POWER BRAKE T 50

for passengers cars

Construction, operation,
installation and maintenance

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ALFRED TEVES
MASCHINEN UND ARMATURENFABRIK KG
FRANKFURT/MAIN

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TECHNICAL DATA FOR POWER BRAKE UNIT T 50

General Description

The power brake unit T 50 is a vacuum-assisted hydraulic device which utilizes engine intake manifold vacuum and atmosphere pressure for its operation. The power unit adds to the pressure created physically in the pedal master cylinder and delivers this combined pressure to the wheel cylinders. It is a self-contained unit having no external rods or levers exposed to dirt and moisture. Construction of the T 50 is such that in case of vacuum failure, the brakes will function as in a conventional brake system. The power unit is mounted in the hydraulic line between the pedal master cylinder and the wheel cylinders. A vacuum line connection is made from the power brake unit to the engine intake manifold.

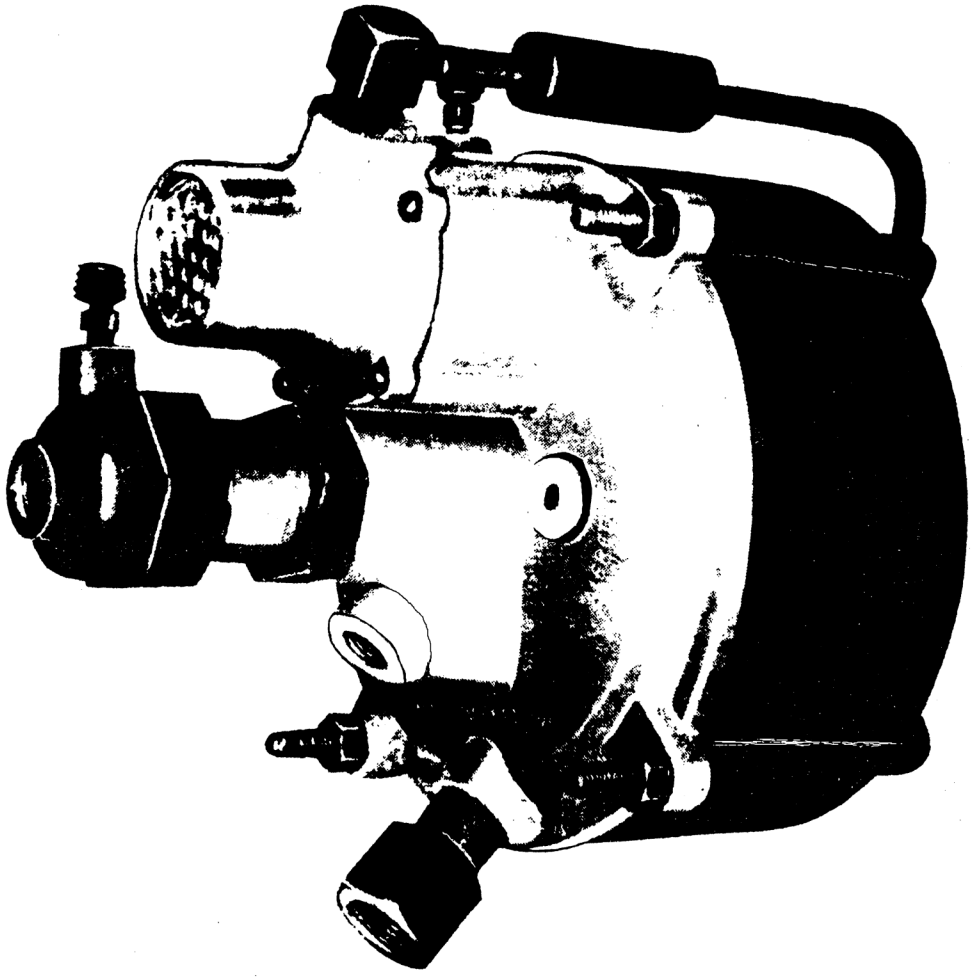


Fig. 1
Power brake unit T 50

CONSTRUCTION

The power brake unit T 50 consists of the following 3 main sections: (Fig. 2)

1. Vacuum power cylinder
2. Hydraulic slave cylinder
3. Hydraulically actuated control valve.

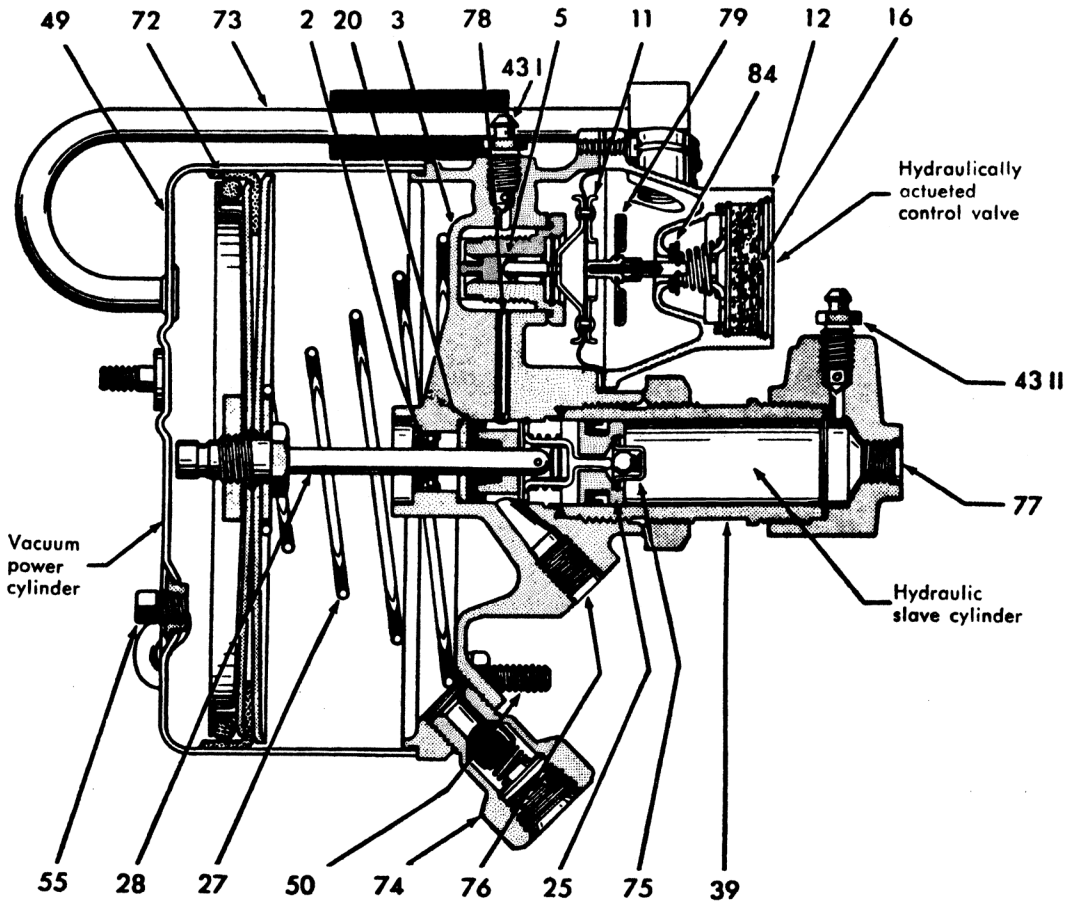


Fig. 2

Power brake unit: cross section

The vacuum power cylinder consists of cylinder shell (49) with piston (72), piston return spring (27) and push rod (28), and is clamped to end plate (3) by four hook bolts (50). Control tube (73) connects the left chamber of the vacuum cylinder with the right side of diaphragm assembly (11) of the control valve, while the right side of the vacuum cylinder is connected through vacuum check valve assembly (74) to the intake manifold. The right chamber of the vacuum cylinder is also connected to the left side of the diaphragm assembly (11).

The hydraulic slave cylinder consists of a cylinder tube (39) and a piston (25) which is pinned to the push rod (28), and a ball check valve assembly (75).

Hydraulic rubber cup (20) and vacuum seal (2) are provided in the end plate to seal the push rod. The hydraulic line from the master cylinder is attached at port (76) and the hydraulic line to the wheel cylinders at port (77). Passage (78) in the end plate connects the slave cylinder at left of piston (25) with the left side of control valve piston (5).

The control valve contains piston (5) which is in contact with diaphragm assembly (11). Within valve cover (12) is found vacuum – (79) and atmosphere poppet assembly (84) and air cleaner (16)

For bleeding purpose, bleed screws (43) are placed at the top of the end plate (3) and in the slave cylinder end cap. Plug (55) is placed in the end of the cylinder shell to provide for lubrication of the power cylinder.

PRINCIPLE OF OPERATION

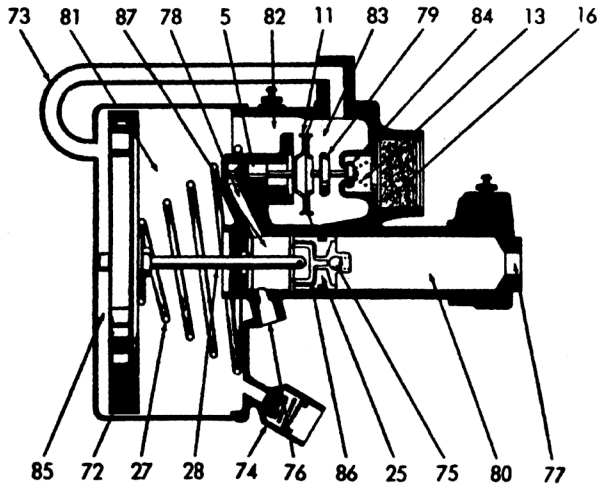


Fig. 3

Power brake unit in released position

The line from the master cylinder is attached at port (76). Fluid is ported to the left side of valve piston (5) by passage (78) and past ball check valve (75) of piston (25) into slave cylinder chamber (80). Vacuum is transmitted through vacuum check valve (74) to cylinder chamber (81) and valve chamber (82). Vacuum enters valve chamber (83) via disphragm assembly (11) and vacuum poppet (79). Atmosphere poppet (84) is held on its seat by poppet spring (13) and atmosphere pressure, closing atmosphere off from chamber (83). Valve chamber (83) ist connected to cylinder chombre (85) by tube (73) thus transmitting constant vacuum to both sides of power piston (72).

In released position (Fig. 3) power piston (72) is held to the left in the vacuum cylinder by return spring (27). In this position, yoke (86) of hydraulic piston (25) is against the piston stop washer and ball of check valve (75) is lefted from its seat. Valve piston (5) is at its leftward position separating poppet (79) from its seat at diaphragm assembly (11).

When the brake pedal is applied, fluid under pressure by-passes ball check valve (75) and is transmitted to slave cylinder chamber (80) and to the wheel cylinders. At the same time pressure is built up at the left of valve piston (5), moving the piston to the right, contacting the diaphragm seat with the vacuum poppet (79) and opening atmosphere poppet (84). (Fig. 4).

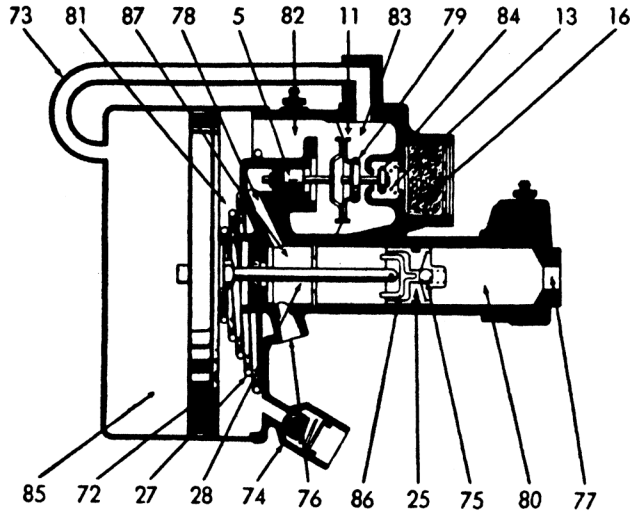


Fig. 4
Power brake unit in applied position

Atmosphere now enters valve chamber (83) through air cleaner (16) past the opened poppet (84) and through tube (73) the power chamber (85), moving power piston (72), push rod (28) and slave cylinder piston (25) to the right compressing return spring (27). With this movement of the hydraulic piston (25), yoke (86) allows the ball of check valve (75) to seat trapping fluid in slave cylinder chamber (80) and transmit the hydraulic pressure to the wheel cylinders.

The vacuum differential across power piston (72) is the same as that across diaphragm assembly (11), which is balanced by the master cylinder pressure at the left side of valve piston (5). In this way the hydraulic output pressure in slave cylinder chamber (80) is in proportion to the master cylinder input pressure. The total output pressure is equal to that from power piston (72) plus the pressure from the master cylinder.

Since the fluid displacement ahead of piston (25) in chamber (80) is almost the same as that behind the piston in chamber (87), the driver has the „feel" of the brakes.

After the desired degree of brake application has been obtained, the control valve will reach a „lap" or „holding" position. In this position, vacuum poppet (79) rests

on diaphragm assembly (11) and at the same time atmosphere poppet (84) is on its seat in the valve cover. Hydraulic pressure at the left of piston (5) is balanced by vacuum differential across diaphragm assembly (11). Any increase or decrease in hydraulic input pressure will cause a corresponding increase or decrease in vacuum differential and an increase or decrease in hydraulic output pressure.

When the unit is fully applied (Fig. 4), piston (5) is completely to the right against its stop and atmosphere poppet (84) is lifted from its seat. Cylinder chamber (85) is therefore completely exposed to atmosphere and maximum possible differential exists across the power piston. Any increase in hydraulic output pressure comes from the master cylinder only. When the pressure is released from the left side of piston (5), the piston moves to the left (Fig. 3), seating atmosphere poppet (84), after which the vacuum differential pushes the seat on diaphragm assembly (11) away from vacuum poppet (79). Manifold vacuum from chamber (82) is again communicated to cylinder chamber (85) through valve chamber (83) and tube (73). Spring (27) returns power piston (72) and hydraulic piston (25) to the released position. Yoke (86) lifts the ball of check valve (75) from ists seat, opening chamber (80) to chamber (87). This allows for any fluid expansion or contraction in the lines to be compensated for from the master cylinder reservoir.

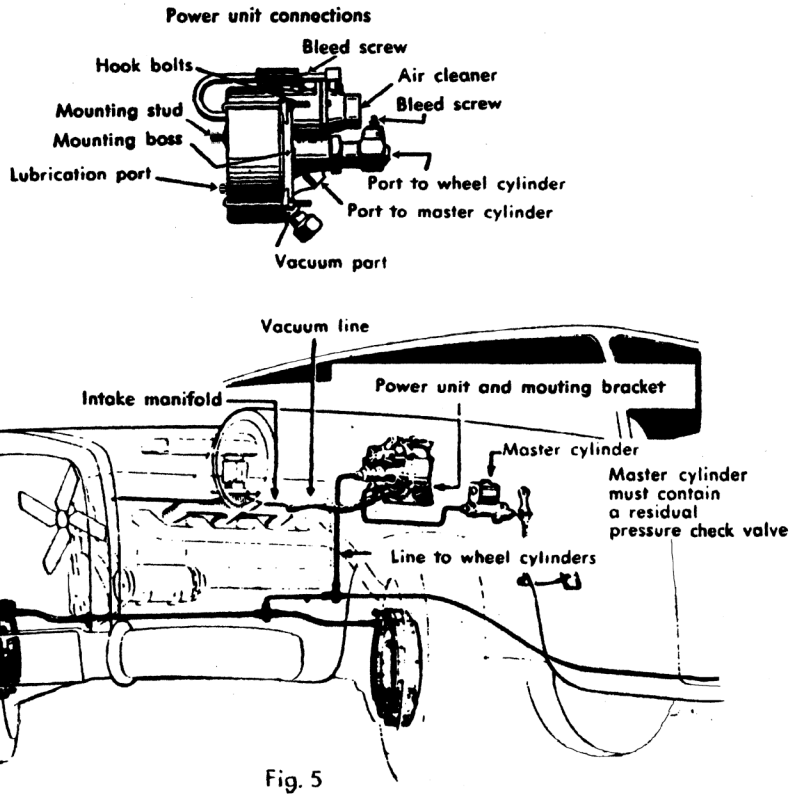


Fig. 5

Power brake unit T 50 installation

In case of vacuum failure, the brakes can be applied in the conventional manner. Fluid under master cylinder pressure in this case by-passes directly through check valve (75) to the wheel cylinder lines.

INSTALLATION

The power brake unit T 50 is to be mounted with the centerline of its slave cylinder horizontal, and with the bleed screws up. The location of the unit on the vehicle is not fixed, the location selected should be made if possible with regard to the following recommendations. (see figure 5.)

1. The unit should be located at a point which is free of excessive road dirt and dust and away from excessive engine heat.
2. The bleed screws and the lubrication port in the vacuum cylinder should be easily accessible.
3. The hydraulic line- and vacuum line connections should also be easily accessible.
4. The vacuum line should be free of restrictions and should not be less than 3/8" I. D.

When installing the unit in vehicle, a mounting bracket is used to which the unit is fastened by means of mounting studs and hook bolts. (see figure 5.) Two tapped holes are provided in the end plate for mounting.

Bleeding

The power brake system bleeding may be done manually or with a pressure bleeder under special attention of the following points:

1. Only ATE BLUE ORIGINAL brake fluid is to be used.
2. Clean dirt from around master cylinder filler cap before removing same. Fill reservoir if necessary and maintain fluid in reservoir during bleeding.
3. Attach bleeder hose to upper bleed screw (43) and place other end in container with fluid. Open bleed screw and bleed until solid stream of fluid free from bubbles appears.
4. Attach hose to lower bleed screw (43) and bleed in like manner.
5. Bleed wheel cylinders, bleeding shortest line last.
   Note: If system is bled manually, tighten bleed screws in each step before releasing brake pedal.
6. After bleeding, fill reservoir to within 3/4" of filler port opening with ATE BLUE ORIGINAL brake fluid. Fluid withdrawn should not be used again.

Lubrication

The vacuum cylinder should not be lubricated until after the unit is installed, to prevent oil from coming into contact with the rubber cups, which in this case would be destroyed and endanger the function of the unit.

When lubricating, the engine should be off and power unit in released position. Remove plug (55), fig. 2, and add by means of an injection can mineral oil *) until it starts to run out through plug opening. Replace plug and tighten to prevent vacuum leakage.

In case it has not been possible for some reasons to install the unit as per specification, care should be taken that the quantity of oil amounts to approx. 2 cubic inches, but in no case more! Vacuum cylinder oil should be added, if necessary every 18 000 Miles, however, at least once a year.

SYSTEM TESTS

Wheel brake tests

Road test brakes on vehicle by making brake applications at about 20 MPH in order to see if vehicle stops evenly and quickly. Irregular braking such as "dive" to right or left, lining fade, or loss of pedal reserve due to drum distortion are conditions which are in no way affected by the power unit. If the brake pedal travels to within 1 inch of the toe board, the brake shoes require readjustments or relining.

Hydraulic system tests

With engine stopped and transmission in neutral, apply brake pedal several times to destroy all vacuum in the system. Depress brake pedal. If the pedal is "spongy", there is evidence of air in the system. Rebleed system. If pedal gradually falls away under foot pressure, the hydraulic system is leaking and must be repaired immediately by an ATE-Brake Service Station.

Performance tests without measuring instruments

With engine stopped and all vacuum destroyed, as in test above, depress brake pedal, hold foot pressure on pedal and start engine. If vacuum system is operating properly, the pedal will move toward the toe board. If no action is felt, vacuum system is not operating. Inspect vacuum line.

Another simple test of the vacuum is by holding a plane rubber disc of $2^3/_8$ inches in diameter in front of the air filter. With running engine and actuation of the brake pedal, this rubber disc will be drawn against the filter and be held there. If rubber disc is drawn against filter at running engine **without** pedal actuation, it is evidence of the atmosphere poppet of the control valve being leaky. Replace valve cover (12).

With engine stopped and all vacuum destroyed, depress brake pedal. Start engine. If pedal does not fall away at constant foot power, but moves somewhat against the foot is evidence of the ball in the slave cylinder piston not tightly sealing.

Replace ball or piston of slave cylinder, if ball seat or ball is damaged.

*) Use commercial shock absorber oil having a viscosity of from 5° to 6° Engler at 68° F (for example Gasolin Shock Absorber Oil).

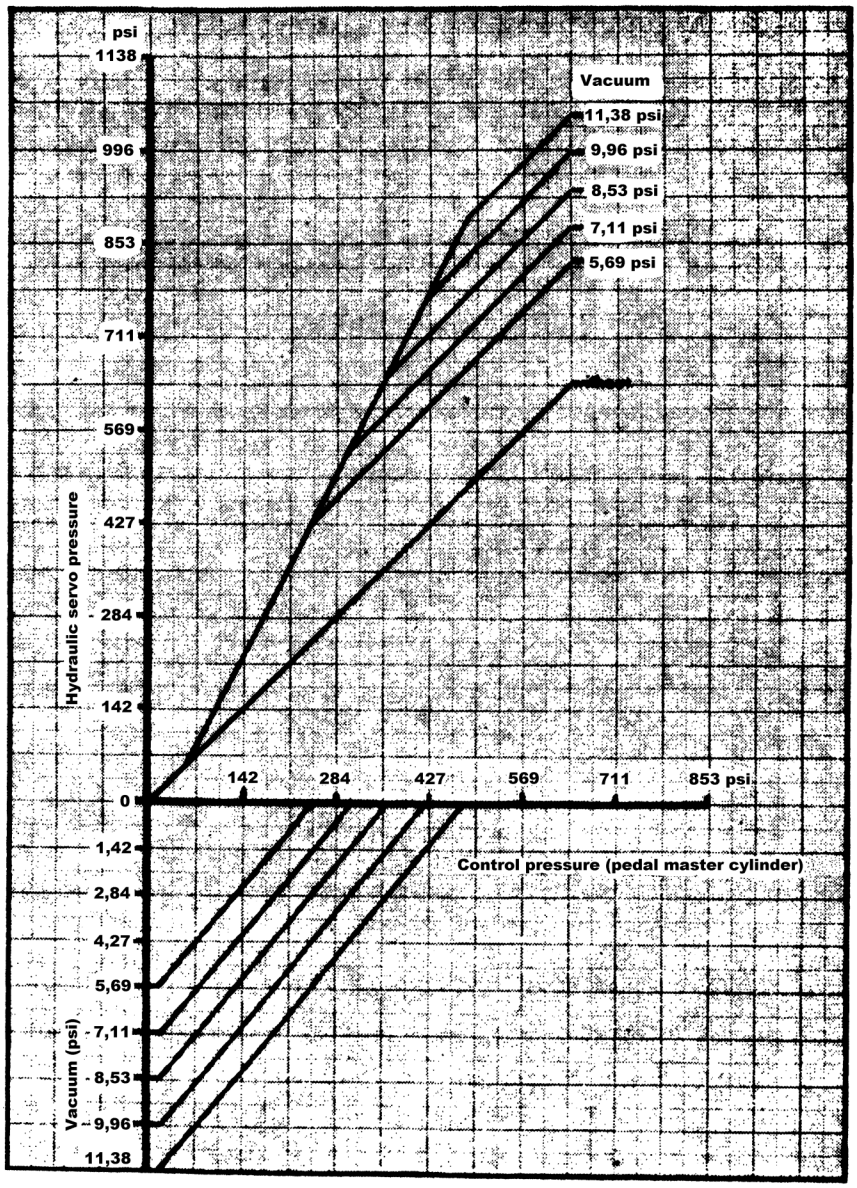


Fig. 6

Performance curves

Performance test with measuring instruments

Connect one vacuum gage between the intake manifold and the power unit and a second vacuum gage at the plug port (55) (cylinder shell lubrication port). At bleed screw opening of a wheel cylinder attach a properly bled hydraulic gage. Start engine and observe vacuum gages, both of which should indicate manifold vacuum. (The gage reading at the lubrication port may be slightly lower than manifold vacuum due to vacuum check valve.) Depress brake pedal and observe vacuum gage at the lubrication port of power unit and hydraulic gage at wheel cylinder. With increase in pedal pressure, the vacuum should decrease and the hydraulic pressure should correspondingly increase according to performance curve (fig. 6).

If the hydraulic pressure does not correspond to values given in curves, the power unit should be removed from vehicle and repaired or replaced. Repair work should be carried out only by specialists and it is absolutely necessary that the corresponding special tools, as well as testing and measuring devices are at their disposal.

MAINTENANCE

Removal from vehicle

1. Disconnect hydraulic lines from power unit T 50. (The line from pedal master cylinder is attached to the end plate beneath the slave cylinder tube and the line to the wheel cylinders is attached at the slave cylinder end cap.) Plug open lines to prevent entrance of dirt.
2. Disconnect vacuum line from end plate vacuum port of vacuum check valve.
3. Separate power unit from vehicle mounting bracket.

Disassembly and Reassembly Procedure

When disassembly is made of a power unit which has been in service for a long period of time it is recommended that the repair kits and seals, and other parts necessary for replacement be obtained prior to disassembly (see page 28). After disassembly is completed in the following steps, wash all parts in alcohol. (Use only alcohol on rubber parts or parts containing rubber.) Use an air hose to blow dirt and cleaning fluid out of all internal passages. It is important to place the cleaned parts on clean paper or cloth.

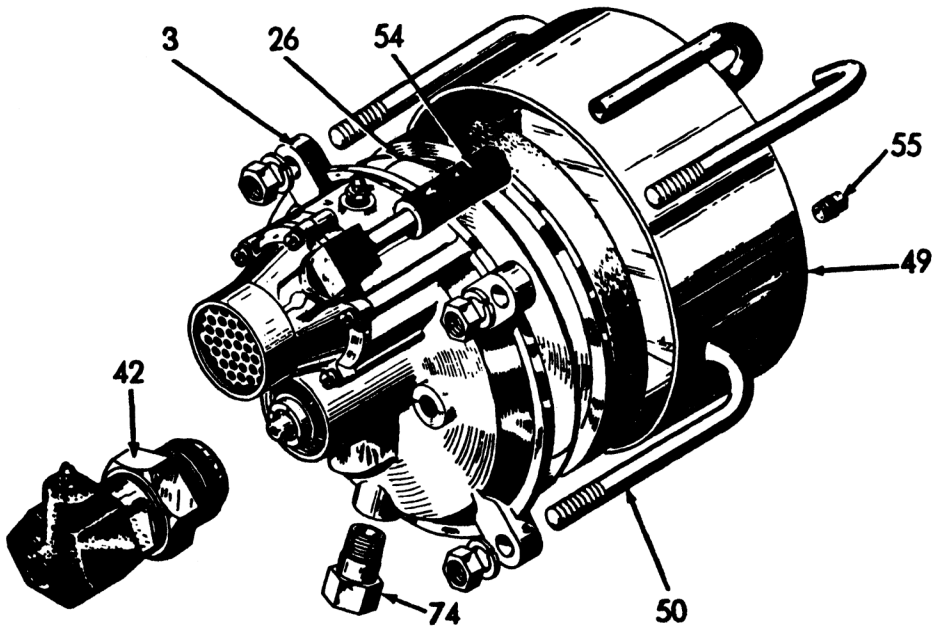


Fig. 7

Removal of vacuum cylinder, hydraulic slave cylinder and vacuum check valve from end plate

1. As an aid for reassembly, scratch alignment marks between cylinder shell (49) and end plate (3). Slide hose connector (54) on control tube.
2. Loosen nuts of hook bolts (50) to disengage bolts from cylinder shell (49). (see fig. 7)
3. Remove cylinder shell (49) and gasket (26) from end plate. If shell sticks to end plate, tap shell with fibre mallet to loosen. Remove pipe plug (55) and remove hook bolts from end plate.
4. Loosen tube nut (42) and unscrew slave cylinder assembly from end plate.
5. Remove check valve (74).

After cleaning of vacuum cylinder shell, inspect bore for scoring or dents. Rust or corrosion can be removed with fine emery cloth.

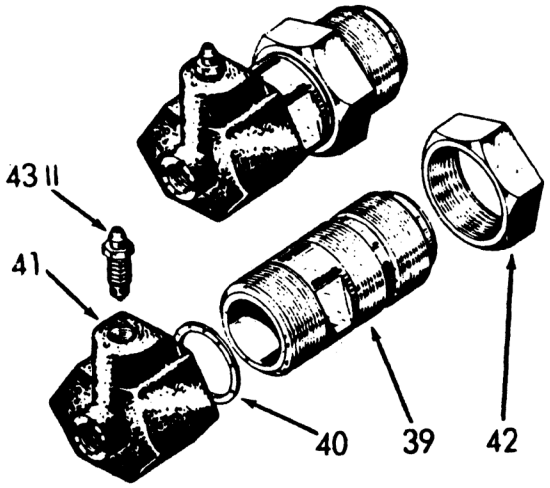


Fig. 8
Slave cylinder disassembled

Disassembly of hydraulic slave cylinder

(see fig. 8)

1 Unscrew tube nut (42) from slave cylinder tube (39).

2. Clamp end cap (41) in vise and with an end wrench on flats of slave cylinder tube, remove tube (39) and gasket (40).

3. Remove bleed screw (43 II) from end cap.

After cleaning parts, inspect bore of slave cylinder tube for scoring or points of excessive wear, also sealing surfaces. Replace copper gasket (40) with a new part when reassembly is made.

Reassembly of hydraulic slave cylinder

1. Place new gasket (40) in end cap (41) and screw in cylinder tube (39).
2. Clamp end cap in vise and tighten tube against gasket. Screw tube nut (42) onto tube.
3. Place bleed srew (43 II) in end cap – do not tighten.

Disassembly of vacuum check valve

(Fig. 9)

1. Remove snap ring (48).
2. From valve body (44), lift out spring retainer (47), spring (46) and ball (45).

After cleaning parts, inspect ball seat in valve body for scoring or corrosion. It is recommended that ball (45) be replaced when valve is reassembled.

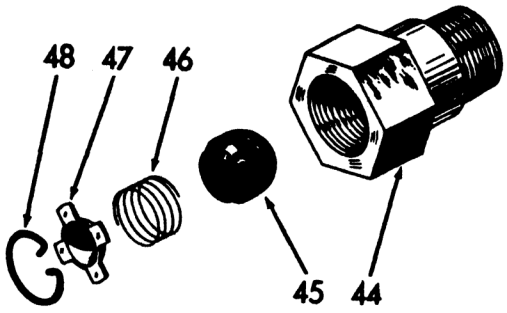


Fig. 9

Vacuum check valve disassembled

Reassembly of vacuum check valve

1. Place end of spring (46) over retaining step on ball (45) and insert into valve body.
2. Install spring retainer (47), centering in end of spring.
3. Insert snap ring (48) in place in groove in valve body.

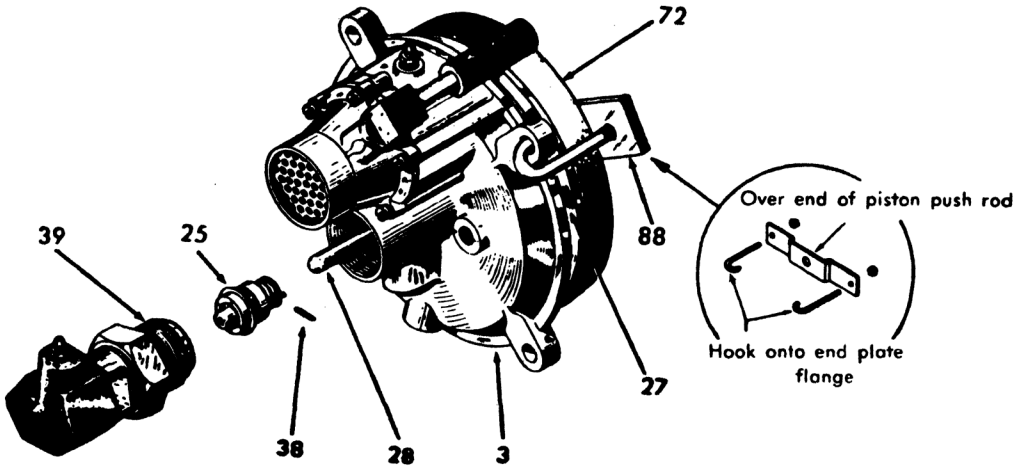


Fig. 10

Removal of hydraulic piston and power piston from end plate

Removal of hydraulic piston and power piston from end plate

1. Push in power piston (72), compressing return spring (27), so that hydraulic piston (25) protrudes from end plate (3). As an aid for holding power piston in place, special bracket AW 76957 with the hook bolts AW 76956 (88) can be used. (see page 27)
2. To disengage hydraulic piston from push rod (28, pull back spring on piston and remove retainer pin (38).

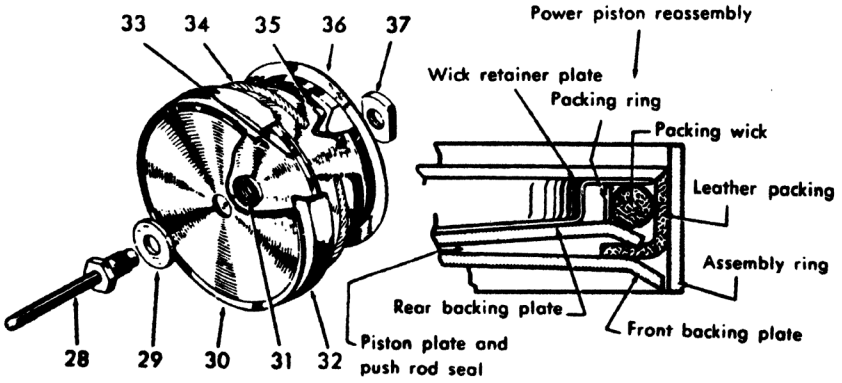


Fig. 11
Disassembly and reassembly of power piston

Disassembly of power piston

1. Using care to protect finished surface of push rod (28) when clamping hex of push rod in vise and removing nut (37) with end wrench.
2. From push rod separate wick retainer plate (36), packing ring (35), packing wick (34), rear backing plate (33), leather packing (32), push rod seal (31), front backing plate (30) and push rod washer (29). After cleaning parts, inspect push rod surface for score marks running in direction of axis of rod. Replace push rod seal, leather packing, packing wick, and packing ring with new parts when piston is reassembled.

Reassembly of power piston

(see cross-section fig. 11)

1. Place assembly ring (see special tools, page 27) flat on work bench, and front backing plate with edge down into ring.
2. On plate place new leather packing and new push rod seal, and over seal and packing place rear backing plate with edge down as shown.

3. Dip new wick into specified mineral oil, let excess oil drip off and coil wick inside of packing. Insert new packing ring inside of wick (with barbs of ring pointing up into wick) and engage notch of loop end of ring with hook at opposite end.
4. Place wick retainer plate over assembled parts with "cut out" coinciding with loop of ring.
5. Place push rod washer (29) on threaded end of push rod (28) and clamp hex in vise.

   Place assembled parts with assembly ring on threaded end of push rod with front backing plate against the push rod washer. Be sure piston plate and push rod seal (31) is in alignment.
6. Tighten push rod nut (37) against push rod washer. Do not remove assembly ring until ready to assemble piston into cylinder shell.

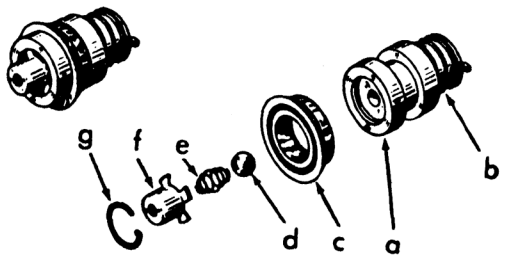


Fig. 12
Hydraulic piston disassembled

Disassembly of hydraulic piston

1. Remove cup (c) from piston.
2. Remove snap ring (g), ball retainer (f), ball spring (e) and ball (d).
3. The rest of piston should not be further disassembled. After cleaning parts, inspect ball seat. Replace snap ring, ball and cup with new parts when piston is reassembled.

Reassembly of hydraulic piston

1. Place new ball (d) on seat in piston (a), insert spring (e) and ball retainer (f), and install new snap ring (g).
2. Coat new cup (c) with brake fluid and insert in recess of piston with lip toward check ball assembly.

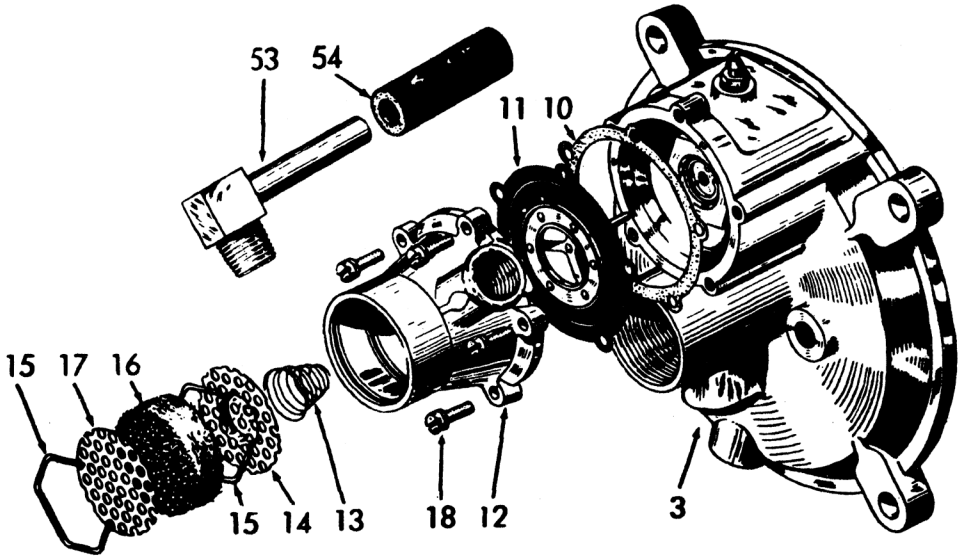


Fig. 13
Removal of air cleaner, valve cover and diaphragm from end plate

Removal of air cleaner, valve cover and diaphragm from end plate

1. Disengage outer snap ring (15), hair retainer (17) and filter packing (16).
2. Remove inner snap ring (15), spring retainer (14) and spring (13).
3. Scratch alignment marks beween valve cover (12) and end plate (3).
4. Remove cover screws (18) and separate valve cover (12), diaphragm (11) and gasket (10) from end plate (3).
5. Remove hose connector (54) from control tube (53) and unscrew tube from valve cover.

After cleaning parts, inspect rubber poppets in valve cover. If poppets need replacing, do not attempt to remove poppets from cover, but replace the valve cover and poppets assembly. Replace diaphragm assembly (11) and gasket (10) with new parts, also poppet spring (13) and cleaner packing (16)

Reassembly of valve cover

(Fig. 13)

1. Center small coil of poppet spring (13) over end of atmosphere poppet and large coil of spring on spring retainer (14) which ist held by inner snapring (15).
2. Insert new cleaner packing (16), retainer (17) and outer snap ring (15).

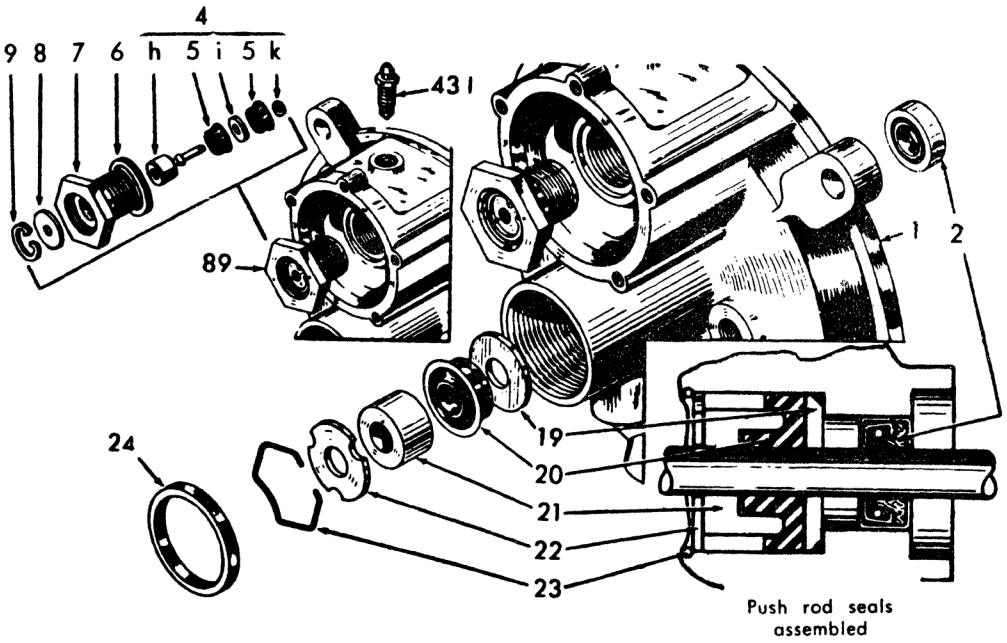


Fig. 14
Removal of valve piston and push rod seal from end plate

Disassembly of end plate

1. Remove cylinder end seal (24) from bore of end plate.
2. Remove snap ring (23), piston stop washer (22), cup retainer (21), diaphragm (20) and guide washer (19).
3. Drive out with a 9/16" O. D. rod leather seal (2).
4. Remove bleed screw (43 l).
5. With a 1 1/8" socket wrench, remove valve fitting assembly (89).

Disassembly of valve fitting
(Fig. 14)

1. Remove fitting seal (6).
2. Remove snap ring (9) and piston stop washer (8).
3. Push piston (4) with cups out of bore of fitting.

After cleaning parts, inspect bore of fitting. Replace seal (6), snap ring (9) and piston (4) with cups with new parts.

Reassembly of valve fitting
(Fig. 14)

1. Coat new piston cup and bore with brake fluid before inserting piston.
2. Insert piston (4) with cups.
3. Insert piston stop washer (8) and snap ring (9).

4. Replace new seal (6) over threaded end of fitting.

After cleaning end plate and push rod seal parts, inspect end plate bore and seat for seal. If scratches are found, replace end plate. Snap ring (23), cup (20), guide washer (19), seal (24) and leather seal (2) should be replaced by new parts.

Reassembly of end plate
(Fig. 14)

1. Screw in valve fitting (89) and tighten. Replace bleed screw (43 I) loosely.
2. Press in new leather push rod seal (2) with lips pointing in.
3. Place new guide washer (19) in bore of end plate withe chamfered side toward leather seal. Install new cup (20), cup retainer (21), piston stop washer (22) and new snap ring (23).
4. Place new slave cylinder end seal (24) against shoulder in end plate bore.

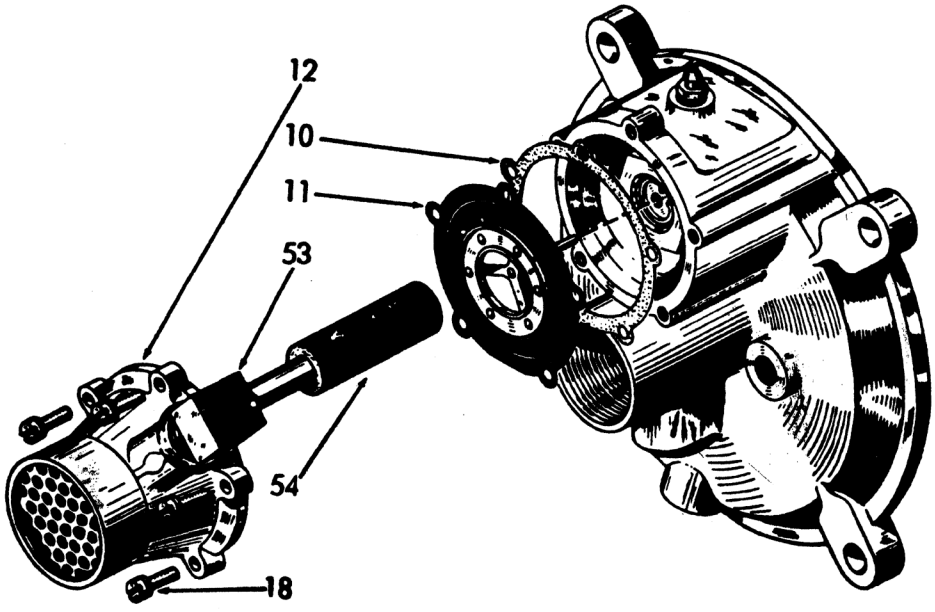


Fig. 15
Reassembly of valve cover to end plate

Reassembly of valve cover to end plate

1. Place thread compound on threads of control tube (53) and screw tube into valve cover (12). Slide hose connector (54) onto control tube.
2. Align new gasket (10) and new diaphragm (11) with end plate.
3. Observing alignment marks, assemble cover to end plate with 5 screws (18).

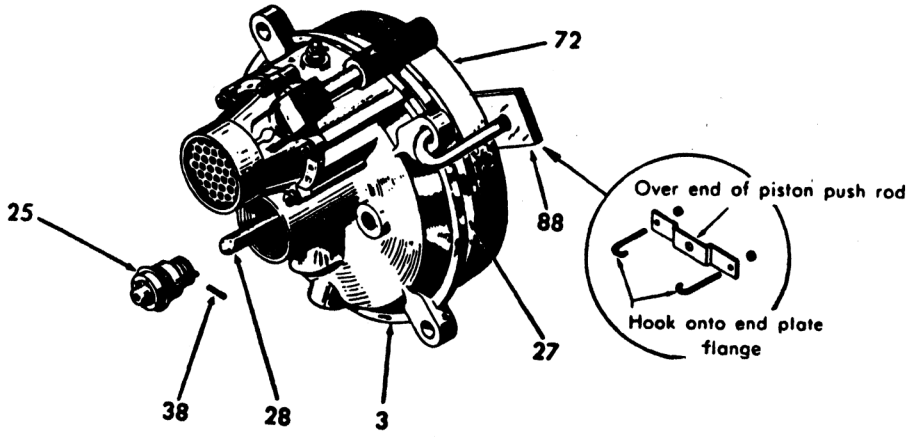


Fig. 16

Reassembly of power piston, slave cylinder piston and slave cylinder to end plate

Reassembly of power piston, slave cylinder piston and slave cylinder to end plate

(Fig. 16)

1. Remove assembly ring from power piston (72) and coat push rod (28) with brake fluid. With large coil of return spring (27) against end plate, push road (28) through seal and washer parts of end plate. Hold in place with special bracket AW 76957 and hook bolts AW 76956 (88) which were used in disassembly.
2. Pull back spring (25) and attach piston to push rod (28) with new pin (38).
3. Coat bore of cylinder (39, fig. 10, page 15) with brake fluid and insert piston (25).
4. Screw slave cylinder assembly into end plate (3) by hand as far as possible. Tighten tube nut against end plate.
5. Remove bracket tool AW 76957 and hook bolts AW 76956.

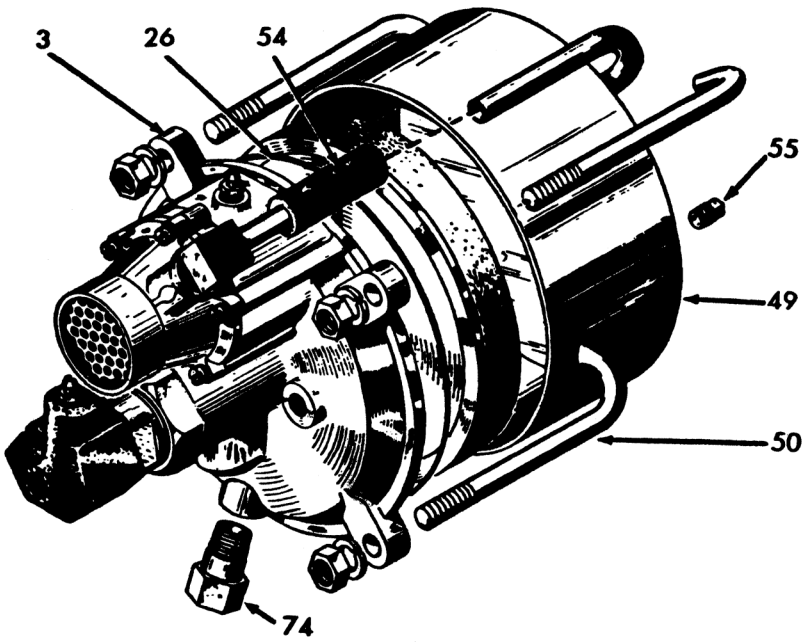


Fig. 17

Reassembly of vacuum cylinder and check valve to end plate

Reassembly of vacuum cylinder and check valve to end plate

1. Place new end plate gasket (26) in groove.
2. Coat bore of vacuum cylinder (49) and lip of piston packing with specified mineral oil. Insert piston into vacuum cylinder, observing end plate and cylinder alignment marks.
3. Clamp vacuum cylinder with 4 hook bolts (50) to end plate. Slide hose connector (54) onto tube of vacuum cylinder.
4. Screw in plug (55) and valve connector (74) in vacuum cylinder, resp. end plate and use new gaskets.

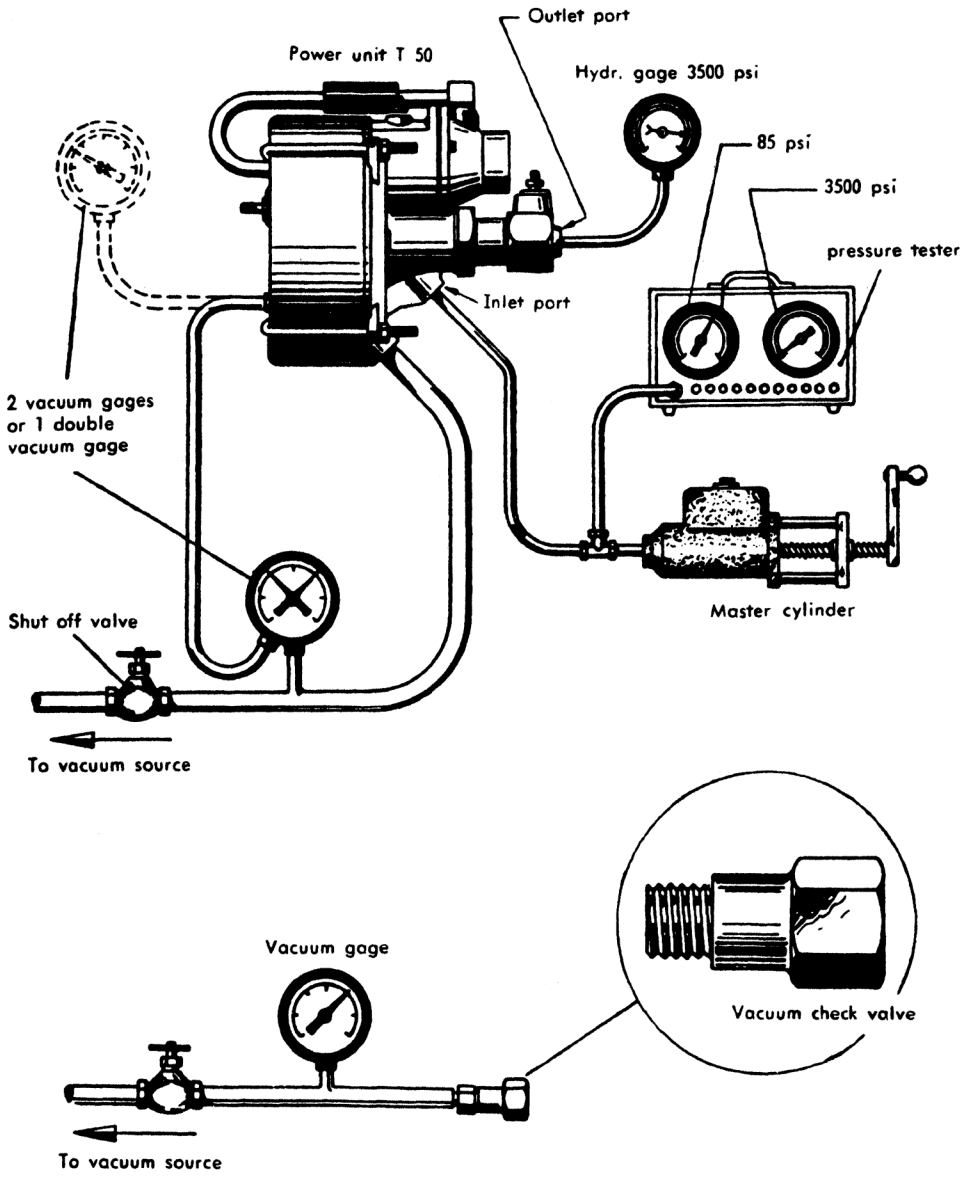


Fig. 18

Bench testing equipment for power brake unit T 50 and vacuum check valve

Bench testing power brake unit T 50

(Fig. 18)

All test apparatus must be checked for possible vacuum- or hydraulic leaks prior to bench testing.

Required equipment

1. Two accurate vacuum gages or a double gage.
2. A hydraulic gage 0–3500 psi (for slave cylinder) and an ATE-pressure tester AW 35954.
3. Vacuum source for – 8,5 to – 11,4 psi and a shut-off valve.
4. A master cylinder with hand crank AW 76934 to supply hydraulic pressure.

Test

Remove vacuum check valve before starting test.

1. **Visual check**

   Check unit visually for defects such as omitted, damaged, or improperly assembled parts.

2. **15 psi-Low pressure check**

   Attach master cylinder with hand crank to input port and pressure tester. Attach hydraulic gage (0–3500 psi) to output port of slave cylinder. (see fig. 18.) After bleeding apply 15 psi pressure and hold. The unit should not leak more than one psi in the full minute.

3. **2000 psi-High pressure check**

   Raise hydraulic pressure at outlet port to 1800–2100 psi and hold. Pressure should not drop more than 200 psi in 15 seconds.

4. **1000 psi-Intermediate pressure check**

   Decrease pressure to 900–1100 psi. Pressure should not drop more than 25 psi in the full minute. Release hydraulic pressure.

   If leakage is indicated in one of the above hydraulic tests, inspect for faulty slave cylinder tube seals, push rod hydraulic cup, or valve piston cup and valve fitting seal.

5. **Vacuum leakage check – power brake unit in release position**

   This check should be made without a vacuum reserve tank. The hose length between the vaccum shut off valve and the power unit vacuum should not be more than 12 inches.

   With hydraulic pressure completely released, attach vacuum line to power brake unit and apply 5,7 psi-vacuum to unit. After vacuum is shut off, leakage should not be greater than – 0,43 psi in 15 seconds.

If leakage is indicated, inspect for defective end plate-cylinder shell seal, atmosphere poppet, valve cover gasket, or hose connector (54) on control tube.

6. Operational tests

Attach a vacuum gage to lubrication plug opening of vacuum cylinder and one at the line to vacuum source. In case a double vacuum gage is used, attach one connection to lubrication port and the other one to vacuum source.

Use also:
ATE-pressure tester at the master cylinder with hand crank and a hydraulic gage (0–3500 psi) at the slave cylinder of the power unit. Apply hydraulic pressure slowly until a vacuum differential of – 0,28 to – 0,74 psi is indicated. The input hydraulic pressure should not be greater than 25 psi.

Increase hydraulic pressure gradually until a vacuum differential of 5,7 psi is reached.

Check control pressure at the master cylinder (369–426 psi) and the pressure at the slave cylinder (667–795 psi) according to performance curve (fig. 6). If values do not fall within the limits given, check for faulty control valve parts. (If unit applies automatically during above operation, leak past the hydraulic piston cup or ball check is indicated.)

With unit fully applied, check for vacuum leakage as in test 5. Leakage, in excess of value given in test 5, indicates a faulty vacuum poppet in control valve or leakage past power piston packing.

Release hydraulic pressure until 15 psi is indicated. The vacuum differential should not be over –0,74 psi.

7. Restriction test

With vacuum lines removed from power unit and gage removed from output port, apply master cylinder and observe fluid flow from power unit output port. Remove hydraulic line from input port and attach to power unit output port. Apply master cylinder and observe fluid flow from input port. The flow in the latter case **should not** be restricted. If restriction is indicated, the power piston ist not returning to its complete released position. Inspect for power piston friction. (Also check for faulty hydraulic piston yoke.) After bench testing is completed, remove test equipment and use air pressure to blow out excess brake fluid from slave cylinder.

Testing of vacuum check valve

(Fig. 18)

Test should be made without a reserve tank and the hose connection between the valve and vacuum source should not exceed 6 " length. Valve is to be tested at a vacuum of –5,7 psi. After vacuum is shut off, leakage should not be greater than 0,43 psi pressure drop in 15 seconds. If leakage is indicated, inspect valve for defective ball or ball seat.

Shipping and storage

Opening of vacuum check valve and hydraulic ports should be plugged to prevent entrance of dirt and dust.

The units should be stored with the axis of the push rod in horizontal position to prevent excess vacuum cylinder oil from the power piston from coming into contact with rubber parts around the push rod. The power brake unit should not be stored more than 6 months to prevent congealing of the brake fluid following bench test of unit. The manufacturing date is stamped on the end plate.

Preventive maintenance

The periodic inspection of the power brake unit T 50 and brake system can be very beneficial to the vehicle owner or operator.

Vacuum line

Inspect for loose connections at engine intake manifold and at vacuum check valve. Vacuum line should be free of restriction or obstruction and should show no signs of collapse.

Hydraulic lines and fittings

Check all lines and hoses, as well as all connections for leakage. Abrasion and restrictions should not be present.

Brakes and wheel cylinders

Inspect wheel cylinders for leakage, as well as adjustment of brakes and linings.

Pedal master cylinder and pedal

Periodically check fluid level in master cylinder reservoir. Excessive fluid loss may indicate leakage in brake system. Inspect pedal privots or linkage for binding.

Power brake unit T 50

Check hydraulic input and output ports for fluid leaks. Observe for leakage around slave cylinder tube at end plate and end cap. Inspect air cleaner opening for obstruction. The air cleaner should not be subjected to excessive road dirt. Replace cleaner packing, if necessary.

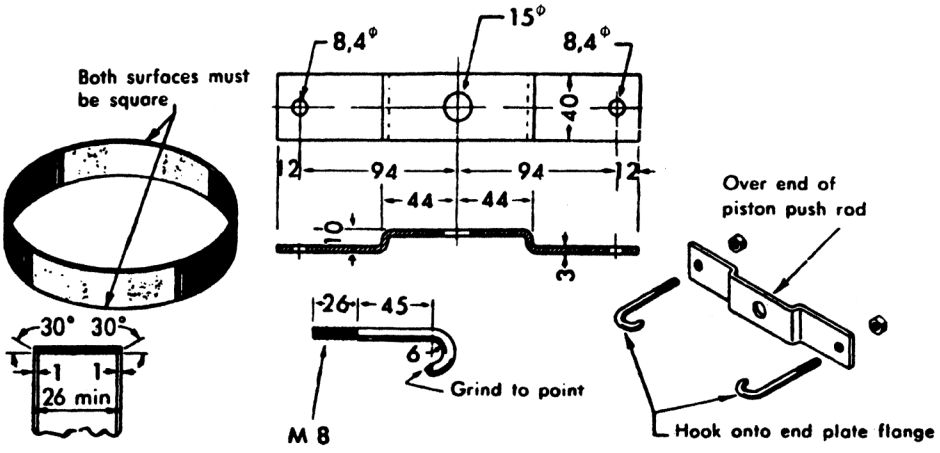


Fig. 19

Special tools

Fig. 19 illustrates two tools required in the disassembly and reassembly of the power brake unit T 50.

A. Assembly ring AW 76955 required to reassembly power piston. The ring can be made from a section of vacuum cylinder.

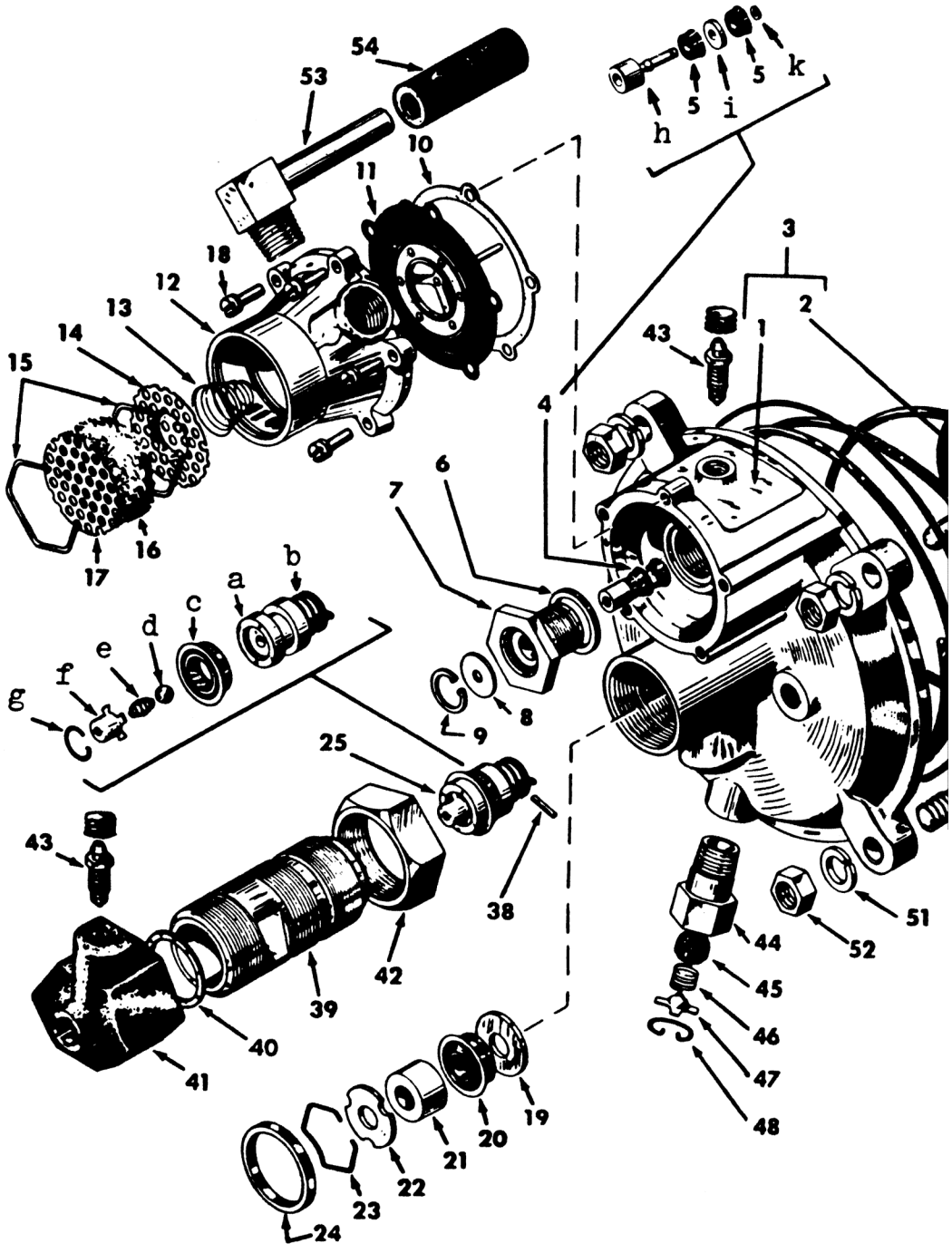
B. Piston clamping bracket AW 76957 and two hook bolts with nuts AW 76956 to be used as an aid in disengaging and attaching hydraulic piston to push rod.

SERVICEABLE PARTS OF THE POWER BRAKE UNIT T 50

Key Nr.	Part	No. req'd
1	End plate	1
2	Leather seal	1*
3	Assembly-End plate and seal	1
4	Cup-Valve piston	1*
5	Piston-Valve	1
6	Seal-Valve fitting	1*
7	Fitting-Valve	1
8	Stop-Valve piston	1
9	Snap ring	1*
10	Gasket	1*
11	Diaphragm-Ass'y	1*
12	Assembly-Cover and poppets	1
13	Spring-Poppet	1*
14	Retainer	1
15	Snap ring	2*
16	Hair-Air cleaner	1*
17	Retainer-Hair	1
18	Screw and lockwasher	5
19	Guide washer-Push rod	1*
20	Cup – Push rod	1*
21	Retainer-Cup	1
22	Washer – Piston stop	1
23	Snap ring	1*
24	Seal – Slave cylinder end	1*
25	Ass'y – Hydraulic piston containing parts a–g	1
25 a	Piston	1
25 b	Spring	1
25 c	Cup	1*
25 d	Ball	1*
25 e	Spring	1*
25 f	Retainer-Ball	1
25 g	Snap ring	1*
26	Gasket-Endplate	1*
27	Spring	1
28	Push rod	1
29	Washer	1
30	Plate-Piston (front)	1
31	Seal-Plates and push rod	1*
32	Packing-Piston	1*
33	Plate-Piston (rear)	1
34	Wick-Packing	1*
35	Ring-Piston packing	1*
36	Retainer-Wick	1
37	Nut-Push rod	1
38	Pin-Piston	1*
39	Cylinder tube	1

Key Nr.	Part	No. req'd
40	Gasket-End cap	1*
41	End cap	1
42	Nut	1
43	Screw-bleed	2
44	Valve body and gasket	1
45	Valve seal	1*
46	Spring	1
47	Retainer-Valve spring	1
48	Snap ring	1
49	Shell-Vacuum cylinder	1
50	Hook bolt	4
51	Lockwasher	4
52	Nut-Hook bolt	4
53	Tube-Vacuum	1
54	Hose-Vacuum	1*
55	Plug	1

*: Are wearing parts and must be closely inspected at repair work. They are contained in a repair kit.


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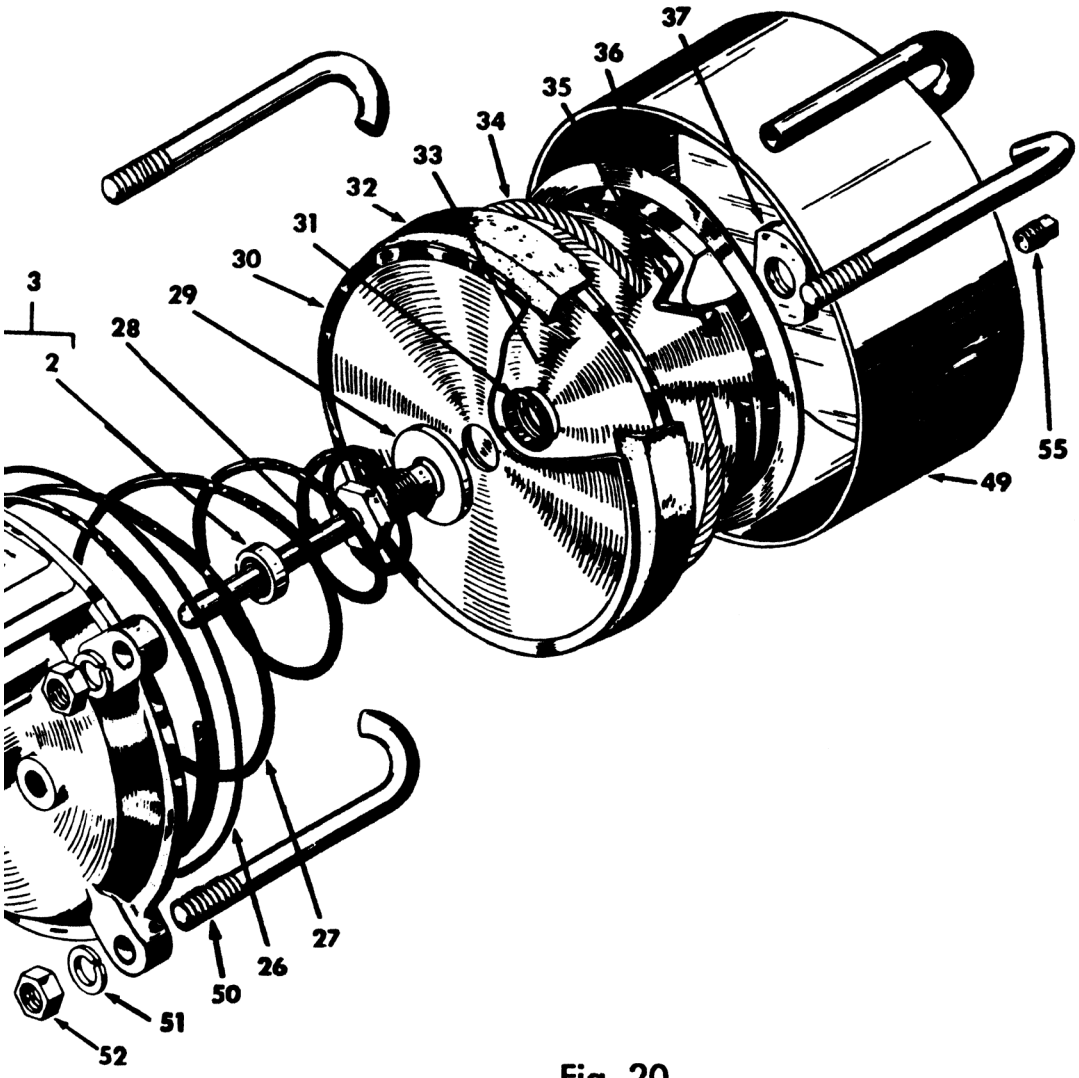


Fig. 20

Serviceable parts of the ATE-power brake unit T 50

TROUBLE SHOOTING

Complaint	Source of trouble	Remedy
I. Hard pedal	1. Vacuum failure due to: a) Collapsed, restricted, or loose vacuum line. b) Low manifold vacuum (less than 15-16" Hg. at engine idle) c) Leaking atmosphere poppet of control valve. 2. Bound up pedal	1. a) Check vacuum hose, fittings and check valve. Replace or repair faulty lines and fittings. b) If trouble is indicated at engine (low vacuum), have engine serviced. c) Replace valve cover (12). 2. Inspect pedal shaft and linkage for points of possible binding. Lubricate pivot points.
II. Upward movement of pedal and subsequent high foot pressure.	Leaky ball valve of slave cylinder piston.	Inspect ball seat of slave cylinder piston and ball. Replace damaged parts
III. Irregular or insufficient braking.	1. Glazed linings. 2. Grease or brake fluid on linings. 3. Sticking wheel cylinder pistons.	1. Clean lining with emery cloth and wipe out brake drum. 2. Replace linings (always axlewise) 3. Disassemble wheel cylinder, repair or replace parts.
IV. Grabby brakes	1. Linings not chamfered or badly riveted. 2. Grooved or out-of-round brake drums.	1. Chamfer linings or reline. See that linings fully contact brake shoes. 2. Resurface brake drums or replace them.

Complaint	Source of trouble	Remedy
V. Pedal goes to floor	1. To much play between shoes and drums. 2. Hydraulic leakage at: a) master cylinder or in line to power unit T 50. b) wheel cylinders, brake hoses or line to wheel cylinders. See also VII.	1. Adjust brakes or replace worn linings. 2. a) Inspect and, if necessary, replace primary cup and residual check valve in master cylinder, check also piping. b) Inspect wheel cylinders, hoses and piping. Replace faulty parts.
VI. Pedal is "spongy"	Evidence of air being in the hydraulic system.	Thoroughly bleed system and check fluid level in reservoir, replenish if necessary.
VII. Reservoir needs frequent replenishing with brake fluid	Leakage in the hydraulic system. See also IV.	Check system for leakage. (reservoir, connecting pipe to master cylinder, secondary master cylinder cups, connections at master cylinder, stoplight switch, slave cylinder tube (39) and connections at T 50, piping, hoses and wheel cylinder.
VIII. Reservoir needs frequent replenishing with brake fluid, and exhaust smokes densely during brake application.	1. a) Cups (5) of control valve piston (4) are damaged. b) Brake fluid is heavily contaminated. 2. a) Cup (20) on push rod (28) is damaged. b) Brake fluid is heavily contaminated.	1. a) Replace complete control piston (4). b) Clean entire braking system as per specification and fill with ATE-BLUE-ORIGINAL BRAKE FLUID. 2. a) Replace cup (20) b) Clean entire braking system as per specification and fill with ATE-BLUE-ORIGINAL BRAKE FLUID.

Complaint	Source of trouble	Remedy
IX. Brakes fail to release	1. Compensating port in master cylinder clogged-up or covered up by primary cup. 2. Brake shoes fail to return to their starting position. 3. Swollen rubber parts due to the use of unsuitable brake fluid or mineral oil. 4. Vacuum power piston does not return to its end position. 5. Ball valve in slave cylinder piston is not lifted from its seat.	1. Clean master cylinder or set play at master cylinder push rod according to specification. 2. Check brake shoe return springs, wheel cylinder cups, wheel cylinder pistons, automatic adjustment and replace defect parts. 3. Disassemble entire brake system, clean as per specification, and replace all rubber parts, also those of the power unit, including hoses and stoplight switch. Fill system with ATE-BLUE-ORIGINAL BRAKE FLUID. 4. Check leather cup (32), spring (27), push rod (28) and vacuum cylinder (49) and replace damaged parts. 5. Check slave cylinder piston (25) for fluid passage in both directions in released position and replace piston if necessary.