

POWER BRAKE BOOSTER AND MASTER CYLINDER

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DESCRIPTION AND OPERATION

POWER BRAKE BOOSTER

The vacuum power cylinder contains the power piston assembly which houses the control valve and reaction mechanism and the power piston return spring. The control valve is composed of the air valve and the floating control valve assembly. The reaction mechanism consists of a hydraulic piston, reaction plate, and a series of springs. An air filter element is assembled around the push rod and fills the cavity inside the hub of the power piston. This keeps dirt and dust from entering the vacuum booster. The push rod, which operates the air valve, projects out of the end of the power cylinder housing through a boot.

MASTER CYLINDER

The master cylinder is composed of a primary piston and secondary piston; it is supplied with fluid from two separate reservoirs. A check valve is mounted on the primary circuit which supplies fluid to the rear brakes. This keeps a slight static pressure in the rear brake system. When the pedal is depressed, the push rod moves the two pistons forward simultaneously until the seals of the two pistons cover the compensating ports in the cylinder. The pressure is increased in the two chambers simultaneously, thus supplying fluid to both front and rear brake systems.

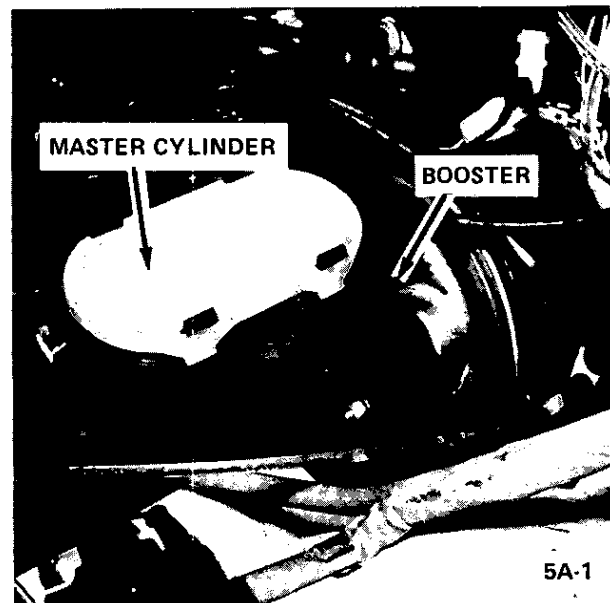
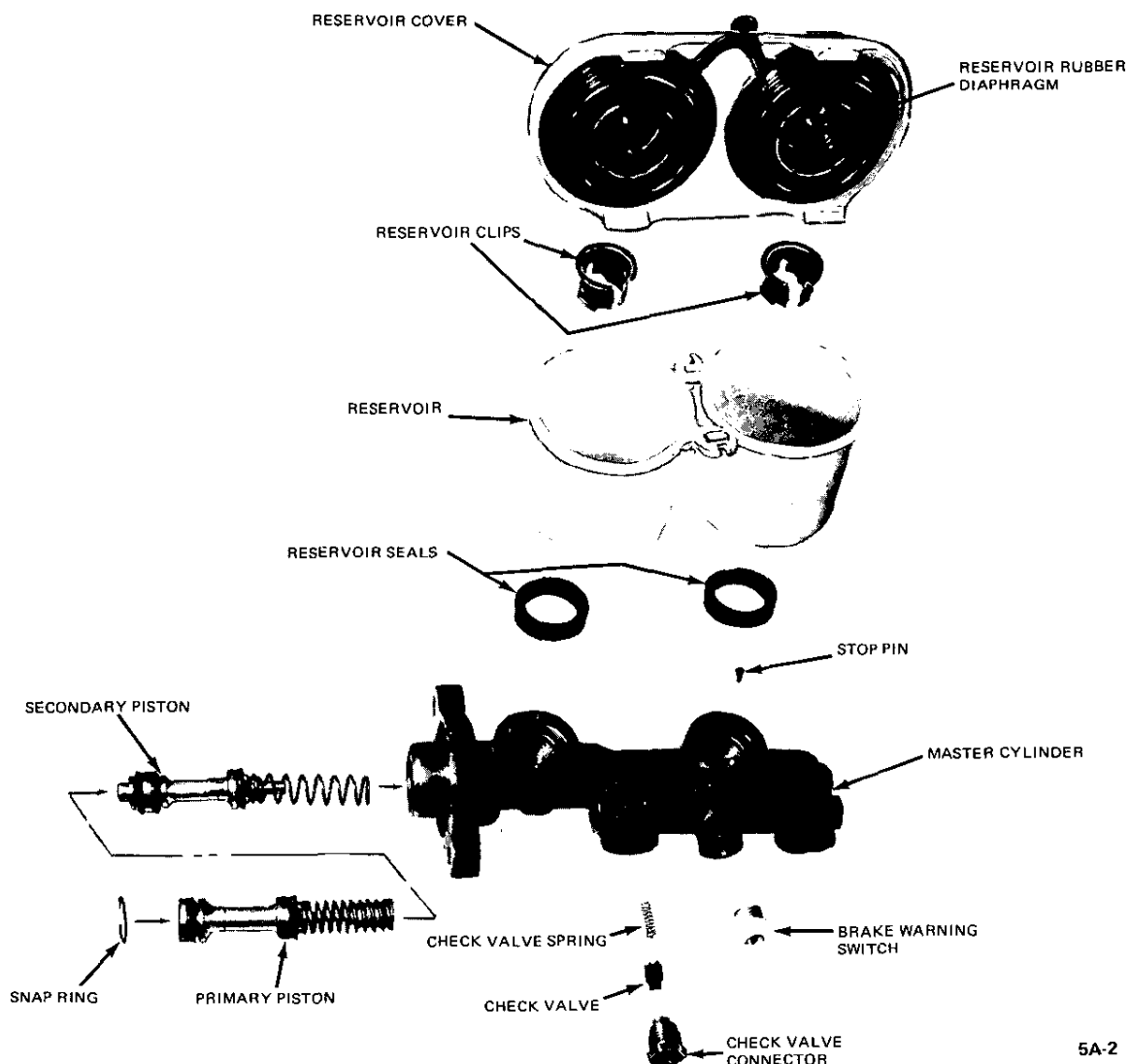


Figure 5A-1 Brake Booster Attachment (Opel 1900 and Manta)

In the GT, the brake fluid container is arranged at right angles to the tandem brake master cylinder. See Figure 5A-3. It is pushed over the feed port of the rear brake circuit onto the brake master cylinder and



5A-2

Figure 5A-2 Exploded View Master Cylinder (Opel 1900 and Manta)

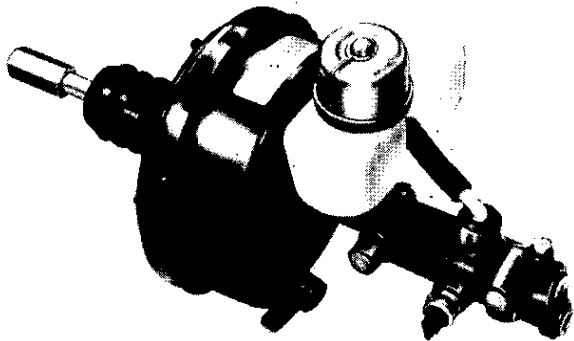
held in position by a retaining plate. The front brake circuit is connected to the brake fluid container by a hose and a connector. See Figure 5A-4.

An offset brake actuating rod, consisting of pedal rod, adjuster and connecting tube, is used between the brake pedal, the tandem brake master cylinder and brake booster respectively. The connecting tube is pressed onto the pedal rod and adjuster. The specified brake pedal free travel of 1/4 inch is obtained by adjusting the brake booster piston rod and lock nut of the adjuster.

VACUUM CONTROL VALVE

A vacuum control valve is installed into the vacuum

hose between the intake manifold and the brake booster and serves to prevent air from flowing back (vacuum release) when the engine is shut off. See Figure 5A-5. ***This valve cannot be disassembled and must be replaced when defective.*** To do this, the short hose should be used between the intake manifold and the vacuum control valve and the long hose between the vacuum control valve and the brake booster. Arrows on the valve housing indicate its correct position in the line. Should a vacuum control valve be installed backward no air could be drawn out of brake booster, thus rendering it inoperative. Hose clamps should be installed to prevent the possibility of vacuum leaks.



5A-3

Figure 5A-3 Power Brake Master Cylinder (GT)

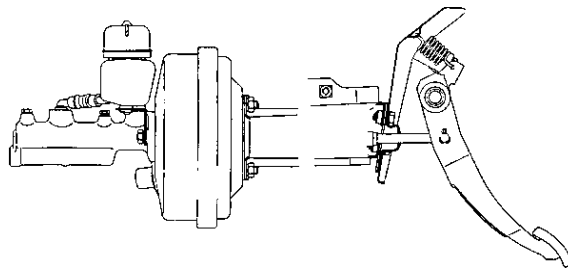
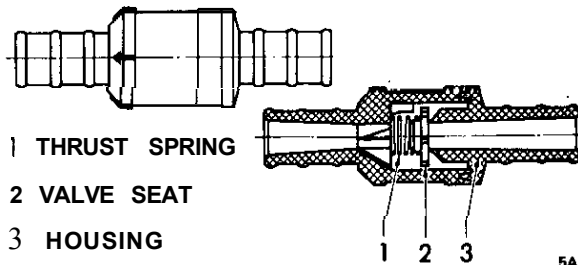


Figure 5A-4 Brake Pedal and Master Cylinder Attachment (GT)



5A-5

Figure 5A-5 Vacuum Control Valve

DIAGNOSIS

POWER BRAKE UNIT TROUBLE DIAGNOSIS

Condition	Possible Cause	Correction
Hard Pedal	1. Broken or damaged hydraulic brake lines.	1. Inspect and replace as necessary.
	2. Vacuum failure.	2. Check for: a) Faulty vacuum check valve or grommet • replace. b) Collapsed or damaged vacuum hose • replace. c) Plugged or loose vacuum fitting • repair. d) Faulty air valve seal or support plate seal • replace. e) Damaged floating control valve.
	3. Defective diaphragm.	3. Replace
	4. Restricted air filter element.	4. Replace
	5. Defective apply piston seals.	5. Repair and replace master cylinder.
	6. Cracked or broken power pistons or retainer.	6. Replace power unit.

Condition	Possible Cause	Correction
Grabby Brakes (Apparent Off- and On Condition)	1. Broken or damaged hydraulic brake lines.	1. Inspect and replace, as necessary.
	2. Insufficient fluid in master cylinder.	2. Fill reservoirs with approved brake fluid check for leaks.
	3. Defective master cylinder seals.	3. Repair or replace, as necessary.
	4. Cracked master cylinder casting.	4. Replace
	5. Leaks at front disc brake calipers or rear wheel cylinders in pipes or connections.	5. Inspect and repair, as necessary.
	6. Air in hydraulic system.	6. Bleed system.
Brakes Fail to Release	1. Blocked passage in power piston.	1. Inspect and repair or replace, as necessary.
	2. Air valve sticking shut.	2. Check for proper lubrication of air valve "O" ring.
	3. Broken piston return spring master cylinder.	3. Replace
	4. Tight pedal linkage.	5. Repair or replace, as necessary.

MAINTENANCE AND ADJUSTMENTS

CHECKING BRAKE BOOSTER OPERATION

The operation of the brake booster can be checked by simple means and without any special devices.

1. With engine off, **first** clear the booster of any vacuum by depressing brake pedal several times.
2. Then depress brake pedal and start engine. If the vacuum system is working correctly, the brake pedal, kept under even foot pressure, moves farther downwards due to the additional pressure developed by the booster. Should the brake pedal not move farther downwards, the vacuum system is deficient. In this case check the vacuum hose to booster, to vacuum control valve and to engine intake manifold connections.
3. If the vacuum system operates properly, the defect is in the brake booster itself. A dirty filter impairs or

even prevents air from entering into the booster and thereby the formation of a difference in pressure in the vacuum cylinder.

Repairs cannot be carried out on the brake booster. If no deficiency can be found in the vacuum system or filter, the brake booster has to be replaced.

Under normal operating conditions the brake booster requires no service. However, under adverse conditions such as frequent driving on sandy or dusty roads, the filter and sound **deadener** should be replaced occasionally. To do so, the brake booster must be removed but it isn't necessary to detach the master cylinder.

BRAKE BOOSTER FILTER SERVICE

Under normal operating conditions the filter need not be exchanged for a new one.

Under adverse operating conditions - frequent driv-

ing on dusty and sandy roads - the filter and sound deadener should occasionally be replaced. To do so, brake booster has to be removed without detaching brake master cylinder.

Proceed as follows:

1. Remove protective cap (boot).
2. On the GT only, pry retainer from housing using a screwdriver. See Figure 5A-6.

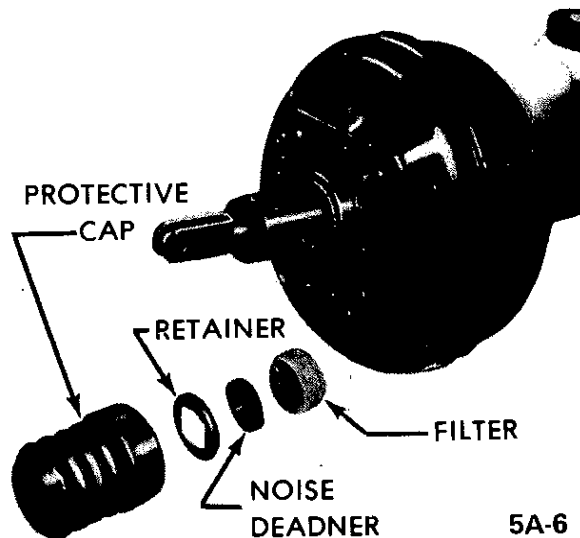


Figure 5A-6 Brake Booster Filter (GT)

3. With a pointed tool remove air silencer and filter out of control housing bore and pull it off thrust rod.
4. Install new **filter** and air silencer. On the GT, the smooth side of the filter must face towards the inside. The radial slots in filter and deadener must be staggered to each other by 180 degrees.
5. Slide retainer over control housing (GT only) and seal it with light plastic hammer strokes. Slide protective cap over control housing and slip it onto brake booster housing.

VACUUM CONTROL VALVE SERVICE

A vacuum control valve is installed into the vacuum hose between intake manifold and brake booster. It serves to prevent air from flowing back (vacuum release), when engine is shut off.

The vacuum control valve cannot be disassembled and has to be replaced, if defective. On replacement, note the following:

1. The vacuum control valve should be located near the intake manifold. Therefore, the short vacuum

hose has to be installed between intake manifold and vacuum control valve and the long hose between vacuum control valve and brake booster.

2. The arrows on the vacuum control valve housing must point towards the intake manifold, otherwise no air can be drawn out of the brake booster which renders the brake booster ineffective.
3. The connections of the vacuum hoses to the intake manifold, vacuum control valve and brake booster must be airtight. For this reason make sure, that the hose clamps are properly installed.

MAJOR REPAIR

BRAKE BOOSTER REMOVAL AND INSTALLATION

Removal

1. Disconnect brake pipes from master cylinder. Place a cloth under the master cylinder and brake pipes to absorb any brake fluid drippings.
2. Disconnect vacuum hose from brake booster.
3. Remove four nuts and washers attaching brake booster to brake booster support.
4. On the GT only, remove master cylinder support to fender skirt bolts.
5. On the GT, loosen thrust rod lock nut and unscrew the piston push rod while holding the master cylinder brake booster assembly. On the Opel 1900 and Manta, remove the nut and bolt attaching clevis on the pedal.
6. Remove assembly from car.
7. Disconnect master cylinder from brake booster.

Installation

CAUTION: *Fasteners in the following steps are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part or lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

1. Using a new front housing seal, assemble master

cylinder to **brake** booster and torque nuts to 14 **lb.ft.** on the GT and 12 **lb.ft.** on the Opel 1900 and Manta.

2. Position assembly into brake booster bracket and, on the GT only, thread piston push rod onto the thrust rod.
3. Install brake booster to support attaching washers and nuts and tighten to 11 **lb.ft.** of torque.
4. On the GT install master cylinder support to inner fender skirt bolts.
5. Connect vacuum hose to brake booster.
6. By turning the piston push rod on the thrust rod, (GT only) adjust until the brake pedal free travel is 1/4 inch and tighten the lock nut.
7. Connect brake pipes to master cylinder and bleed brakes.

MASTER CYLINDER OVERHAUL. GT

Removal of Master Cylinder

1. Disconnect the two brake pipes from the master cylinder.
2. Remove the front support to skirt attaching bolts, the cylinder to booster retaining nuts and lift out master cylinder.

Disassembly

1. Prior to brake master cylinder disassembly, pour brake fluid out of brake fluid reservoir, remove reservoir from master cylinder and take sealing plugs out of housing.
2. Screw static pressure valve(s) out of housing.
3. To facilitate disassembly, push piston somewhat into cylinder and insert a rounded off piece of welding rod approx. .12 in. thick into feed port to retain piston in this position.
4. Remove stop screw and snap ring out of housing and take out both pistons together with springs.
5. Remove stop screw from piston for rear brake circuit and remove all component parts. Remove also all component parts from intermediate piston of front brake circuit.

Cleaning and Checking

1. Clean parts with genuine brake fluid, Delco Supreme No. 11, or equivalent. Do not use any other cleaning solvents. Dry with compressed air. Free up compensating and feed ports.

2. Polish cylinder bore of housing with crocus cloth. If lapping scores and rust spots are still noticeable, replace brake master cylinder assembly.

3. **Check** inner components for damage and replace, if required. The rubber seals and static pressure valve always have to be replaced.

Assembly

1. Assemble front and rear brake circuit pistons. Prior to assembly coat rubber seals with brake fluid.

2. Coat cylinder bore, piston sliding surfaces and seals with brake fluid.

3. Insert preassembled intermediate piston for front brake circuit together with thrust spring and spring seat into cylinder bore. The smaller diameter of the tapered thrust spring must face piston.

4. With a drift, push piston (against spring pressure) into housing and insert a piece of welding rod **into** feed port of front brake circuit to retain piston.

5. Install stop screw with new seal ring into housing and tighten.

6. Insert preassembled piston for rear brake circuit into cylinder bore and install snap ring into groove in housing.

7. Check piston for free movement by moving it to and fro. If required, place washers under the head of the stop screw.

8. Lightly push piston into housing and remove piece of welding rod out of feed port of front brake circuit.

9. With a rounded off piece of welding rod (.020 + .024 in.) check whether compensating ports are free.

10. Screw in new static pressure valve(s).

11. Coat new sealing plugs with brake fluid and insert them into housing. Push twin brake fluid container into sealing plugs and install screen and cover with seal ring.

Installation

1. Install master cylinder onto brake booster with washers and nuts. Torque to 14 **lb.ft.**

2. Attach the front mounting bracket.

3. Install brake lines on master cylinder, and bleed brakes.

4. If required, adjust mechanically actuated stop light switch. Pedal travel of $5/8$ " to 1" should actuate switch. Add or subtract washers between bracket and switch to obtain proper adjustment.

5. Road test car for proper brake performance.

MASTER CYLINDER OVERHAUL. OPEL 1900 AND MANTA

Removal of Master Cylinder

1. Remove master cylinder from brake booster by disconnecting brake pipes and removing two self-tightening nuts that secure master cylinder to brake booster. Be careful not to loosen the front housing seal.

Disassembly

1. Prior to brake master cylinder disassembly, **pour** brake fluid out of brake fluid reservoir.

2. Remove reservoir from master cylinder body by removing reservoir clips with snap ring pliers. See Figure 5A-7.

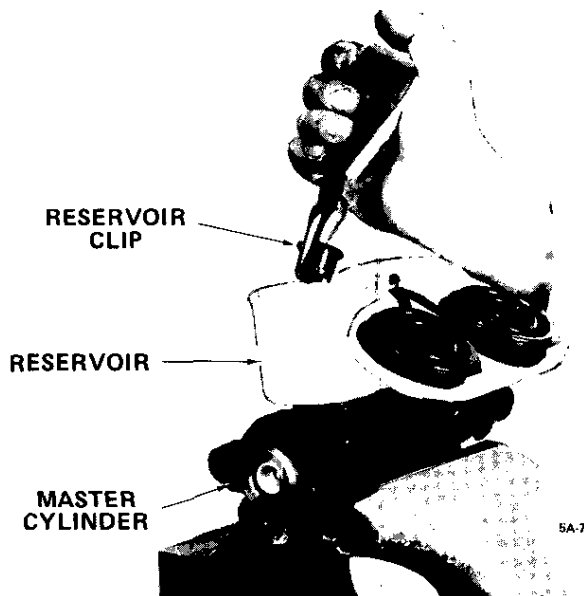


Figure 5A-7 Removing Reservoir Clips

3. Remove the piston stop screw which is fitted in master cylinder body.

4. Place master cylinder in a vise and push piston forward and insert a rod with a spherical end into the hole nearest the mounting flange. This will retain the piston in a forward position and allow for removal of snap ring. See Figures 5A-8 and 5A-9.

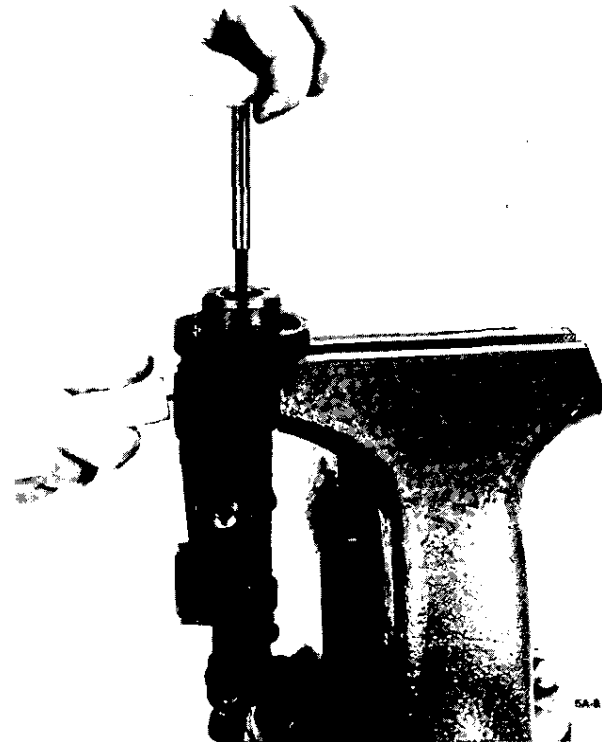


Figure 5A-8 Retaining Piston in Forward Position

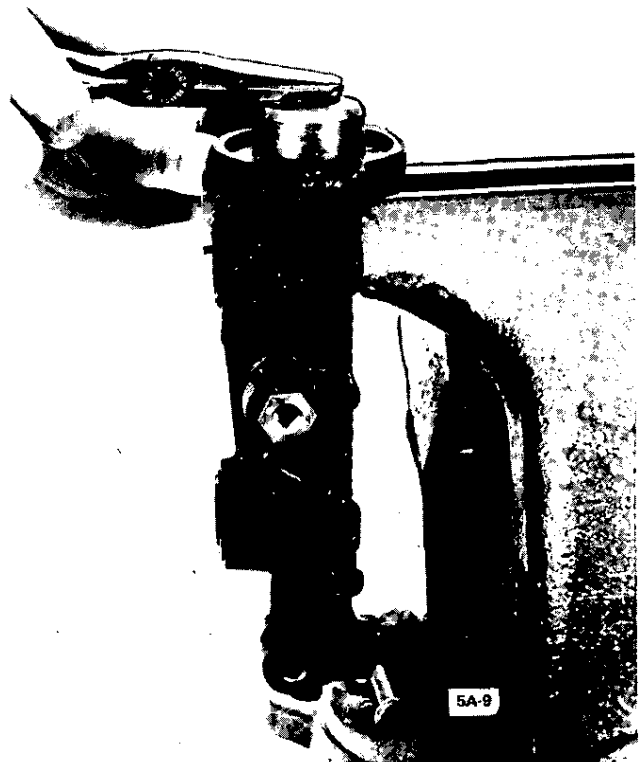


Figure 5A-9 Removing Snap Ring

NOTE: Snap *ring* should not be reused.

5. Remove primary and secondary pistons from cylinder.

6. Remove check valve by unscrewing check valve connection.

Cleaning and Checking

1. Clean parts with genuine brake fluid, Delco Supreme No. 11, or equivalent. Do not use any other cleaning solvents. Dry with compressed air. Free up compensating and feed parts.

2. Inspect cylinder bore for pits, scoring, cracks, nicks or other defects.

NOTE: *Whenever the master cylinder is overhauled, a new repair kit must be used.*

Assembly

NOTE: *Before reassembly double check that there is no foreign particles in the master cylinder bore or on any parts that are to be assembled into it.*

1. Coat master cylinder bore with clean brake fluid and install secondary and primary pistons.

2. Install new snap ring while holding primary piston in a forward position.

3. Install check valve spring, check valve and check valve connector and torque to 26 lb.ft.

4. Install stop screw.

5. Lubricate reservoir seals and remount on master cylinder body.

6. Install reservoir clips into reservoir and mount reservoir onto master cylinder without distorting seals. Do not force reservoir onto master cylinder.

7. Position reservoir cover onto reservoir.

Installation

1. Mount master cylinder to brake booster, using a new front housing seal if old one is damaged or distorted. Torque nuts to 12 lb.ft.

2. Install brake pipes to master cylinder and bleed brakes.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Brake Booster Size	7 in.
Brake Boost Ratio • (GT)	2.06 to 1
Brake Boost Ratio • (Opel 1900 and Manta)	2.64 to 1

	Name	Torque Lb.Ft.
Nut	Master Cylinder to Brake Booster (GT)	14
	Master Cylinder to Brake Booster (Opel 1900 and Manta)	12
Nut	Brake 'Booster to Support	11