



► Fig. 4 Pistons, installing

- lubricate piston and cylinder bore lightly with brake cylinder paste
- install piston and insert inner lip of dust boot into groove in cylinder

Brake – Hydraulic Components, Regulator, Booster



► Fig. 5 Pistons, installing

Note

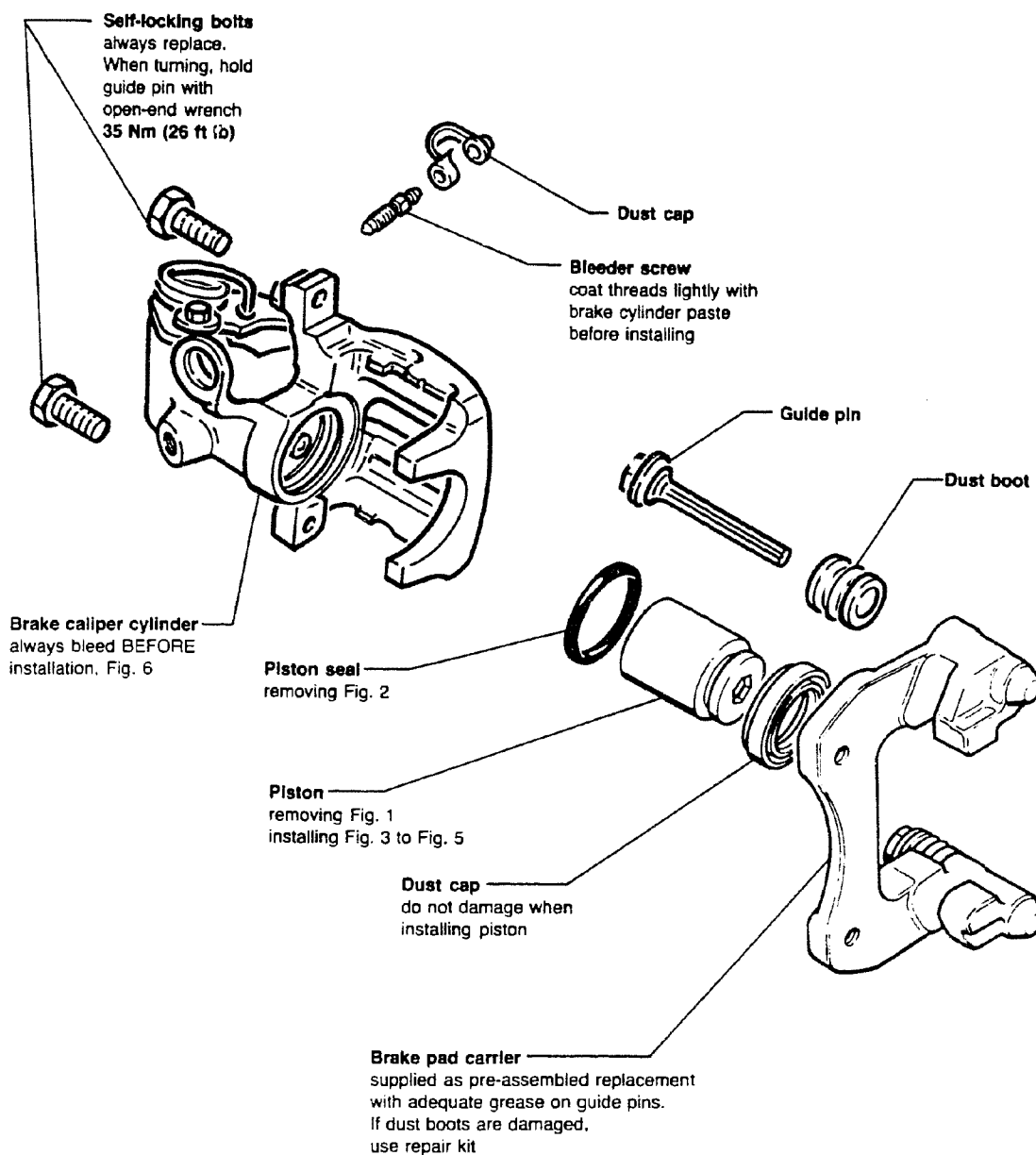
Lip of boot must slip into piston groove.

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Brake – Hydraulic Components, Regulator, Booster

WARNING

Brake fluid is poisonous and corrosive to painted parts.

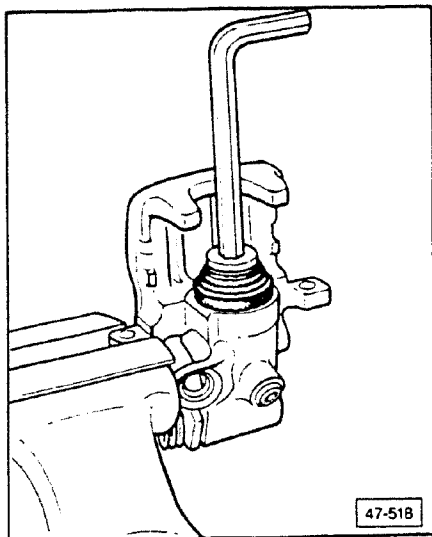


N

parts in repair kit. Coat seals, pistons
liners lightly with VW brake cylinder
paste or equivalent before installing.

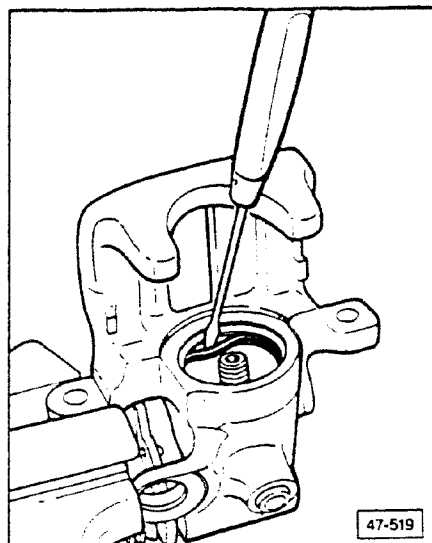
47-524

Brake – Hydraulic Components, Regulator, Booster



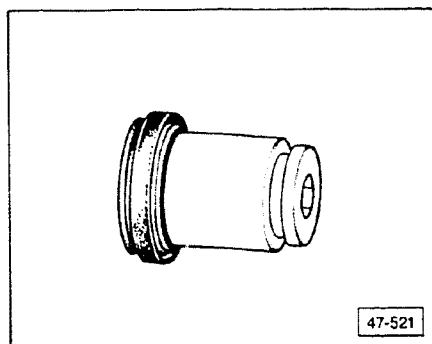
► Fig. 1 Piston, removing

- unscrew



► Fig. 2 Piston seal, removing

- pry out carefully to avoid damaging piston bore



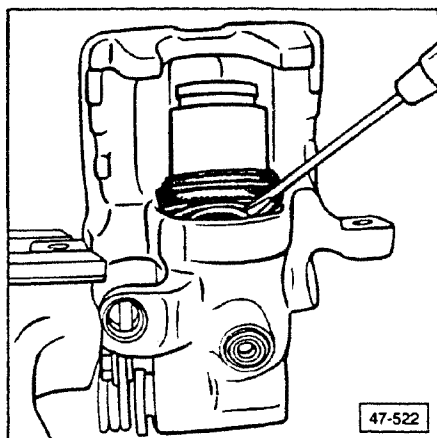
► Fig. 3 Dust cap for piston, installing

- slide outer lip onto piston

Note

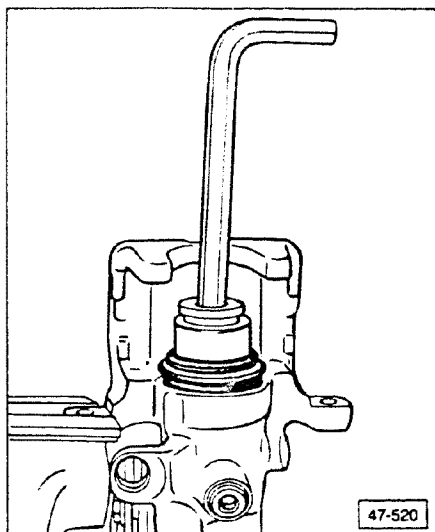
If either piston or bore in brake caliper is corroded, pitted or scored, affected part must be replaced.

Brake – Hydraulic Components, Regulator, Booster



► Fig. 4 Piston, installing

- lubricate piston and cylinder bore lightly with brake cylinder paste
- insert inner lip of dust cap into groove of brake cylinder

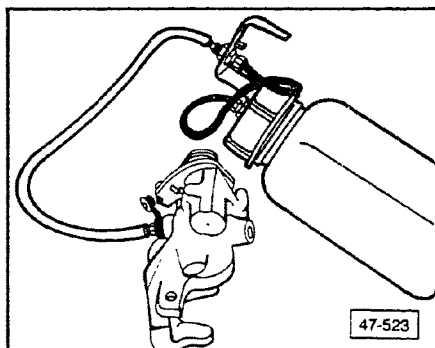


► Fig. 5 Piston, installing

- press piston down while screwing in as far as possible

CAUTION

Outer lip of dust cap must slip into groove of piston.



► Fig. 6 Brake caliper, bleeding

- fill caliper through bleeder valve until brake fluid comes out of threaded hole for brake hose connection without bubbles

Brake — Hydraulic Components, Regulator, Booster

CAUTION

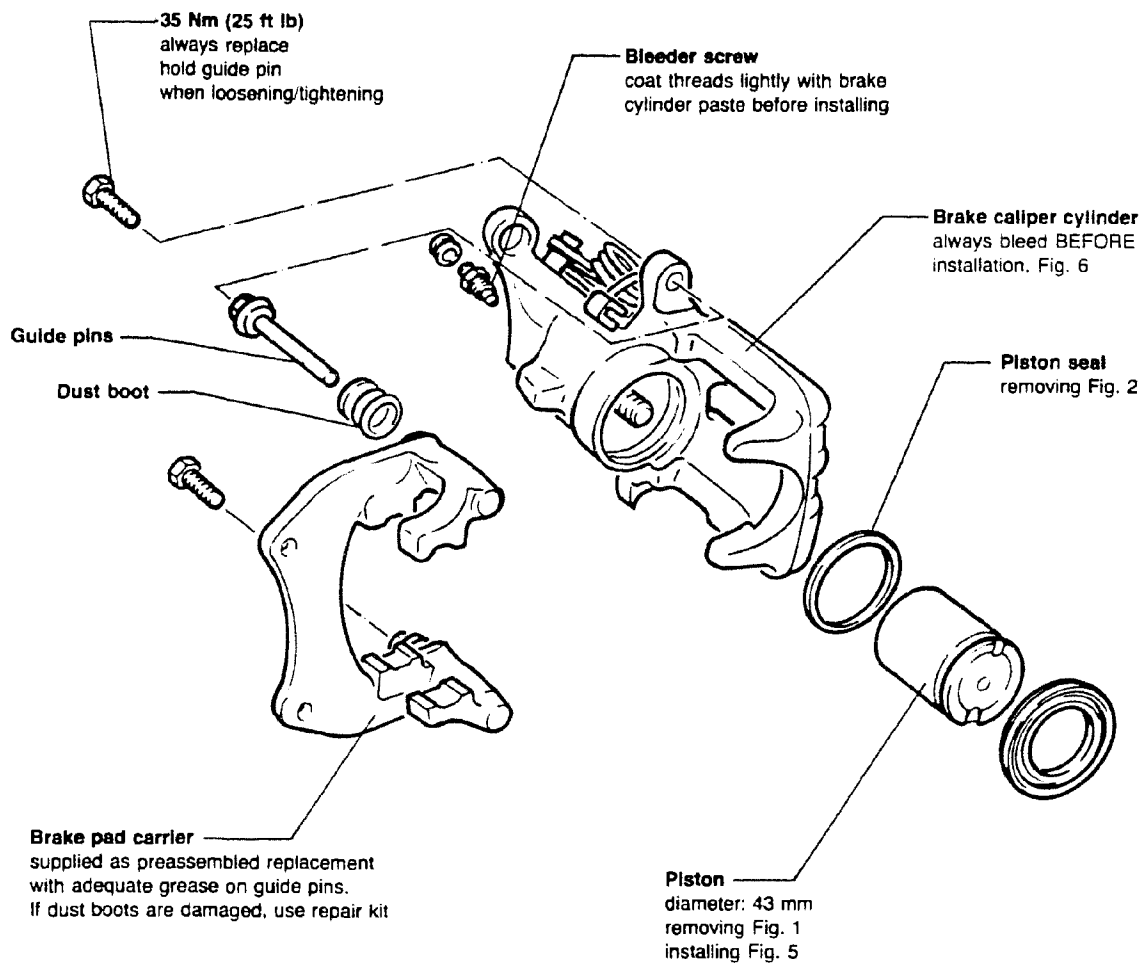
Use all parts in repair kit.

Coat seals and pistons lightly with VW/Audi brake cylinder paste or equivalent before installing.

CAUTION

New brake calipers are supplied filled with brake fluid and have been bled.

When repairing, always bleed calipers before installation in vehicle.

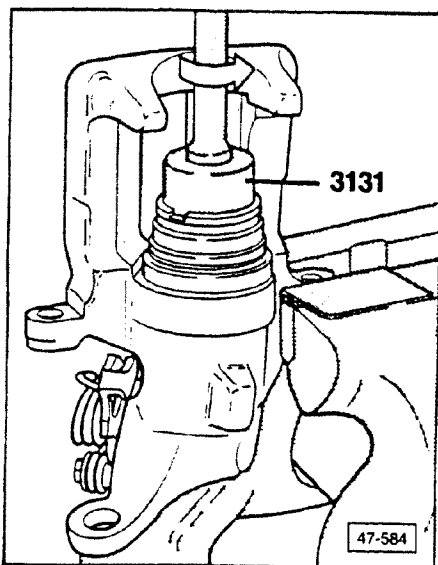


WARNING

Brake fluid is poisonous and corrosive to painted parts.

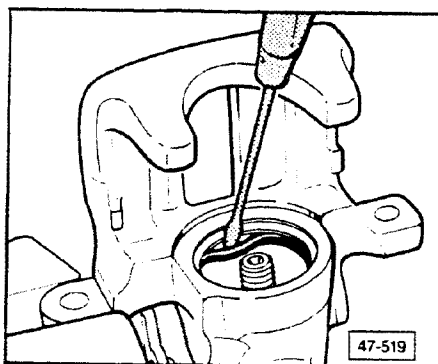
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Brake – Hydraulic Components, Regulator, Booster

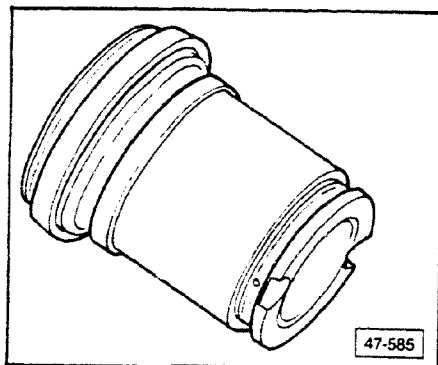


► Fig. 1 Piston, removing

- unscrew with special tool



► Fig. 2 Piston seal, removing



► Fig. 3 Piston, installing

- slide dust boot on piston

Brake – Hydraulic Components, Regulator, Booster

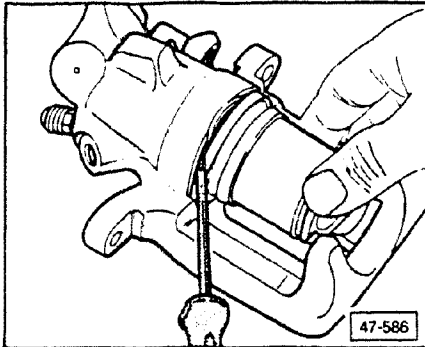


Fig. 4 Piston, installing

- lubricate piston and cylinder bore lightly with brake cylinder paste
- hold piston in front of housing and insert lip of dust boot into groove in cylinder

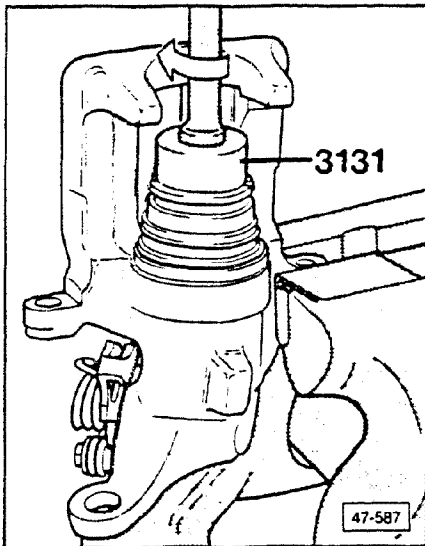


Fig. 5 Piston, installing

- press down on piston firmly and screw in

Note

Lip of boot must slip into groove in piston.

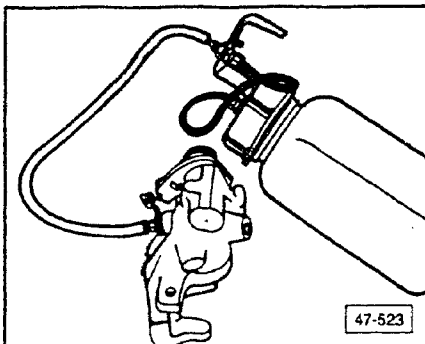
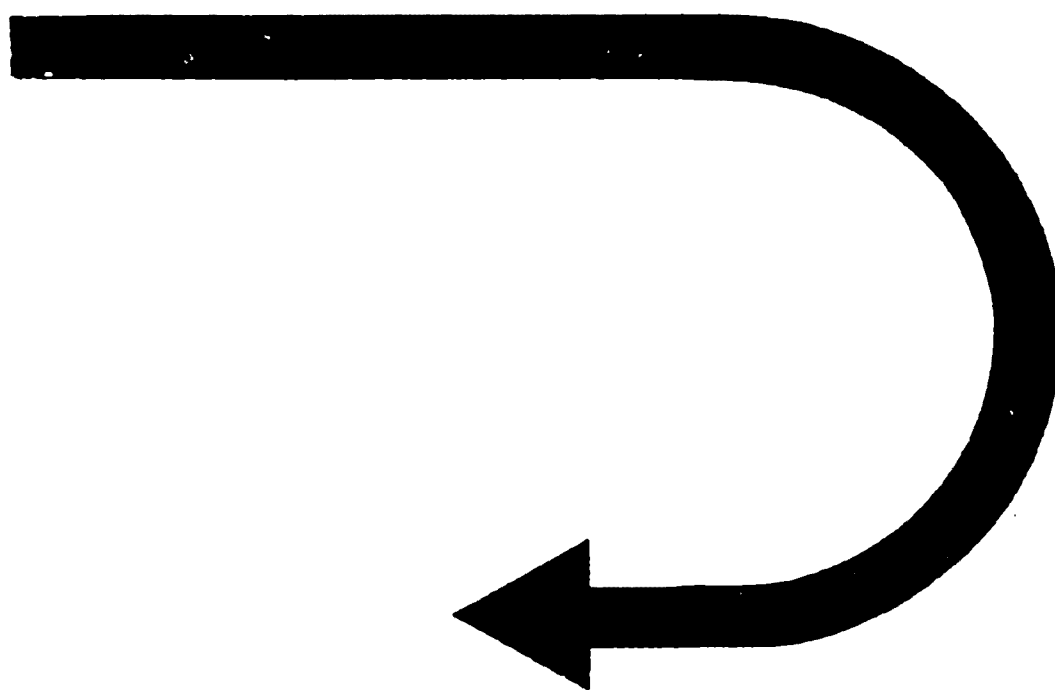


Fig. 6 Brake caliper, bleeding

- fill caliper through bleeder valve until brake fluid comes out of threaded hole for brake hose connection without bubbles

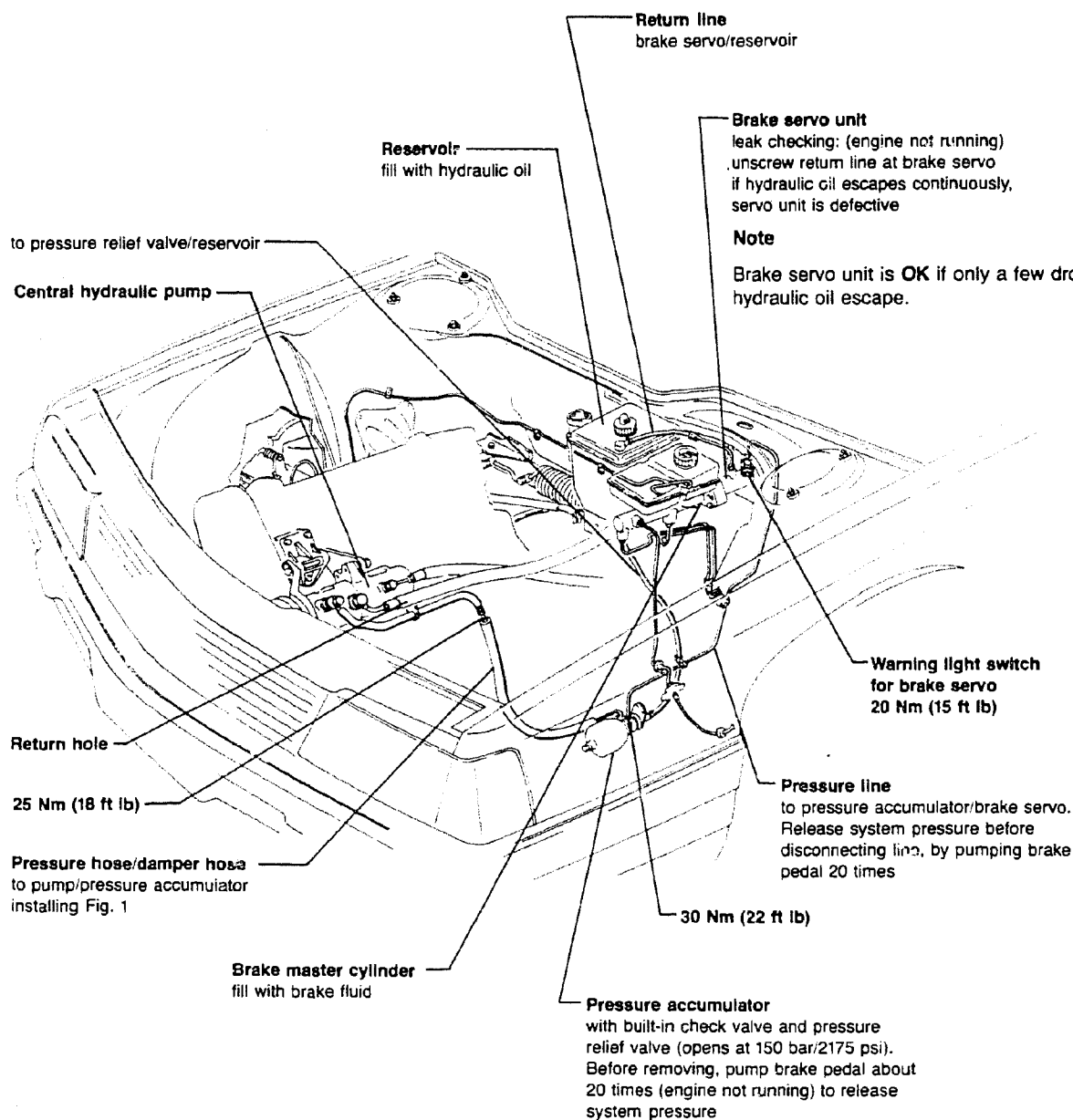
CONTINUED IN THE
BEGINNING OF NEXT ROW



Brake – Hydraulic Components, Regulator, Booster

CAUTION

Reservoir must be filled with hydraulic oil, Part No. **G 002 000**. Do not use ATF.

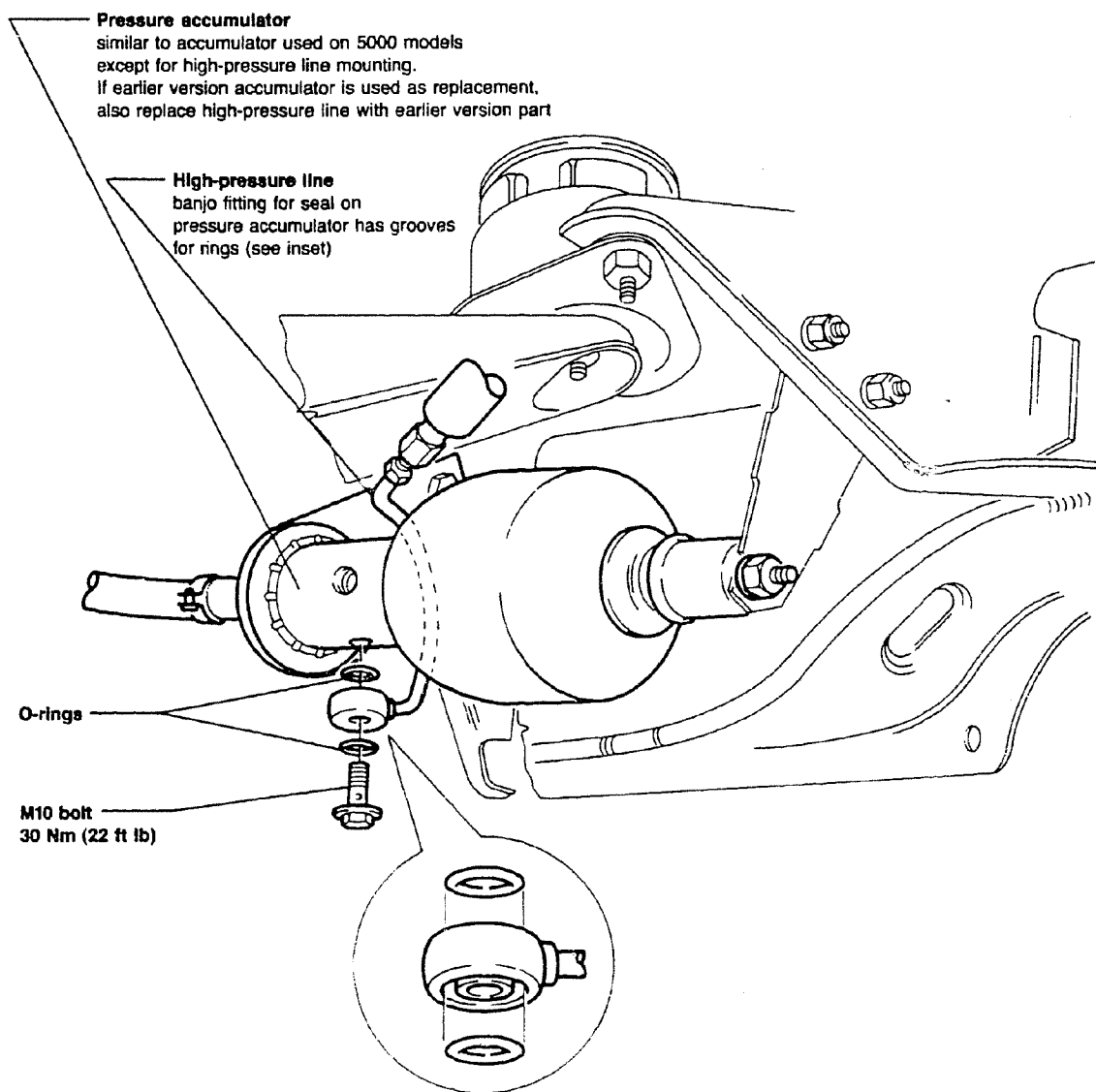


Note

Before discarding, drill 3 mm (1/8 in.) hole into pressure accumulator to release pressure (always wear safety glasses).

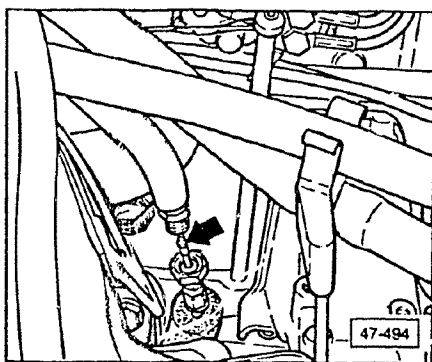
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Brake – Hydraulic Components, Regulator, Booster



47-726

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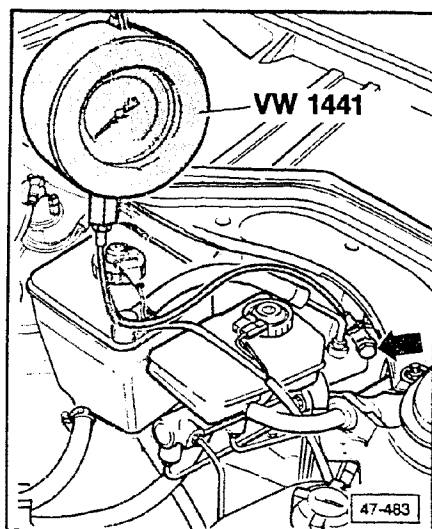
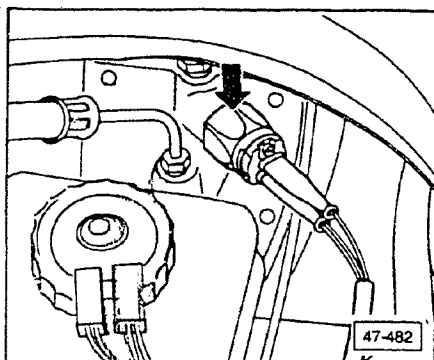
► Fig. 1 Damper hose, installing

- fit longer side of damper hose into pipe and shorter side into hose
- tighten connection to 25 Nm (18 ft lb)

Gas pressure of pressure accumulator, checking

Note

- gas pressure of new accumulator
78-82 bar (1131-1189 psi) at 20°C (68°F)
- minimum gas pressure
30 bar (435 psi) at 20°C (68°F)
- with engine not running, press brake pedal about 20 times to reduce system pressure
- disconnect wire on warning light switch and remove switch (arrow)



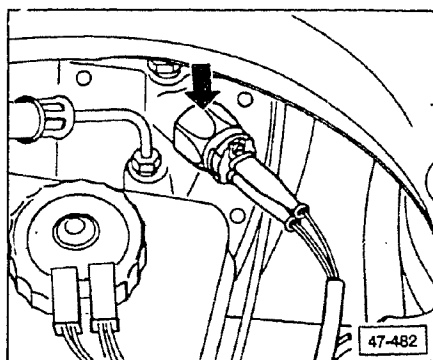
- attach pressure gauge with hollow bolt and copper washers to brake servo unit

Note

Attach thick copper washer between brake servo unit and banjo fitting and thin copper washer between hollow bolt and banjo fitting

- start engine and let idle until pressure gauge reads approximately 140 bar (2030 psi)
- turn ignition **OFF**
- pump brake pedal until pressure drops slowly
 - pressure reading at which gauge pointer drops down rapidly to "0" is gas pressure of pressure accumulator
 - if pressure is lower than 30 bar (435 psi) accumulator must be replaced
- remove pressure gauge
- install brake light warning switch and reconnect wire connector
- check all connections for leaks

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Operating pressure of hydraulic brake servo, checking

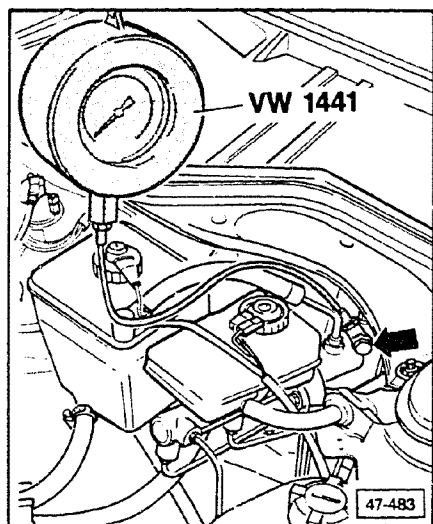
Test conditions:

- V-belt tension OK
- no leaks in servo system
- with engine not running, press brake pedal about 20 times to reduce pressure in system
- disconnect wires on warning light switch and remove switch (arrow)
- attach pressure gauge with hollow bolt and copper washers to brake servo unit (arrow)

Note

Attach thick copper washer between brake servo unit and banjo fitting and thin copper washer between hollow bolt and banjo fitting

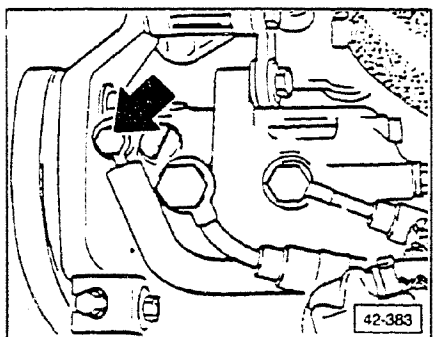
- start engine and let idle until pressure gauge reads more than 140 bar (2030 psi)
 - if specified pressure is not reached, check delivery rate of central hydraulic pump
- turn ignition OFF, leave pressure gauge connected



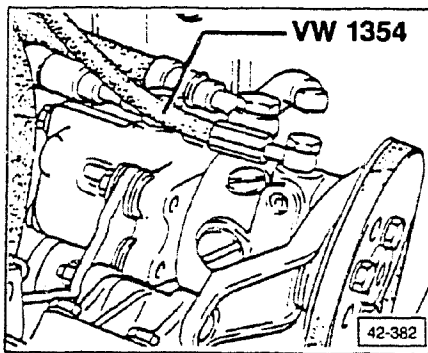
Delivery rate, checking

- remove pressure line from hydraulic pump (arrow)

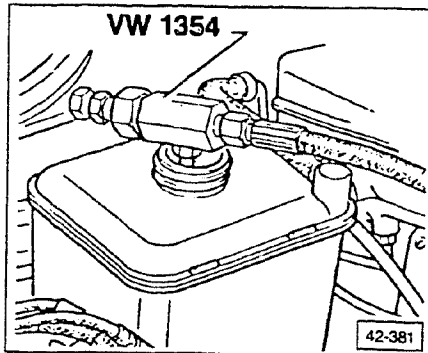
more



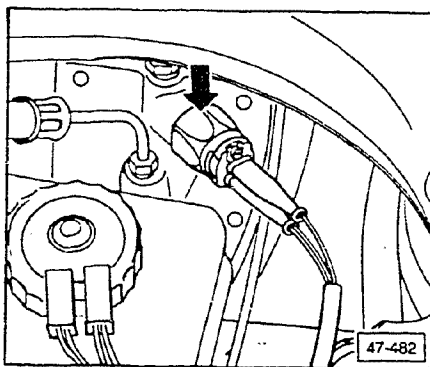
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- connect hose of pressure limiter VW 1354 to pump, using existing hollow bolt
- remove cap from fluid reservoir



- put end of pressure limiter hose into reservoir
- start engine, let idle until line is bled (no bubbles)
- turn ignition **OFF**
- hold hose into measuring jar
- start engine and let idle
- check delivery rate
 - must be at least 0.25 liters/min. (0.26 US qt/min)
 - if specification not reached, replace hydraulic pump
 - if delivery rate is **OK**, but operating pressure is still not reached, replace pressure accumulator
- with engine shut off, press brake pedal about 20 times to reduce pressure in system
- remove pressure gauge and pressure limiter
- install brake warning light switch and reconnect wire connectors
- attach pressure line to hydraulic pump
- check all connections for leaks

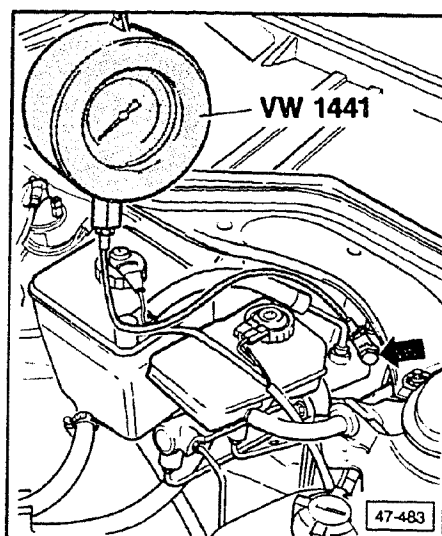


Pressure accumulator, check valve, checking

Test condition:

- no leaks in brake servo unit
 - with engine not running, press brake pedal about 20 times to reduce pressure in system
 - disconnect wires on warning light switch and remove switch (**arrow**)
- more

Brake – Hydraulic Components, Regulator, Booster



- attach pressure gauge with hollow bolt and copper washers to brake servo unit (arrow)

Note

Attach thick copper washer between brake servo unit and banjo fitting and thin copper washer between hollow bolt and banjo fitting

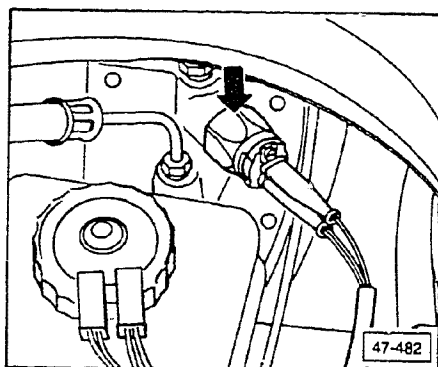
- start engine and let idle until pressure gauge reads approximately 140 bar (2030 psi)
- turn ignition **OFF**
- pump brake pedal until pressure drops to 135 bar (1957 psi)
 - operating pressure should not drop below 130 bar (1885 psi) within 5 minutes
- if pressure drop is more, check-valve is leaking. Replace pressure accumulator
- with engine not running, press brake pedal about 20 times to reduce operating pressure
- remove pressure gauge
- install brake light warning switch and reconnect wire connectors
- check all connections for leaks

Pressure accumulator, pressure relief valve, checking

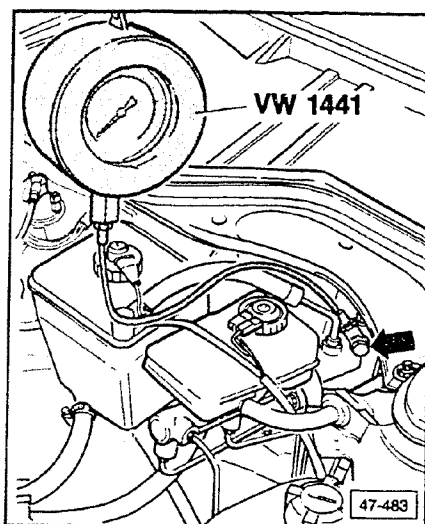
Test condition:

- pump delivery rate OK
- with engine not running, press brake pedal about 20 times to reduce pressure in system
- disconnect wires on warning light switch and remove switch (arrow)

more



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- attach pressure gauge with hollow bolt and copper washers to brake servo unit (arrow)

Note

Attach thick copper washer between brake servo unit and banjo fitting and thin copper washer between hollow bolt and banjo fitting

- start engine and let idle until pressure gauge reads more than 140 bar (2030 psi)
 - if specification is not reached, pressure relief valve leaking, replace pressure accumulator
- recheck system pressure
- with engine not running, press brake pedal about 20 times to reduce system pressure
- remove pressure gauge
- install brake light warning switch and reconnect wire connectors
- check all connections for leaks

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Hydraulic brake servo; troubleshooting

Fault	Possible cause	Check	Remedy
Warning light for hydraulic system flashing (hydraulic brake servo not working or servo assistance insufficient)	1) Hydraulic oil level in reservoir too low	Visual check	Top up hydraulic oil in reservoir to mark "MAX"
	2) V-belt not sufficiently tensioned Pump defective	Visual check Check delivery rate at engine idling speed	Tension V-belt or replace; replace pump is necessary
	3) Hydraulic brake servo leaking internally	Detach return line between hydraulic brake servo and oil reservoir and watch for leakage. If operating pressure is present (140 bar minimum) and brake pedal not depressed, only drops of hydraulic oil may escape from the connection	Replace brake servo
	4) Pressure accumulator faulty	Check check-valve Check pressure relief valve	Replace pressure accumulator if pump delivery rate and hydraulic brake servo are OK
Warning light for hydraulic system flashes hydraulic brake servo working)	5) Warning switch faulty	Check operating pressure (minimum 120 bar)	Replace warning switch
Servo assistance is reduced or disappears after several consecutive braking operations	6) Operating pressure too low	Check operating pressure (minimum 140 bar) at engine idling speed using pressure gauge VW 1441	Replace pressure accumulator
	7) Gas pressure in pressure reservoir too low	Check gas pressure (minimum 30 bar) using pressure gauge VW 1441	Replace pressure accumulator
	8) Operating pressure drops rapidly when engine is switched off (pressure drop more than 5 bar over 5 minutes)	If cause No. 3 does not apply and no leaks in pressure lines are visible, the check valve in the pressure accumulator is leaking	Replace pressure accumulator