GROUP 5 — BRAKES

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1 — SERVICE DIAGNOSIS — BRAKES

Condition	Possible Cause	Correction
HARD PEDAL	(a) Restriction in brake line.	(a) Check all hoses and lines for external damage. If no obvious damage bleed each wheel in turn and ensure free flow of fluid.
	(b) Seized piston in:—	(b)
	(1) Master cylinder.	(1) Overhaul master cylinder.
	(2) Wheel cylinder.	(2) Overhaul wheel cylinder.
	(3) Disc caliper.	(3) Overhaul caliper.
	(c) Incorrect brake linings.	(c) Replace brake lining material.
	(d) Binding pedal linkage.	(d) Dis-assemble, clean and lubricate pedal linkage.
	(e) Low manifold vacuum	(e) Determine cause of loss of vacuum in engine and rectify.
	(f) Collapsed or leaking vacuum hose.	(f) Replace hose.
	(g) Restricted vacuum hose.	(g) Re-route or replace as required.
	(h) Leaking vacuum chamber.	(h) Repair brake booster.
	(i) Damaged booster diaphragm.	(i) Repair brake booster.
	(j) Faulty non-return valve.	(j) Replace non-return valve.

EXCESSIVE PEDAL TRAVEL

Excessive pedal travel can fall in two groups:— (a) HYDRAULIC and (b) MECHANICAL. With the engine stopped, transmission in neutral, apply brakes several times to destroy vacuum, hold foot pressure on brake pedal, if pedal moves towards floor a Hydraulic fault is indicated.

HYDRAULIC	(a) Air in system.	(a) Bleed brakes.
	(b) Incorrect brake fluid.	(b) Replace fluid and re-bleed brakes.
	(c) Leakage past rubber seals in:—	(c)
	(1) Master cylinder.	(1) Replace cups.
	(2) Wheel cylinder.	(2) Replace cups.
	(3) Disc caliper piston.	(3) Replace seal.
	(d) Defective booster unit.	(d) Repair booster.
	(e) Fluid low in master cylinder.	(e) Top up fluid.
	(f) Fluid leak from pipe connection.	(f) Check all connections and tighten as required.
MECHANICAL	(a) Disc knocking back friction pads.	(a) Remove discs and re-machine.
	(b) Excessive lining or pad wear.	(b) Replace linings or pads.
	(c) Cracked brake drum.	(c) Replace brake drum.
	(d) Self-adjusters not operating.	(d) Rectify fault and re-adjust.
	(e) Incorrect master cylinder push-rod adjustment.	(e) Adjust push-rod.
SPONGY BRAKE PEDAL	(a) Air in hydraulic system.	(a) Bleed brakes.
	(b) Incorrect brake fluid.	(b) Replace fluid and re-bleed brakes.
	(c) Cracked brake drum.	(c) Replace brake drum.
BRAKES LOCK OR DRAG	(a) Oil or grease on linings.	(a) Replace brake linings.
	(b) Excessively worn linings.	(b) Replace brake linings.
	(c) Incorrect brake adjustment.	(c) Check adjuster operation and manually adjust brakes.
	(d) Seized piston in caliper.	(d) Overhaul calipers.
	(e) Seized piston in wheel cylinder.	(e) Overhaul wheel cylinder.
	(f) Restricted brake line.	(f) Locate and repair or replace section of brake line affected.

Condition	Possible Cause	Correction
	(g) Blocked master cylinder compensating port.	(g) Clean and overhaul master cylinder.
	(h) Residual pressure valves faulty.	(h) Replace residual pressure valves.
	(i) Sticking non-return valve in booster.	(i) Replace non-return valve.
	(j) Seized pedal linkage.	(j) Dismantle pedal pivot assembly and lubricate.
	(k) Seized linkage in brake drums.	(k) Remove drum, clean and re-assemble.
	(l) Incorrect master cylinder push-rod adjustment.	(l) Adjust push-rod.
	(m) Brake pedal stopper/light switch incorrectly adjusted.	(m) Adjust correctly.
	(n) Park brake not releasing.	(n) Inspect, lubricate and adjust cable as required.
PREMATURE REAR WHEEL LOCK-UP	(a) Contaminated rear linings.	(a) Replace brake linings
	(b) Inoperative proportioning valve	(b) Check valve pressure (replace if necessary).
BRAKES PULLING	(a) Distorted disc.	(a) Re-machine disc.
	(b) Distorted drum.	(b) Re-machine drum.
	(c) Unmatched linings or pads.	(c) Replace linings or pads.
	(d) Distorted brake shoes.	(d) Replace brake shoes.
	(e) Restriction in hose or line.	(e) Replace hose or line as required.
	(f) Incorrect wheel alignment.	(f) Re-set wheel alignment
PULSATING PEDAL	(a) Non parallel disc surfaces.	(a) Re-machine discs.
	(b) Out of round brake drums.	(b) Re-machine brake drums.
RAPID PAD WEAR	(a) Scored disc surfaces.	(a) Re-machine discs.
	(b) Inferior pad material.	(b) Replace pads.
	(c) Brakes dragging.	(c) See previously listed causes and corrections.
BRAKES OVERHEAT OR FADE	(a) Incorrect or contaminated brake fluid.	(a) Replace fluid and re-bleed system.
	(b) Incorrect lining material.	(b) Replace linings.
	(c) Incorrect brake adjustment.	(c) Adjust brakes.
	(d) Broken, weak or incorrectly assembled shoe return spring.	(d) Replace shoe return spring.
	(e) Blocked master cylinder compensating port.	(e) Clean and overhaul master cylinder.
	(f) Restricted brake line.	(f) Locate and repair or replace section of brake line affected.
	(g) Sticking wheel cylinder.	(g) Overhaul wheel cylinder.
	(h) Distorted brake drum.	(h) Re-machine brake drum.
	(i) Rear axle flange runout excessive.	(i) Replace rear axle half-shaft.
	(j) Brake pedal binding.	(j) Dismantle pedal pivot assemble and lubricate.
	(k) Brake pedal stopper/light switch incorrectly adjusted.	(k) Adjust correctly.
PEDAL PRESSURE BUILD-UP	(a) Blocked master cylinder compensating port.	(a) Clean and overhaul master cylinder.
	(b) Incorrect master cylinder push-rod adjustment.	(b) Adjust push-rod.
	(c) Brake pedal stopper/light switch incorrectly adjusted.	(c) Adjust correctly.
SQUEALING BRAKES	(a) Glazed linings or pads.	(a) De-glaze linings or pads.
	(b) Contaminated linings or pads.	(b) Replace linings or pads.
	(c) Incorrect lining or pad material.	(c) Replace linings or pads.
INEFFECTIVE PARKING BRAKE	(a) Broken cable.	(a) Replace cable.
	(b) Seized cable.	(b) Lubricate cable.
	(c) Incorrect cable adjustment.	(c) Adjust cable.

GENERAL INFORMATION

The service brakes consist of disc and calipers on the front wheels of all models with drum brakes fitted on the rear wheels of four door models. Disc and calipers are fitted to the rear wheels of two door models. A pressure booster unit fitted between the brake pedal and master cylinder reduces the pedal effort required from the driver to retard the vehicle.

A rear brake proportioning valve is incorporated in the rear brake hydraulic circuit. The valve controls pressure transmitted to the rear wheel brakes in accordance with brake application. This results in better balanced braking between front and rear wheels and reduces the possibility of rear wheel lock-up in an emergency stop situation.

The brake system is fitted with two warning lamps, one warns the driver when the park brake is engaged, the other when a hydraulic circuit failure has occured. The hydraulic circuit failure lamp is fitted with a checking relay which lights the lamp when the ignition key is turned to the start position, the lamp will go out when the engine has started. This tells the driver, every time the engine is started, if the lamp is operational. Refer to Group 8 Electrical for circuit layout and testing.

Maintenance Recommendations

The first requisite for safe, sure brake operation is periodic inspection as detailed in the Lubrication and Maintenance Schedule for each model—

Included is periodic cleaning, inspection and adjustment or replacement of linings as required. Parking brake operation, cable free travel and adjustment also requires checking. All hoses and tubes should be inspected for correct positioning, leaks or deterioration and connections checked for tightness.

When inspecting fluid level at the master cylinder also check the condition of the fluid.

Fluid Recommendations

Fluid conditions detrimental to safe brake operation are: moisture condensation in the reservoir, accidental mixing of lubricating oil or water with brake fluid, presence of dirt or other contamination in the system.

NOTE: To determine if contamination exists in the brake fluid, place a small amount of the brake fluid into a small clear glass bottle. Separation of the fluid into distinct layers will indicate the mineral oil content.

If any of these conditions are present correction entails draining the system, flushing with brake fluid and bleeding the hydraulic system. Bleeding may also be required when brakes are overheated or non-recommended low boiling point fluid has been inadvertently added to the hydraulic system.

As brake fluid absorbs moisture from the atmosphere which can lower its boiling point and cause a safety problem, a complete change of brake fluid is recommended as specified in Group 1 Lubrication and Maintenance. Only "Chrysler Heavy Duty Brake Fluid" is recommended for the brake system; this should be taken from a sealed container to ensure that the fluid has had the minimum exposure to the atmosphere.

This approved heavy duty type brake fluid retains the correct consistency throughout the widest range of temperature variation; will not affect rubber cups, and helps protect the metal parts of the brake system against corrosion and premature wear.

Never use brake fluid from a container that has been used for any other liquid. Mineral oil, alcohol, anti-freeze, or cleaning solvents, even in very small quantities, will contaminate brake fluid. Contaminated brake fluid will cause piston cups and seals in the master cylinder to swell or deteriorate.

Absolute cleanliness must also be observed during fluid changing or when maintaining the fluid level in the master cylinder at the indicated level. When refitting the master cylinder reservoir cap ensure that the diaphragm gasket is correctly positioned and seal tightly to prevent ingress of moisture from the air.

Fluid Loss

It is normal for the reservoir level to lower slightly between services because fluid displacement compensates for wear on the front disc brake pads. If the reservoir requires constant addition of brake fluid, further investigation is necessary to locate the source of the leak. The master cylinder, all wheel cylinders, connections and flexible hoses should be carefully checked. Loose connections should be tightened, other necessary repairs or parts replacement made and the hydraulic brake system bled.

Low Pedal

Low pedal may be caused by lack of brake fluid in the master cylinder reservoir or malfunction of the automatic adjusting mechanism which compensates for rear brake lining wear. Check the fluid level and if low, follow the recommendations under "Fluid Loss." If the fluid level is normal check the operation of the rear brake automatic adjusting mechanism and adjust manually if necessary.

Brake Hoses and Bundy Tubing

Bundy tubing is used to conduct hydraulic pressure to the front and rear brakes. Flexible rubber hose is used at both front brakes and at a rear axle junction. Bundy tubing is also used to connect the rear wheel cylinders.

Inspection of brake hose and tubing should be included in all brake service operations. The hoses should be checked for:

(1) Correct length, severe surface cracking, pulling, scuffing or worn spots. Should the cotton fabric casing of the hose be exposed to weather by cracks or abrasions in the rubber hose cover, rapid deterioration of the hose can take place with possible burst failure.

(2) Faulty installation causing twisting, wheel, tyre or chassis interference.

Flexible hydraulic brake hoses should always be installed in the vehicle by first tightening the male end of the hose. The hose is then clipped to the hose bracket to give minimum twist. Excessive twist can result in hose interference problems with possible hydraulic system

failure. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks, burrs or rust.

NOTE: Always use factory recommended hoses to ensure quailty, correct length and superior fatigue life.

All Bundy steel tubes are of double wall construction to ensure maximum fatigue strength and they must be securely attached with the recommended retaining clips. Positive sealing of the tube connecting ends is ensured by either double, convex or Bundyvex flares. The double flare can only be used in conjunction with the inverted type seat, where-as both convex and Bundyvex flares are suitable for drill point seats.

NOTE: Ensure that the correct type tube nut is used with each type of flare, (refer Fig. 1).

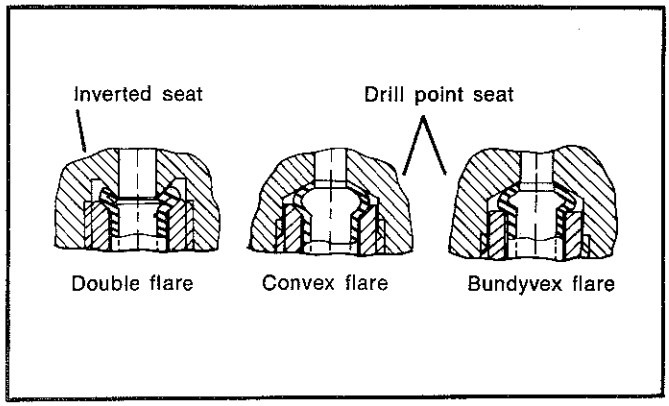


Fig. 1—Types of brake tubing flares and seats

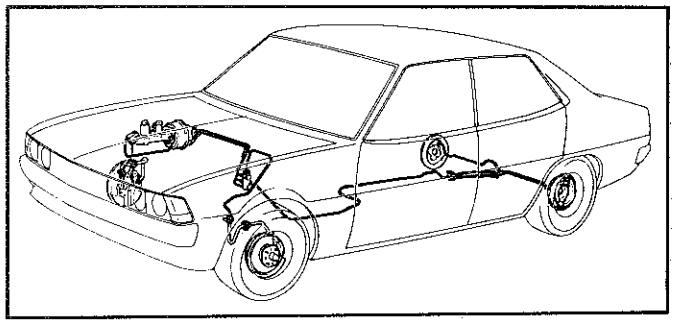


Fig. 2—Brake system (early type sedan)

If the flared seat on a brake tube shows signs of leakage, has small fatigue cracks or other damage, the tube must be replaced or repaired as follows using the appropriate bending or flaring tools.

Procedure for Flaring Bundy Tubing

(1) Using Tool E5C15 cut off damaged flare (Fig. 3).

(2) Ream out any burred or rough edges showing on inside edges of tubing. This will make ends of tubing square and ensure better seating against the flaring tool plug.

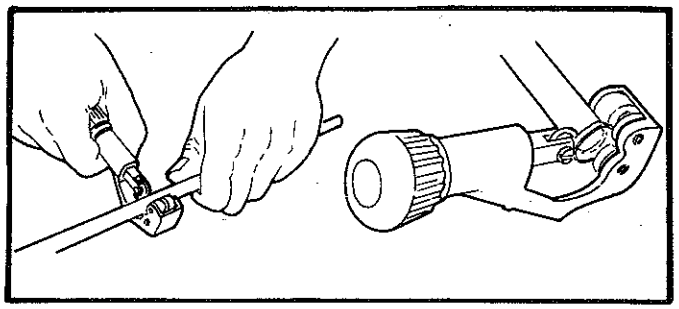


Fig. 3—Bundy tubing cutting tool

NOTE: Following procedure relates to flaring tool shown in Fig. 4 and is given as a general guide only. Follow manufacturers instructions if a flaring tool of a different design is being used.

(3) Place tube nut on tube prior to flaring. To flare, unscrew handles of Tool (Fig. 4) and rotate jaws until mating jaws of tubing size are centred in the area between vertical posts.

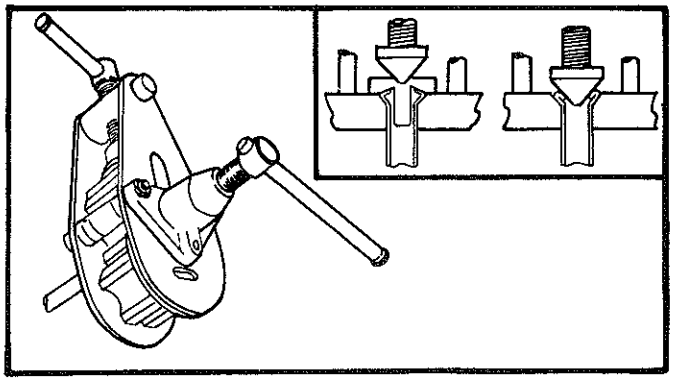


Fig. 4—Bundy tubing flaring tool

(4) Slowly tighten handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

(5) Place gauge "Form A" on edge over end of tubing and push tubing through jaws until end of tubing contacts the recessed notch of gauge matching the size of tubing.

(6) Tighten handles of flaring tool and lock tubing in place.

(7) Place proper size plug of gauge "A" down in end of tubing. Centre tapered flaring screw in recess of disc.

(8) Lubricate taper of flaring screw with brake fluid and screw in until plug gauge has seated on jaws of flaring tool. This action will form a convex flare and the seat for a Bundyvex flare. The Bundyvex flare, back shoulder, will be formed when the tube nut is tightened into the component the tube is being fitted to.

(9) Remove the plug gauge. To form a double flare apply brake fluid to tapered end of flaring screw and screw down until the tool forms the seat required in tubing end.

(10) Remove tubing from flaring tool and inspect seat.

Wheel Stud Tightening

NOTE: The tightening sequence and torque of the wheel stud nuts is important for efficient brake operation.

A diagonal tightening sequence should be used. Tighten all stud nuts to one-half specified torque first, and then repeat sequence tightening to specified torque.

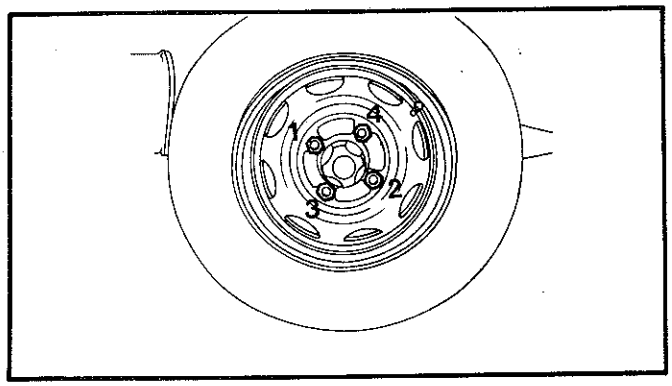


Fig. 5—Wheel stud nut tightening sequence

BLEEDING THE BRAKE SYSTEM

CAUTION: Clean all dirt and oil from the master cylinder cover prior to filling the reservoirs.

Bleeding Master Cylinder (In Vehicle).

(1) Protect paint work area against splash or leakage of brake fluid during the bleeding operation.

(2) Disconnect all brake tubes from the master cylinder unions.

(3) Install the bleeder tubes to the master cylinder ports (refer Fig. 6).

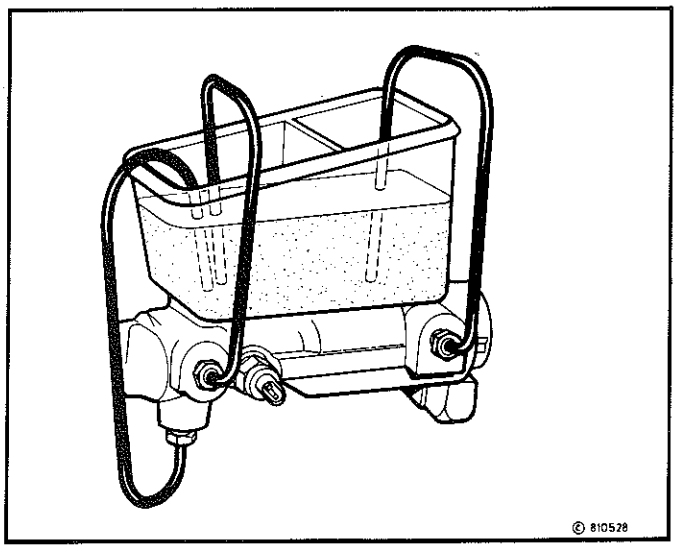


Fig. 6—Master cylinder bleeding tubes

(4) With the reservoirs topped-up, proceed to bleed air from the master cylinder by carefully operating the brake pedal, until no air bubbles are produced.

(5) After bleeding operation, remove the bleeding tubes and reconnect the brake tubes — tighten union to specified torque.

PRESSURE BLEEDING SYSTEM

(1) Attach the pressure bleeder to the master cylinder reservoir and open pressurised fluid tap.

(2) Clean the brake bleed valve of the right rear wheel cylinder (rear drum models) left rear cylinder (rear disc models) and attach a transparent brake bleed hose to the bleeder valve, insert the other end of the bleeder hose into a clean glass jar partly filled with brake fluid.

NOTE: Rear drum brake models are not fitted with a brake bleeder on the left rear wheel.

(3) With 275 kPa (40 p.s.i.) (maximum) air pressure in bleeder tank (or master cylinder pressure pumped up by pedal application), open the bleeder valve with a spanner and permit fluid to enter the jar until all air has been expelled at the wheel cylinder. Tighten the bleed valve securely.

(4) Repeat procedure at right rear wheel (rear disc models) following with left front, then right front wheel in that order.

(5) When the system is completely flushed and bled, close the bleeder fluid pressure tap and remove the bleeder from the master cylinder reservoir.

(6) Fill the master cylinder reservoir to the correct level and replace the cover, ensuring the diaphragm gasket is correctly positioned and clean off any traces of spilt fluid with methylated spirits or suitable solvent.

MANUAL BLEEDING SYSTEM

(1) Clean the brake bleed valve of the right rear wheel cylinder (rear drum models), left rear cylinder (rear disc models) and attach a transparent brake bleed hose to the bleeder valve, insert the other end of the bleeder hose into a clean glass jar partly filled with brake fluid.

(2) With an assistant depressing the brake pedal and replenishing the brake fluid in the master cylinder, open the brake bleeder valve approximately half a turn until the brake pedal bottoms on the floor. Close the bleeder valve and allow the brake pedal to return to the "up" position. Repeat this operation until the replacement fluid (free of air bubbles) is evident in the transparent bleed hose. Tighten the bleed valve securely.

NOTE: Ensure that the master cylinder reservoir is replenished with brake fluid throughout the bleeding operation.

(3) Repeat the bleeding procedure on the right rear wheel (rear disc models), left and right front wheels in that order.

(4) When the system is completely flushed, bled and the reservoir topped up to the correct level, replace the cover, ensuring the diaphragm gasket is correctly positioned and clean off any traces of spilt fluid with methylated spirits or suitable solvent.

BRAKE PEDAL AND SWITCH

Adjustment

(1) Back off the stop lamp switch slightly.

(2) Loosen the operating rod lock nut and rotate the rod to adjust the pedal height to 175 mm (6.9") from the floor, (carpet and underfelt removed).

(3) Tighten the operating rod lock nut.

NOTE: Over adjustment of the operating rod will partially apply the booster/master cylinder thus causing brake drag.

(4) With the operating rod adjusted, adjust the brake pedal stopper (i.e. brake switch) until 10 to 15 mm (0.4 to 0.6") free play exists at the brake pedal, refer Fig. 7.

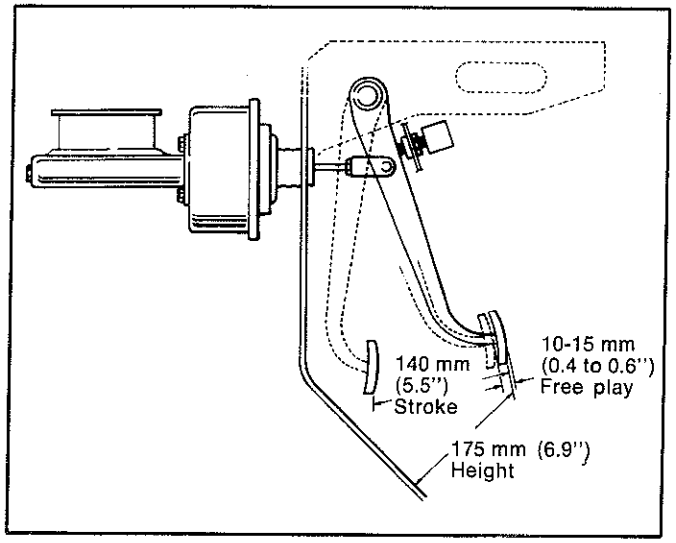


Fig. 7—Brake pedal adjustment

Removal

(1) Disconnect the brake pedal operating rod, remove the clutch cable and disconnect the support member.

(2) Remove the brake and clutch pedal shaft snap rings and remove the pedals.

Inspection

Check the bushing and pedal shaft for wear, deformation and damage. Check the pedals for bend and distortion. Correct or replace any faulty components.

Installation

Install by reversing removal procedure noting the following:

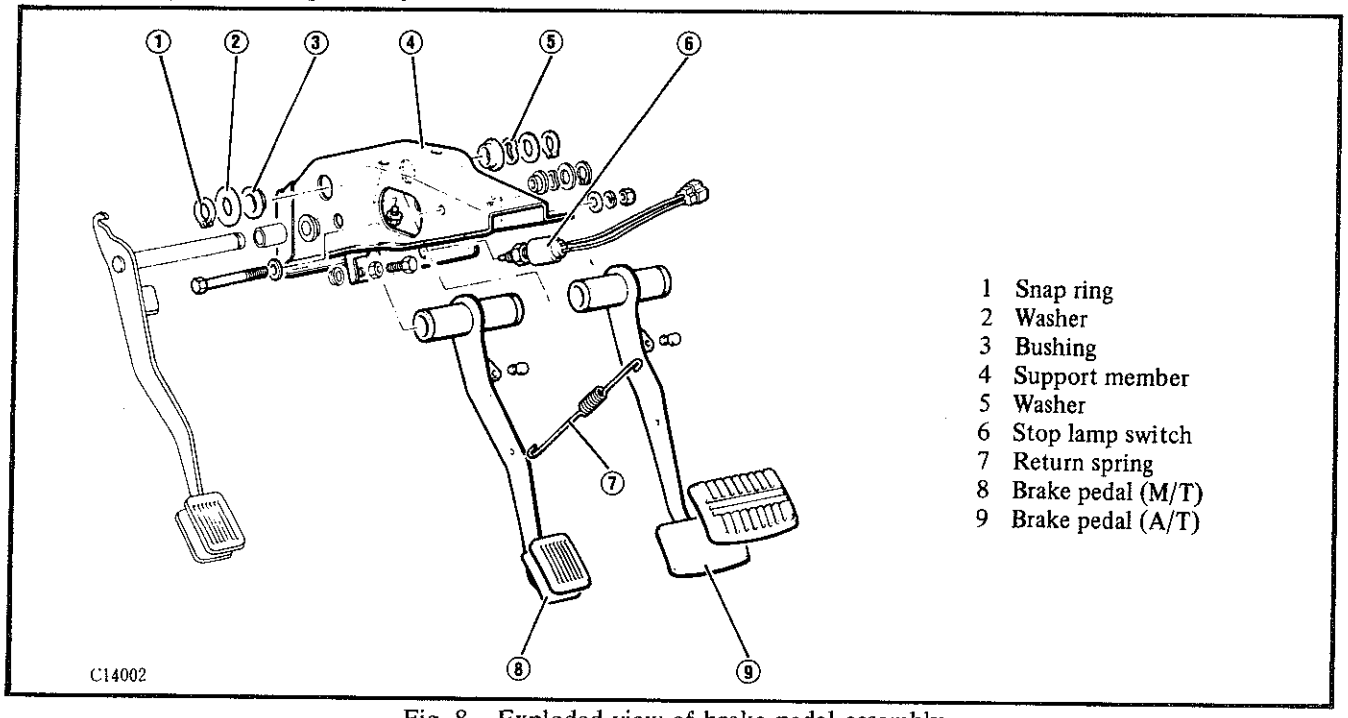
Lubricate the pedal shaft, bush and clutch cable fitting area with suitable grease.

After assembly check the pedal side play, if excessive, greater than 3,0 mm (0.120"), replace the bushing.

Adjust the brake pedal as previously described and adjust the clutch cable as described in Group 6 — Clutch.

SERVICE PROCEDURES

Servicing the hydraulic system is chiefly a matter of adjustment, replacement of worn or damaged parts and correcting the damage caused by grit, dirt or contaminated brake fluid. The following sections describe the service procedures applicable to components fitted on the various models.



1 Snap ring
2 Washer
3 Bushing
4 Support member
5 Washer
6 Stop lamp switch
7 Return spring
8 Brake pedal (M/T)
9 Brake pedal (A/T)

Fig. 8—Exploded view of brake pedal assembly

SECTION 1A — FLOATING CALIPER (PS15) DISC BRAKES

SPECIFICATIONS

DISC BRAKE	
Type	Floating head caliper type PS15 with solid disc
Location	Front wheels only
CALIPER	
Pad type	Akebono AKS 26GS
Lining thickness	9,7 to 10,0 mm (0.380" to 0.390")
Lining replacement thickness	2,0 mm (0.080") or less
Pad dimension (length x width x thickness)	78 x 40,9 x 10 mm (3.07" x 1.61" x 0.39")
Lining area (total)	127,6 cm^2 (19.72 $in.^2$)
Number of pistons	1 per caliper
Piston diameter	51,06 (2.0102")
Caliper bore diameter	51,1 mm (2.0118")
Brake dragging torque (maximum)	4,4 Nm (39 in. lbs.) [Tangential force at wheel attaching bolt — less than 8.0 kg (18 lbs.)]
DISC	
Type	Solid cast iron
Diameter	229 mm (9.00")
Thickness (standard)	13 mm (0.510")
(minimum)	11,4 mm (0.450")
Disc run-out (maximum)	0,15 mm (0.006")

SPECIAL TOOLS

CT1092	Piston spreader

TORQUE SPECIFICATIONS

	Nm	lb./ft.
Inner to outer caliper bridge bolts	79-94	58-69
Caliper torque plate to front strut adapter plate bolts	69-88	51-65
Brake hose	12-16	9-12
Bleeder screw	6,7-8,6	5-6,5
Adapter plate to front strut bolts	39-49	29-36
Disc to hub	34-39	25-29

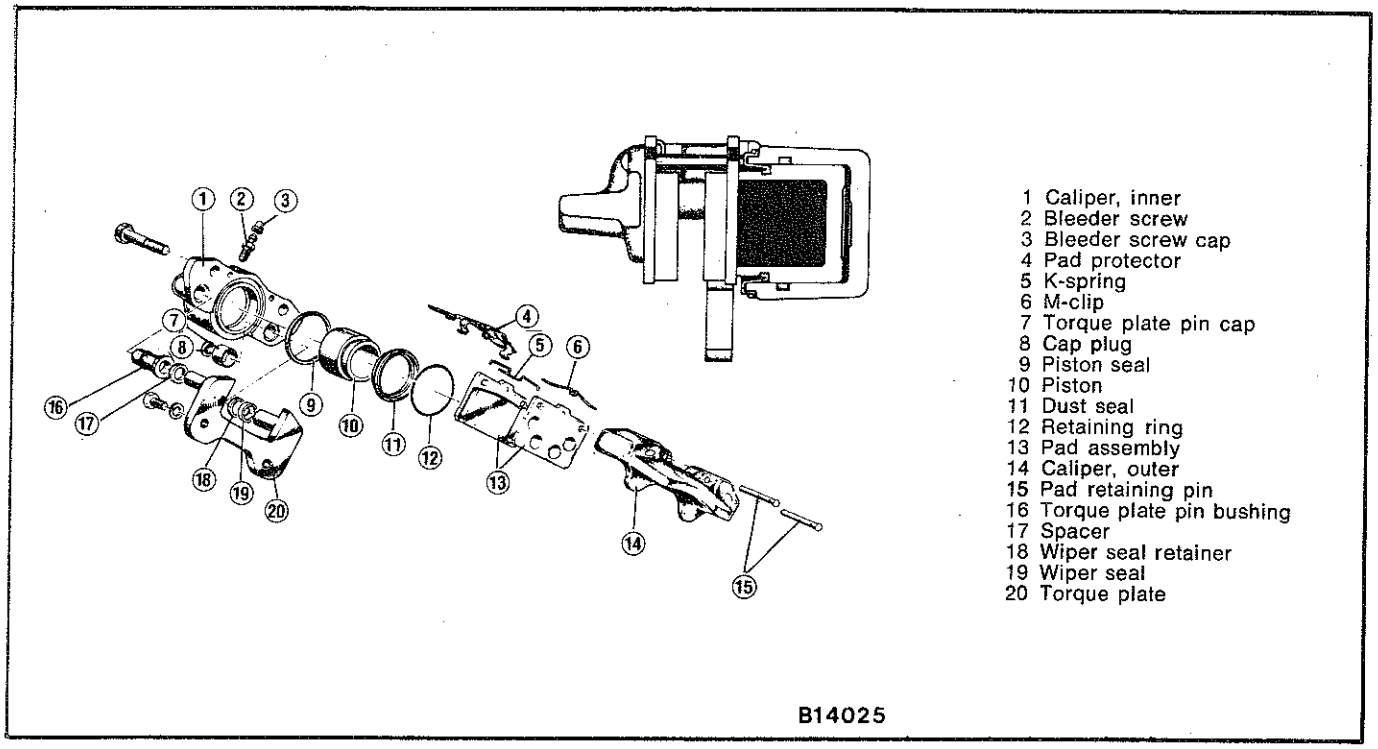


Fig. 1—Caliper exploded view

DISC PADS

Removal

(1) Raise the front of the vehicle and support on jack stands. Remove the wheel and tyre assembly.

(2) Remove the protector by prying up the edge of the clip at the centre of the pad protector with a screw driver.

(3) Holding the centre of the M clip detach the M clip from the pad and its ends from the retaining pins. Then take off the M clip.

(4) Pull the retaining pins from the caliper assembly. Remove the K spring.

(5) Remove the pads by grasping the pad backing centre projection with a pair of pliers.

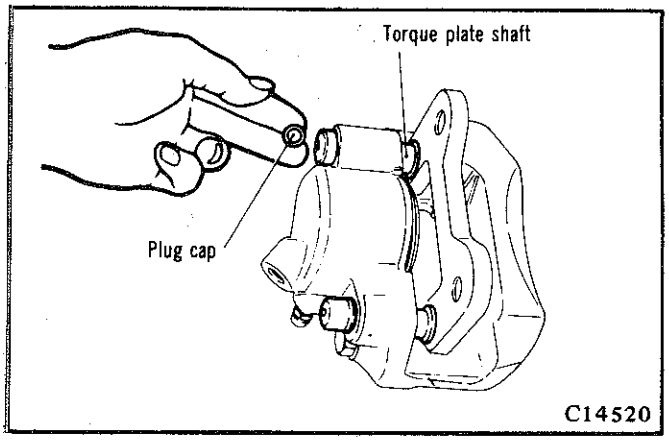


Fig. 2—Torque plate shaft and plug cap

NOTE:

- **Since the caliper is of a floating type, the torque plate shaft should be kept clean. If the shaft is contaminated with dust or mud, the caliper and bushing will wear prematurely.**
- **Rust formation and defective operation of the torque plate shaft are caused by defective conditions (cracks, deterioration, etc.) of the installed plug cap. When the pad is checked for wear or replaced, be sure to check the plug cap for conditions.**

Inspection

(1) Check for presence of oil and wear. Replace pads that are defective or worn below the specified minimum thickness.

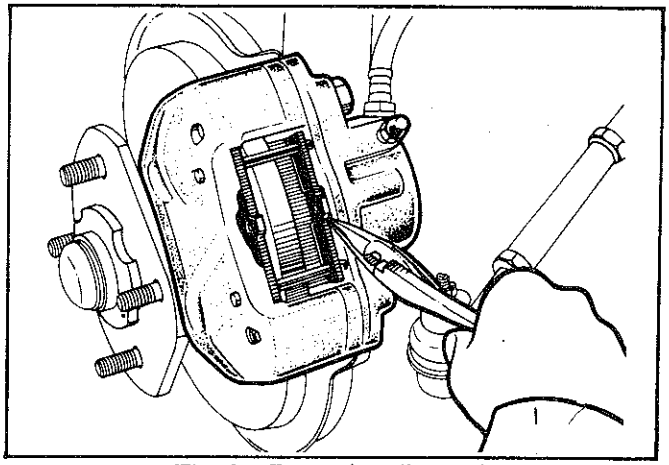


Fig. 3—Removing disc pad

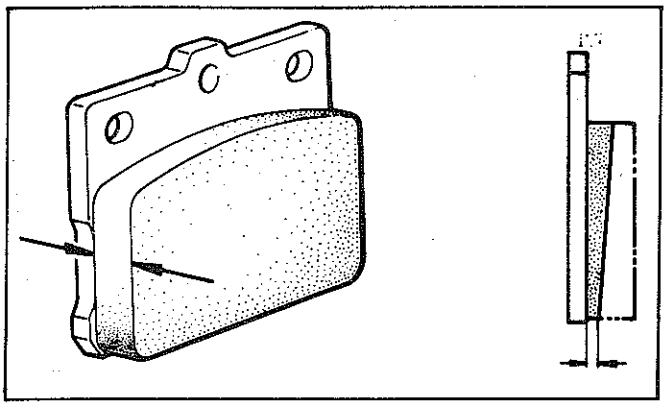


Fig. 4—Checking the pads

NOTE: The pads of the right and left wheels should be replaced at the same time.

(2) Check each disc for wear and damage. Correct or replace the disc that is defective.

(3) Check the torque plate shaft seals for damage and check for smooth torque plate operation.

Installation

Install by reversing removal procedure noting the following:

(1) To replace the brake pad, push the piston back using Special Tool CT1092 and insert the pad through the shim.

(2) Install the K spring and M clip as shown, ensure they are correctly positioned.

(3) Install the pad protector in the direction shown, Fig. 7. Ensure the protector pawl is located between the shim and the caliper.

(4) Check brake dragging torque. To check, drive the car for about 100 m (330 ft.) at low speed. Stop the vehicle using engine braking without depressing the brake pedal and then check the dragging torque. If the specified torque is exceeded, disassemble the piston and check the piston sliding part for dirt and rust and the piston seal for elasticity. If the torque is still too high, check to see if the correct master cylinder check valve is installed.

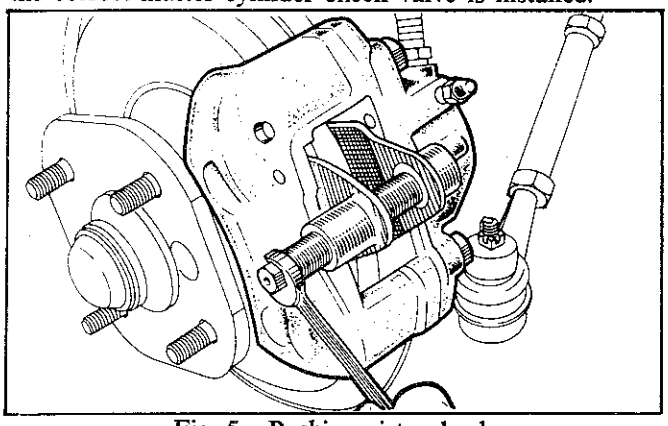


Fig. 5—Pushing piston back

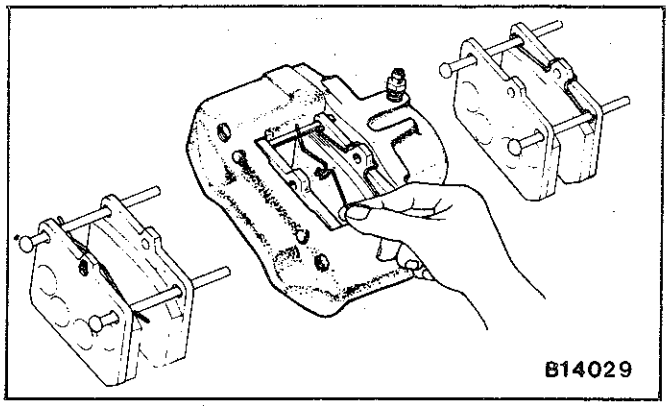


Fig. 6—Installing K spring and M clip

NOTE: When the pad has been replaced, the brakes are likely to drag before the initial run-in is made, but they may be considered serviceable if the dragging torque is within the specified limit.

CALIPER ASSEMBLY

Removal

(1) Remove the disc brake pads as previously described.

(2) Remove the brake hose clip from the strut area, then disconnect the brake hose from the caliper.

(3) Remove the caliper assembly by loosening torque plate and adapter mounting bolts.

Disassembly

(1) Loosen caliper attaching bridge bolts and separate the outer caliper from the inner caliper.

(2) After the removal of the dust seal, remove the piston by applying compressed air at the brake hose fitting.

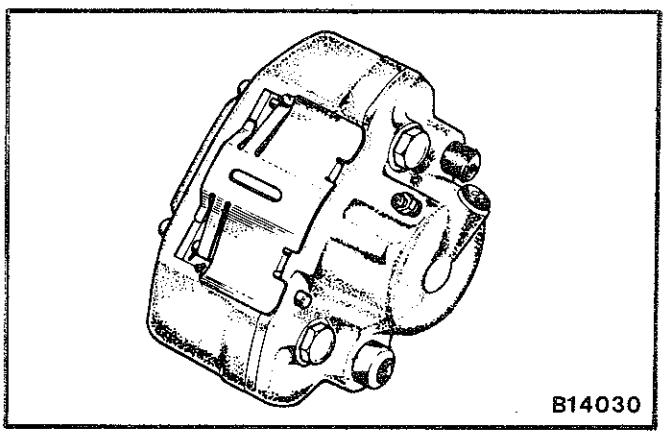


Fig. 7—Installing the pad protector

NOTE: Do not apply a high pressure suddenly, otherwise the piston may jump out, injuring your fingers.

(3) Remove the piston seal. Be careful not to damage the cylinder.

(4) Clean all removed parts with clean methylated spirits.

NOTE: Washing the piston seal, dust seal and other rubber parts in alcohol should be completed within 30 seconds.

Inspection

(1) Inspect the cylinder and piston for wear, damage and rust. Replace any faulty components.

NOTE: The parts kit available includes rubber grease (red) and special grease (yellow) which are an aid when servicing the caliper.

Assembly

(1) Use new piston seal, dust seal, wiper seal, wiper seal retainer, plug cap, spacer, and bushing whenever the caliper assembly has been disassembled.

(2) Apply rubber grease (red) to the piston seal and brake fluid to the piston and caliper bore. Insert the piston seal into the piston using care to avoid twisting the seal.

(3) Whenever the torque plate has been removed from the inner caliper, it is necessary to clean the torque plate shaft and the shaft bore of the caliper and apply the special yellow grease to the rubber bushing, wiper seal inner surface, torque plate shaft and threaded portion before assembly.

NOTE: Use special care to apply the rubber grease (red) and special grease (yellow) to proper parts. Do not intermix them.

(4) Tighten the inner and outer caliper bridge bolts to the specified torque after appropriate amount of brake fluid has been applied to the threaded areas.

(5) Insert the main pin cap all the way into the caliper and check to ensure that the plug cap is correctly held in place.

Installation

Install by reversing removal procedure noting the following:

(1) Tighten the caliper assembly (torque plate) to the front strut adaptor plate to the specified torque.

(2) After tightening the brake hose to the specified torque, bleed the brake hydraulic system as described in Section 1.

NOTE: Since the wheel cylinder uses a large piston, the slightest presence of air will seriously affect the brake pedal stroke. Bleeding, therefore, should be performed carefully and thoroughly.

Adjustment

If the initial pedal stroke has changed after piston seal replacement, take the following steps.

(1) Remove the piston pad and attach a piece of steel (approx. 1 mm (0.040") thick and 300 mm (11.810") long) to the sliding surface of the disc to prevent the sliding surface from being damaged. Insert the end of a tyre lever or similar between the piston and the piece of steel, and force the piston 3 to 5 mm (0.120" to 0.200") into the cylinder by lever action.

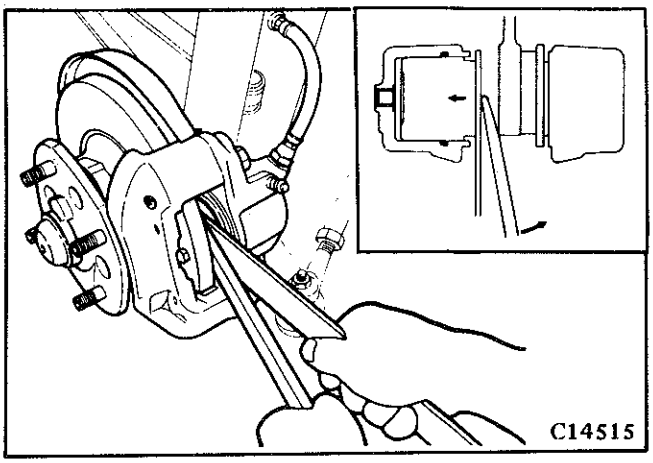


Fig. 8—Forcing piston back

(2) Install the pad and depress the pedal two or three times to push the piston out to its original position.

(3) Repeat the above work five times or more to force the piston through its stroke and seat the piston and seal.

BRAKE DISC

Removal

(1) After removing the wheel remove the caliper assembly and support it suitably. Do not let it hang by the brake hose.

(2) Remove the disc assembly from the knuckle, clamp the disc in a vice equipped with soft jaws and remove the bolts holding the hub to the disc.

NOTE: Avoid holding the disc directly in a vice as this may result in damage to the braking surface of the disc.

Inspection

(1) Check the disc for wear and damage. Correct or replace the disc if defective.

Installation

Install by reversing removal procedure noting the following:

(1) Tighten the torque plate, adapter and dust cover to the specified torque.

(2) Tighten the disc to the hub to the specified torque.

(3) Install the front hub assembly. (See Group 22.)

(4) Check the disc runout. If it is found beyond the specified value, change its location on the hub and recheck the runout.

If the runout cannot be corrected by the above procedure, replace the disc.

(5) Install the caliper assembly to the adaptor and tighten to the specified torque.

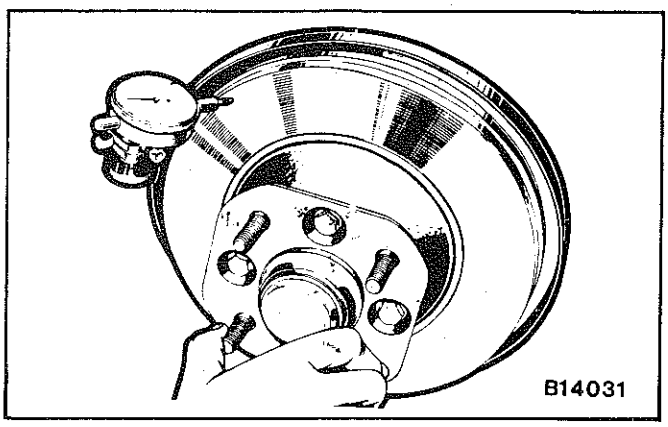


Fig. 9—Checking disc runout

SECTION 1B — PBR SLIDING HEAD CALIPER

SPECIFICATIONS

DISC BRAKE

Type	PBR—Sliding Head Caliper with Solid Disc
Location	Front Wheels Only

CALIPER ASSEMBLY

Lining Thickness	9,70 mm (0.380")
Lining Replacement Thickness	0,80 mm (0.031") minimum
Lining Area	2676 mm² (4.15 in.²) (each pad)
Lining Material Type	Bendix Mintex XB
Number of Pistons	1 per Caliper Assembly (inner side)
Piston Diameter	54,00 to 54,05 mm (2.126" to 2.128")
Piston Bore Diameter	54,10 to 54,15 mm (2.130" to 2.132")

BRAKING DISC

Type	Solid—Cast Iron
Diameter	229 mm (9.00")
Thickness — Standard	13,0 mm (0.510")
— Minimum	11,4 mm (0.450")
Max. Run-out Allowable	0,15 mm (0.006")
Disc Surface Finish — Circumferential	813 micro mm (32 micro inch)
— Radially	1270 micro mm (50 micro inch)
Disc Parallelism (in any direction)	0,06 mm (0.0023")
Disc Swept Area	554,1 cm² (85.89 in.²)

TORQUE SPECIFICATIONS

	Nm	lbs./ft.	lbs./in.
Bleeder Screw	16-20	12-15	144-180
Brake Hose to Caliper	12-16	9-12	108-144
Brake Line Union Nut	11-13		95-115
Caliper Joining Bolts	54-60	40-45	
Caliper Mounting Bolts	60-75	45-55	
Dust Shield Bolts	18	13	156
Hub to Disc Bolts	34-39	25-29	
Wheel Stud Nut — Progressively	75	55	

GENERAL INFORMATION

The single piston, sliding caliper disc brake assembly consists of the hub and disc assembly, caliper, shoe and linings and a splash shield.

When the wheel is in motion, the rotation of the disc cools the braking surface of the disc and prolongs lining life. The braking disc is protected from road splash (inboard side) by a shield bolted to the steering knuckle and by the wheel and tyre on the outboard side.

The caliper has been designed to conserve weight and provide ease of service. It is a single cylinder, two sleeve, floating type. Braking torque is absorbed by two bolts in shear, which extend through the sleeves into the steering knuckle assembly. Because the bolts screw into the knuckle, the conventional torque plate or anchor bracket is eliminated, thus reducing weight. The pad support is nodullar iron and the cylinder is aluminium.

The steel piston is nickel and chrome plated for anti-corrosion and long wear. The square cut rubber piston seal is located in a machined groove in the cylinder bore and provides a hydraulic seal between the piston and the cylinder wall.

A moulded rubber dust boot installed in a groove in the cylinder bore and piston keeps contamination from the cylinder wall and piston.

As the brake pedal is depressed, hydraulic pressure is applied against the piston. This force is transmitted to the inboard brake shoe and lining and the inboard braking surface of the disc. As force increases against the disc from the lining, the caliper assembly moves inboard, sliding on the mounting bolt sleeves, thus providing a clamping force on the disc.

When the brake pressure is released, the piston seal (distorted by applied pressure) returns to its normal position, pulling the piston back to released position (Fig. 2), creating a slight running clearance between outer shoe and the disc.

Automatic adjustment is obtained by outward relocation of the piston as the inboard lining wears and the inward movement of the caliper as the outboard lining wears, thus maintaining correct adjustment at all times.

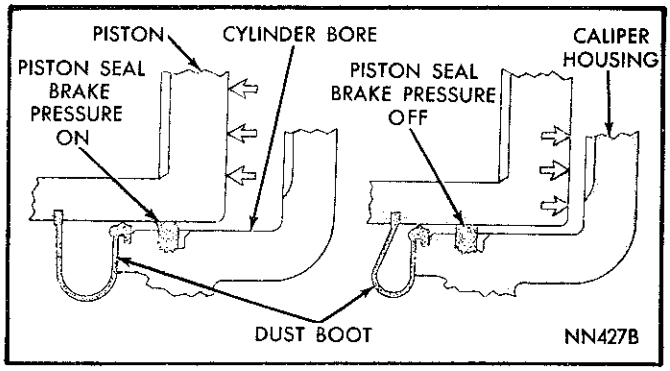


Fig. 2—Piston seal function for automatic adjustment

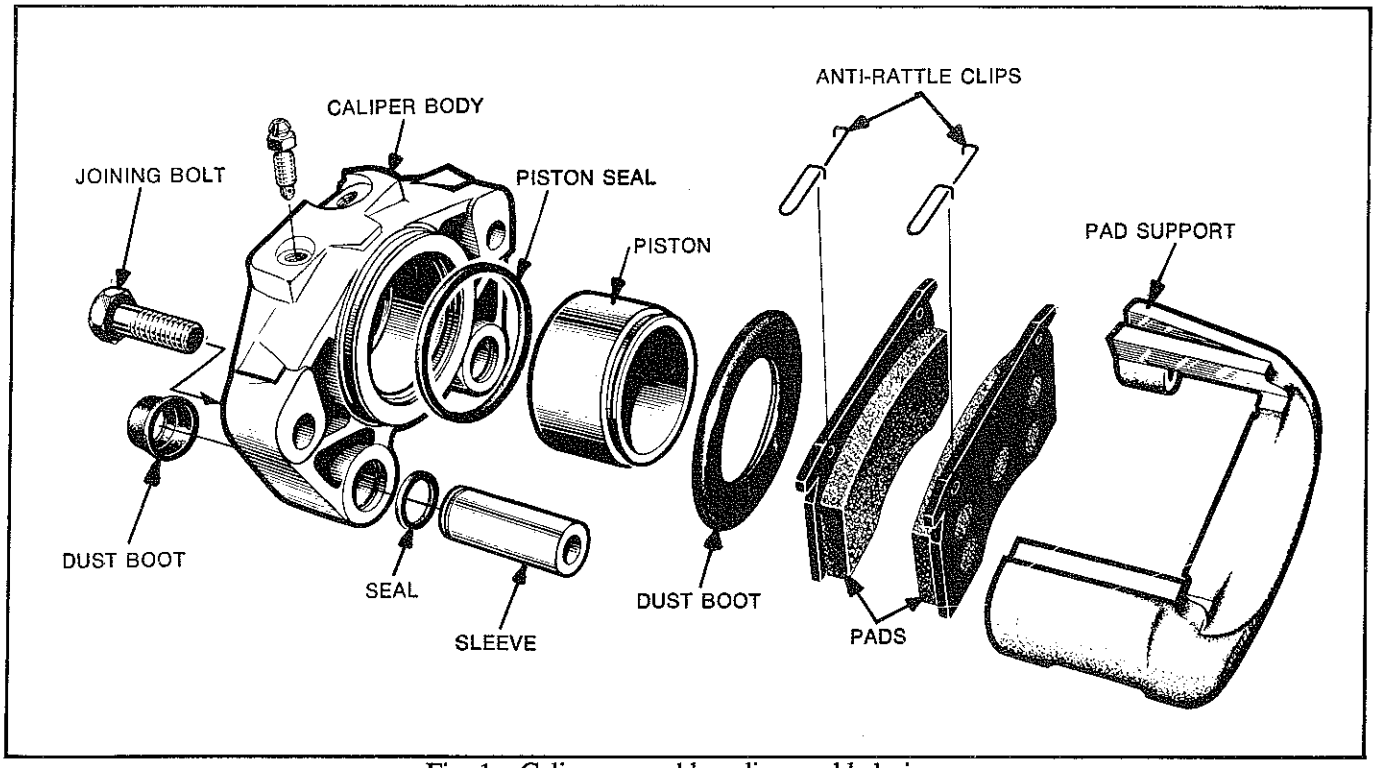


Fig. 1—Caliper assembly—disassembled view

Bleeding Disc Brake System

Bleeding the brake system is described in Section 1, of this group.

ROUTINE MAINTENANCE

Check Brake Lines, Hose and Linings

Raise all four wheels. Remove front wheel and tyre assemblies and inspect the braking disc, linings and caliper. Inspect brake flexible hose and tubing according to procedure outlined in paragraph entitled "Brake Hose and Tubing". (The wheel bearings should be inspected at this time and repacked if necessary.)

Do not get oil or grease on the braking disc or linings. If the linings (pads) are worn to the minimum specification, replace both sets of shoe and lining assemblies (inboard and outboard) on the front wheels. It is necessary that both front wheel sets be replaced whenever a respective shoe and lining is worn beyond specifications or damaged.

Check all brake tube connections for possible leaks. Install new flexible hoses as required.

NOTE: The yellow stripe on the hose is to ensure that no twisting takes place during fitment — always point the wheels straight ahead before fitting hose to bracket and ensure that the stripe in the hose is not twisted more than 15° after final fitment.

Shoe and Lining Wear

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tyre assemblies. Remove the shoe and lining assemblies (see "Brake Shoe Removal" paragraph). Three thickness measurements with a micrometer should be taken across the centre of each shoe and lining assembly; one reading at each end and one reading in the centre.

Brake Roughness

The most common causes of brake roughness (or chatter) with disc brakes are excessive variation in disc thickness and/or excessive disc face runout. These can be easily checked with a dial indicator and a micrometer (vernier type preferred). If either of the measurements are out of specification, the disc must be refinished or replaced.

Other less prevalent causes of roughness can be the use of some type of non-standard lining and extreme abrasion of the disc faces. Also, vehicles which stand unused for periods of time in areas of high humidity or salt air may incur rust on the disc which could cause a temporary brake surge and roughness. Normally, however, this condition should correct itself after a short period of usage. If rust is severe enough, roughness will not clear up and the disc must be resurfaced or replaced.

DISC BRAKES SERVICE PRECAUTIONS

(1) Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures. Handling the braking disc and caliper should be done in such a way as to avoid deformation of the disc and scratching or nicking the brake linings (pads).

(2) If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

(3) During removal and installation of a wheel and tyre assembly, use care not to strike the caliper.

(4) The front wheel bearing end play is important and must be within specifications.

(5) Be sure vehicle is centred on the hoist before servicing any of the front end components to avoid bending or damaging disc splash shield on full right or left hand turns.

(6) Before vehicle is moved after any brake service work, **be sure and obtain a firm brake pedal** by using proper bleeding procedures.

(7) Dragging the brakes (common result of left foot application on vehicles with automatic transmission) should be avoided during vehicle operation.

(8) The wheel, tyre, hub and disc assembly **cannot** be removed as an assembly. The pads and pad support must be removed before removal of the hub and disc assembly.

(9) As lining wears, reservoir level will go down. If fluid has been added between relines, then reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided in this case by removal of a small amount of fluid before overflow occurs.

PAD REPLACEMENT

Removal

(1) Raise the front of the vehicle and support on jack stands.

(2) Remove the wheel and tyre assembly.

(3) Separate the pad support from the caliper body by removing the joining bolts and sliding the pad support assembly up from the caliper body.

(4) Remove the pads from the support and remove the anti-rattle clips from the pads.

Cleaning and Inspection

Check for piston seal leaks (evident by brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged, or fluid is evident, it will be necessary to disassemble caliper assembly and install a new seal, boot (and piston if damaged or corroded). (Refer to "Disassembling Caliper Assembly" paragraph.)

Ensure the pads slide freely on the pad support and that the pad mounting surface is free from damage, wear, rust, dirt, etc.

Check that the caliper sleeves are clean and that the caliper slides freely on the sleeves. Clean the sleeves with a rag dampened with methylated spirits.

NOTE: Do not use abrasive paper to clean the sleeves.

Installation

NOTE: Ensure replacement pads are of the specified material type.

(1) Install the anti-rattle clips onto the pads as shown in Fig. 3.

(2) Install the pads to the support as shown in Fig. 4.

(3) Push the piston back into the bore of the caliper. This may necessitate opening the bleeder to allow excess fluid to escape.

NOTE: Do not re-use old fluid.

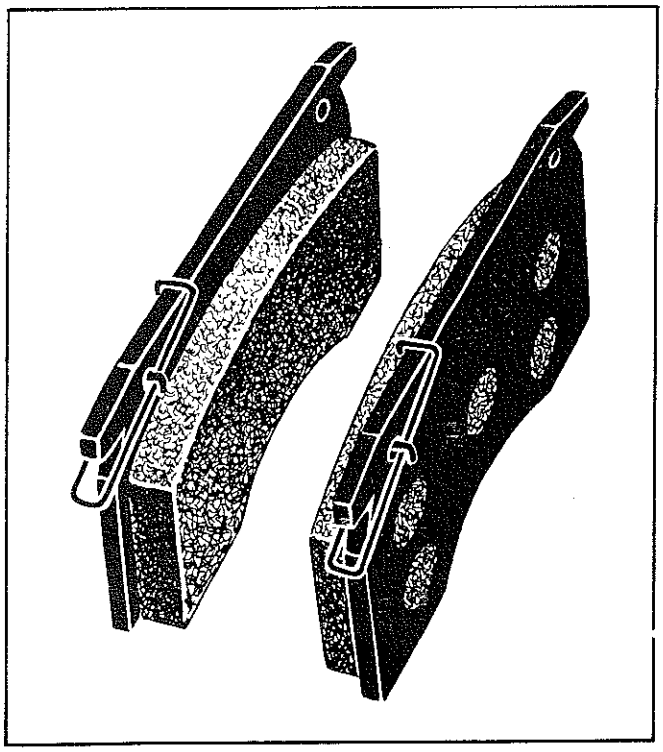


Fig. 3—Anti-rattle clip installation

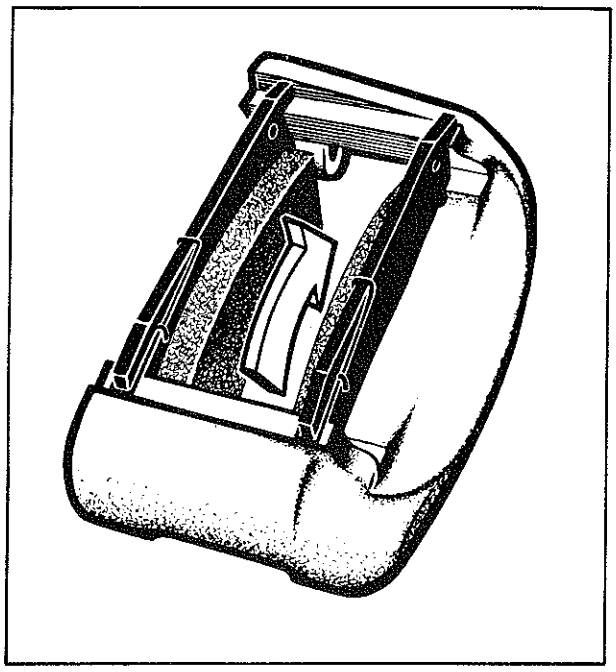


Fig. 4—Anti-rattle clip and pad installation

(4) Position pad support and pad assembly over disc and onto caliper body and tighten the joining bolts to the specified torque.

(5) Install the wheel and tyre assembly and tighten the nuts to the specified torque.

NOTE: Prior to moving the vehicle, stroke the brake pedal until normal brake pedal travel is restored.

CALIPER ASSEMBLY

Removal

(1) Raise front of vehicle and support on jack stands.

(2) Remove the wheel and tyre assembly.

(3) Disconnect the fluid supply pipe from the caliper hose and remove the hose retaining nut and clip from the body. Plug brake pipe to prevent fluid loss.

(4) Remove the caliper assembly retaining bolts and remove the caliper from the vehicle.

Installation

Install by reversing removal procedure and bleed the brake system as described in Section 1.

NOTE: New caliper mounting bolts MUST be fitted and tightened to the specified torque.

Disassembly

(1) Remove the caliper as previously described.

(2) Slide the mounting sleeves out of the caliper body.

(3) Remove the dust seals and boots from the caliper body.

(4) Hold the caliper in a vice as shown in Fig. 5 and separate the caliper body from the pad support by removing the joining bolts.

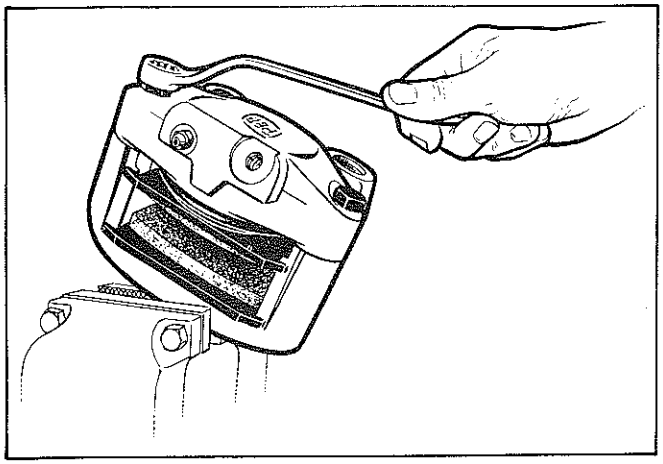


Fig. 5—Separating caliper body from pad support.

(5) Remove the pads from the support.

(6) Remove the piston dust boot and the fluid supply hose.

(7) Assemble the pad support bracket onto the caliper body and install the joining bolts finger tight.

(8) Hold the caliper assemby in a vice and with a piece of wood positioned on the outer pad support face, carefully blow the piston out of the caliper body by slowly applying compressed air to the hydraulic port, Refer Fig. 6.

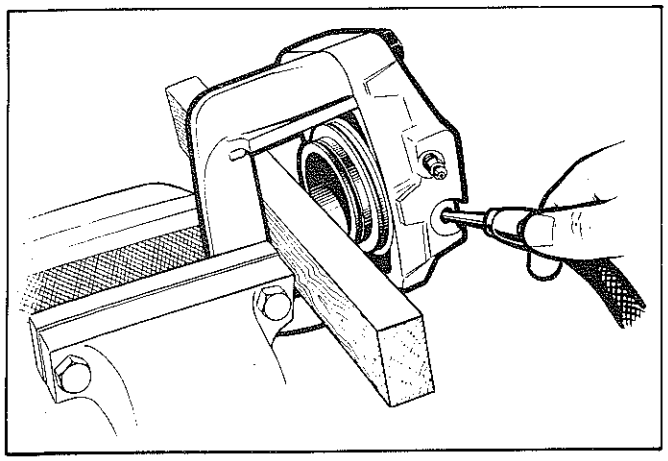


Fig. 6—Removing caliper piston

CAUTION: Keep finger away from the inside of the caliper when removing the piston by air pressure.

(9) Separate the caliper body from the pad support.

(10) Using a blunt tool, remove the piston seal from the groove in the caliper bore. Care must be taken not to damage the seal groove in the bore.

Cleaning and Inspection

Clean all parts in clean methylated spirits and blow dry using compressed air. Blow out all drilled passages and bores. Inspect the piston, caliper mounting sleeves, sleeve holes, pad support and piston bore for damage, scoring, excessive wear and corrosion. Replace any faulty components.

NOTE: The caliper sleeve holes and piston bore must not be honed.

Assembly

NOTE: When using a repair kit, install all the parts supplied in the kit.

(1) Lubricate the new piston seal with clean brake fluid and install the seal in the caliper bore groove. Ensure the seal is correctly seated in the groove.

(2) Lubricate the inside of the caliper bore and the outside of the piston with clean brake fluid.

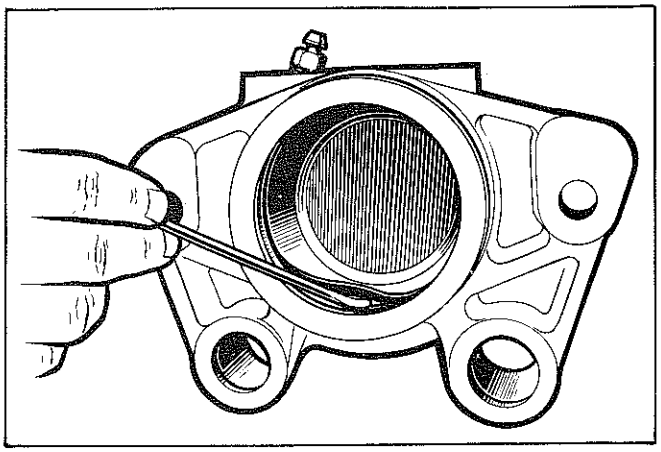


Fig. 7—Removing piston seal from caliper bore

(3) Locate the piston in the caliper body and push it to the bottom of the bore by hand. Refer Fig. 8.

(4) Install the rubber boot onto the piston and caliper body.

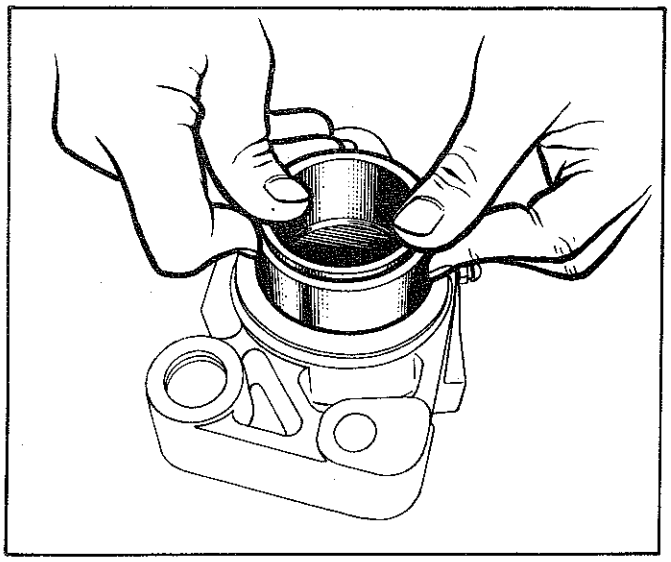


Fig. 8—Installing caliper piston

(5) Screw the bleeder into the caliper body.

(6) Lubricate the sleeve holes, sleeves and seals and pack the sleeve dust boots with "Thermatex EP2" grease, supplied in the repair kit.

(7) Install the seals into the sleeve hole grooves.

(8) Install the dust boot over the end of the sleeve, Refer Fig. 9.

(9) With the boot fitted to the sleeve, locate the boot into the sleeve hole groove using a blunt tool, Refer Fig. 10.

(10) Carefully push the sleeve through the boot, sleeve hole and seal, Refer Fig. 11.

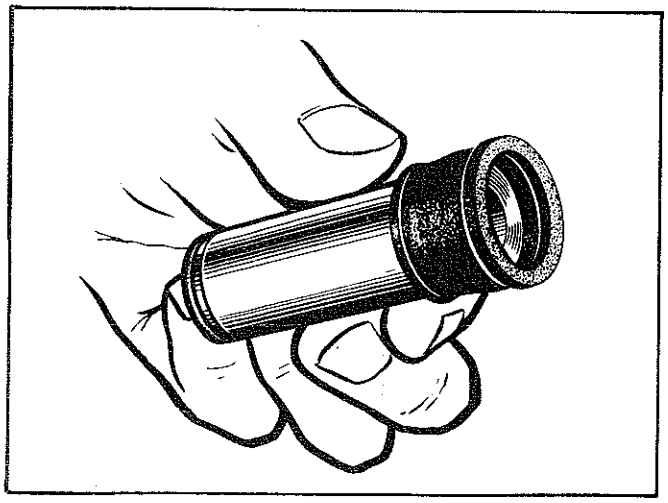


Fig. 9—Installing dust boot onto sleeve

(11) Wipe all lubricating fluid and grease from the caliper body.

(12) Install the anti-rattle clips onto the pads as shown in Fig. 3.

(13) Install both pads onto the pad support bracket as shown in Fig. 4. Ensure that the pads move freely on the pad support bracket.

(14) Assemble the pad support bracket onto the caliper body and tighten the joining bolts to the specified torque.

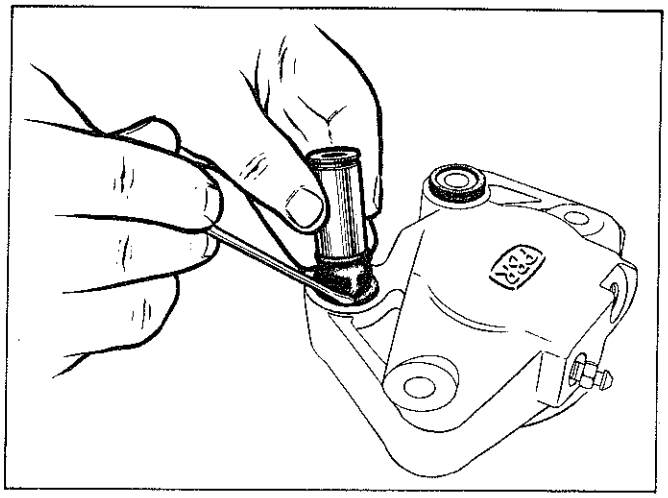


Fig. 10—Installing dust boot to sleeve hole.

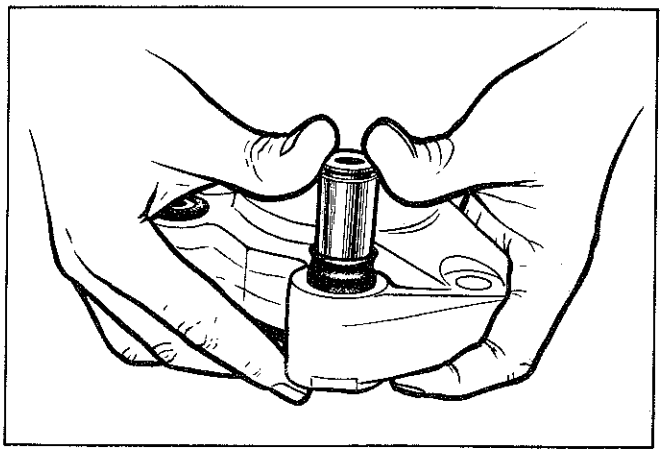


Fig. 11—Installing sleeve into caliper body

BRAKE DISC

Removal

(1) Raise the front of the vehicle and support on jack stands.

(2) Remove the wheel and tyre assembly.

(3) Remove the caliper jointing bolts, then remove the pad support and pads from the caliper body.

(4) Remove the hub dust cap, split pin, lock cap and nut, then remove the disc and hub assembly.

(5) If necessary the disc can be separated from the hub by clamping the disc in a vice equipped with soft jaws and removing the bolts securing the disc to the hub.

NOTE: Failure to use soft jaws in the vice will result in damage to the braking surface of the disc.

Inspection

(1) Check the disc for wear and damage and if necessary refinish the braking surface. A disc that is excessively damaged or worn will have to be replaced.

Installation

(1) Tighten the disc to hub mounting bolts to the specified torque.

(2) Install the disc assembly onto the stub axle and install the hub bearing retaining nuts as described in Group 22 — Wheels, Bearings and Tyres.

(3) Check the disc run out to specification. If the run-out exceeds the specified dimension, change the relative position of the disc to the hub. If this does not correct the runout, replace the disc.

(4) Install the pad support assembly and tighten the joining bolts to the specified torque.

(5) Install the wheel and tyre assembly and tighten the stud nuts in a diagonal sequence as described in Section 1.

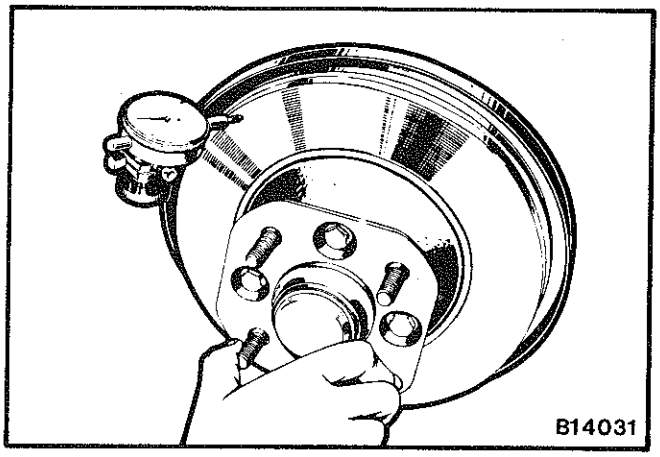


Fig. 12—Checking disc runout

SECTION 1C — FLOATING HEAD CALIPER ('F' TYPE) FRONT DISC BRAKES

SPECIFICATIONS

DISC BRAKE

Type	Floating head caliper 'F' type with solid disc
Location	Front wheels

CALIPER ASSEMBLY

Lining Thickness — New	10,5 mm (0.410") — early models 9,9 mm (0.385") — later models with pad shims
— Wear Limit	2,0 mm (0.080")
Lining Area (per caliper)	10600 mm² (16.43 in.²)
Lining Material	AKS 51GF
Number of Pistons	1 per caliper
Piston Diameter	50,67 to 50,72 mm (1.995" to 1.997")
Piston Bore Diameter	50,80 to 50,85 mm (2.000" to 2.002")

BRAKING DISC

Type	Solid type detachable from hub
Diameter	255 mm (10.04")
Thickness — Standard	12,5 mm (0.490")
— Minimum	11,0 mm (0.430")
Max. Run Out (on face)	0,165 mm (0.0065") or less
Disc Surface Finish — Circumferentially	3030 micro mm (119.3 micro inch) centre line average
— Radially	3030 micro mm (119.3 micro inch) centre line average
Disc Parallelism (in any direction)	0,06 mm (0.0023") max.
Disc Swept Area	634,6 cm² (98.36 in.²)

TORQUE SPECIFICATIONS

	Nm	lbs./ft.	lbs./in.
Adapter plate to strut	39-49	29-36	
Bleeder screw	5-9	4-7	48-84
Brake hose	12-16	9-12	108-144
Caliper support to adaptor plate	69-88	51-65	
Hub to disc bolts	34-39	25-29	
Wheel bearing nut	8		71
Wheel nuts — Alloy wheel	78-98	57-72	

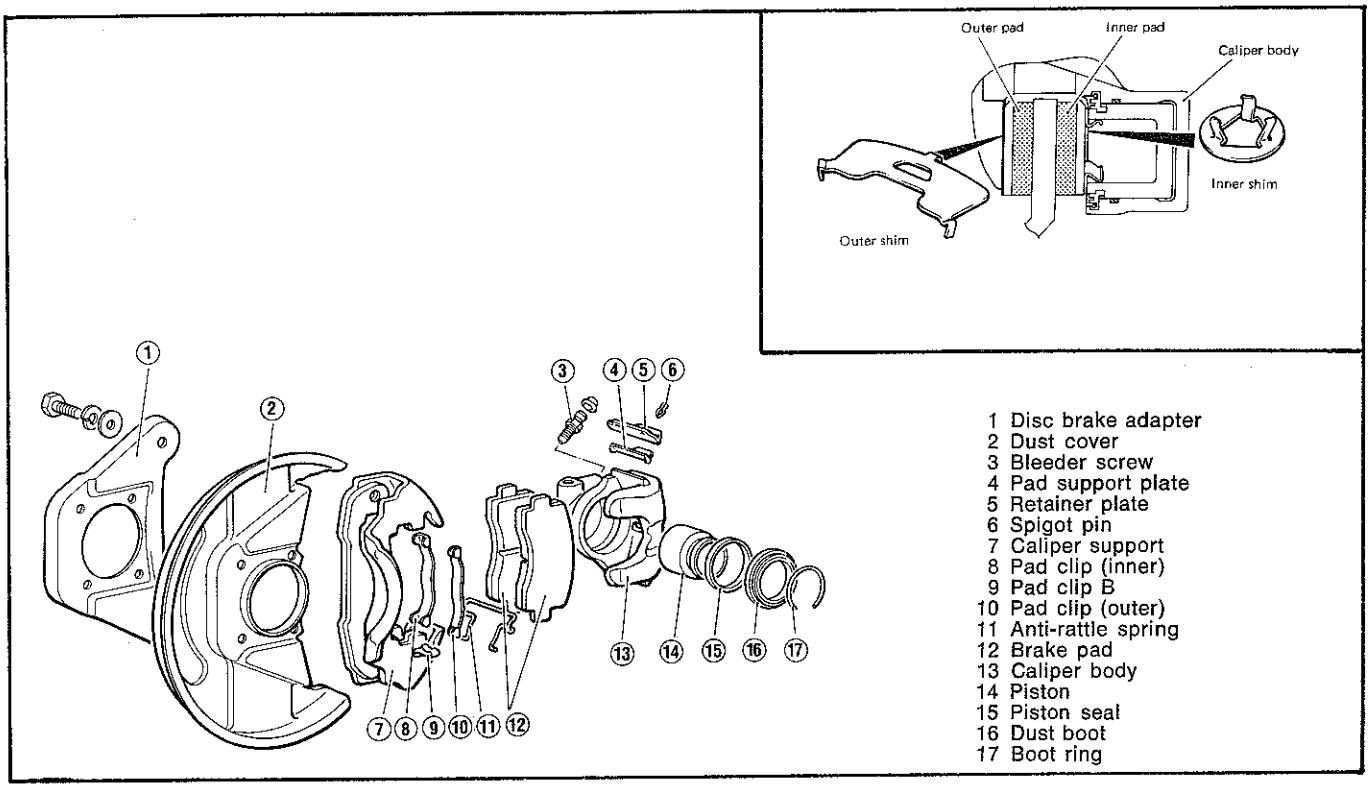


Fig. 1—Caliper assembly components

GENERAL INFORMATION

The single piston, floating head caliper disc brake assembly consists of the hub and disc assembly, the caliper, shoe, linings, splash shield and adaptor plate.

The caliper body is a one piece casting with the inboard side containing the piston cylinder bore. The square section rubber piston seal is located in a machined groove in the cylinder bore and provides a hydraulic seal between the piston and the cylinder wall.

A moulded rubber dust boot installed in a groove in the cylinder bore and piston, keeps contamination from the cylinder wall and piston.

As the brake pedal is depressed, hydraulic pressure is applied against the piston. This force is transmitted to the inboard brake shoe and lining and the inboard braking surface of the disc. As force increases against the disc, the caliper body moves inboard, sliding on the caliper support, thus providing a clamping force on the disc.

When the brake pressure is released, the piston seal (distorted by applied pressure) returns to its normal position, pulling the piston back to the released position, creating a slight running clearance between the shoe and the disc, refer Fig. 2.

Automatic adjustment is obtained by outward relocation of the piston as the inboard lining wears and the inward movement of the caliper as the outboard lining wears, thus maintaining correct adjustment at all times.

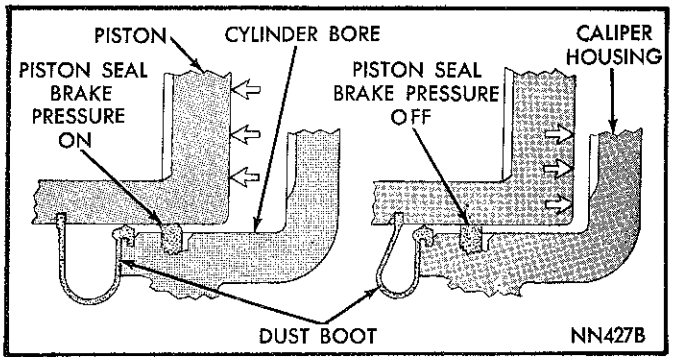


Fig. 2—Piston seal function for automatic adjustment

DISC PADS

Removal

(1) Raise the front of the vehicle and support on jack stands.

(2) Remove the wheels and tyre assemblies.

(3) Remove the spigot pins and pull out the retainer plates.

(4) Remove the caliper assembly diagonally upward or downward and support it suitably.

NOTE: Do not let the caliper hang from the brake hose.

(5) Remove the pads from the caliper support.

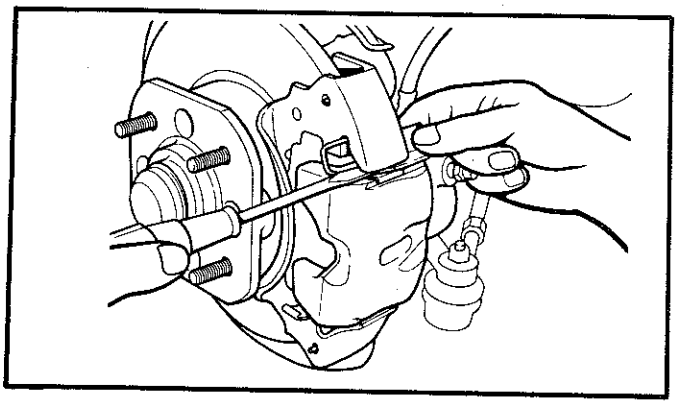


Fig. 3—Removing the retainer plate

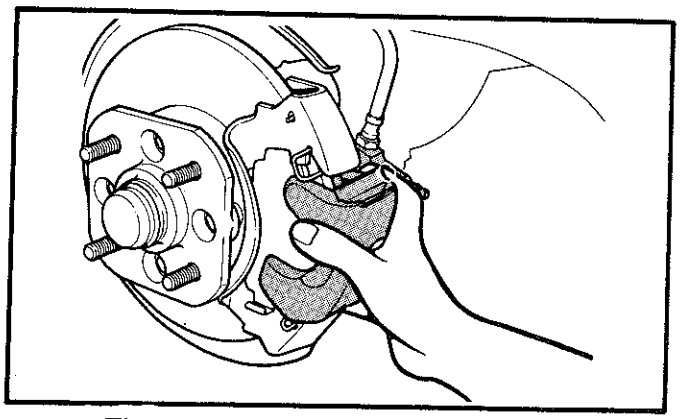


Fig. 4—Removing the caliper assembly

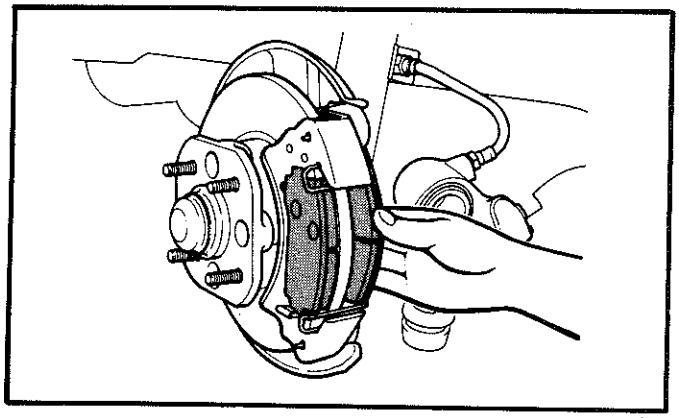


Fig. 5—Removing the pads

Inspection

(1) Check for piston seal leaks and for any ruptures of piston dust boot. If the boot is damaged, or fluid is evident, it will be necessary to disassemble the caliper and install a new seal and boot (and piston if necessary).

(2) Check the pads for wear beyond the specified limit, replace if necessary.

NOTE:

- **If the pads on one wheel require replacing, both front wheels should have the pads replaced.**
- **The groove in the centre of the pad is not a wear indicator, but provides a means of escape for lining dust.**

(3) Check the disc for wear and damage.

Installation

Install by reversing removal procedure noting the following:

(1) If necessary, clean the exposed piston area.

(2) Install the pad clips B and the lower inner and outer pad clips as shown in Fig. 6.

(3) Sparingly lubricate the retainer plates and caliper sliding area with high melting point grease.

If fitted with anti-squeal shims (see inset Fig. 1), apply a small amount of Rykon EP 2 grease to both sides of the outer shim.

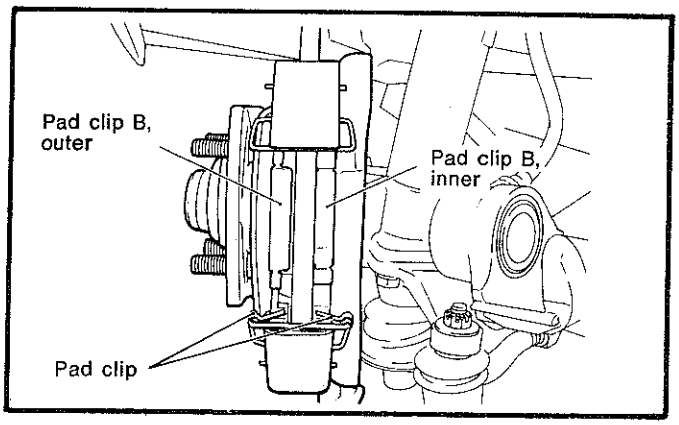


Fig. 6—Pad clip installation

(4) If new pads have been installed it will be necessary to push the piston back into its bore, this can be achieved using a hammer handle.

NOTE: If necessary, the bleeder valve can be opened to facilitate piston displacement.

CALIPER ASSEMBLY

Removal

(1) Remove the brake pads as previously described.

(2) Disconnect the fluid supply hose and remove the caliper from the vehicle. If necessary the caliper support can be removed.

NOTE: To prevent brake fluid loss from the hose, block the brake pedal in the applied position.

Installation

Install by reversing removal procedure and bleed the brake system as described in Section 1 — Bleeding The Brake System. Tighten all bolts to the specified torque.

Disassembly

(1) With the caliper removed from the vehicle, remove the piston dust boot.

(2) Place a suitable piece of soft wood on the outer pad support and apply **low** pressure compressed air to the fluid supply port of the caliper to remove the piston from the caliper housing.

NOTE: Ensure fingers are kept well clear of the piston when applying the compressed air.

(3) Remove the piston seal from the bore, taking care not to damage the caliper bore.

Cleaning and Inspection

Clean all parts in methylated spirits and dry with compressed air. The piston seal and boot should not be immersed in the cleaning fluid for more than 30 seconds.

Check the piston and cylinder for wear, damage or rust and check the seal and dust boot for wear or damage, replace any faulty components.

Assembly

Assemble by reversing disassembly procedure noting the following:

(1) If an overhaul kit is being used, lubricate the piston seal with the red translucent rubber grease, the dust boot with the orange grease and the piston and cylinder bore with brake fluid.

(2) When installing the piston into the bore be careful not to twist or damage the piston seal.

(3) Tighten all bolts to the specified torque.

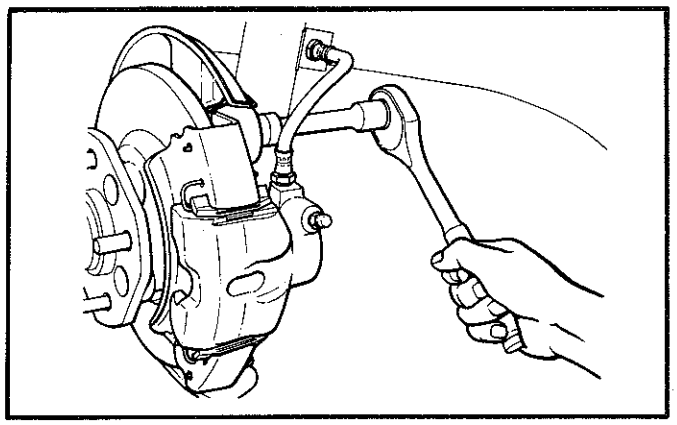


Fig. 7—Removing caliper assembly

BRAKE DISC

Removal

(1) Remove the bolts attaching the caliper support to the adaptor plate and remove the caliper assembly and support it suitably.

NOTE: Do not let the caliper hang from the brake hose.

(2) Remove the hub dust cap, split pin, nut lock and nut, and remove the disc assembly from the stub axle.

(3) Clamp the disc in a vice equipped with soft jaws and remove the hub to disc bolts. The hub and disc can now be separated.

Inspection

Check the disc for wear and damage, repair or replace if necessary.

Installation

Install by reversing removal procedure noting the following:

(1) Tighten all bolts to the specified torque.

(2) Check the disc runout to specification. If the runout exceeds the specified dimension, change the relative position of the disc to the hub. If this does not correct the runout replace the disc.

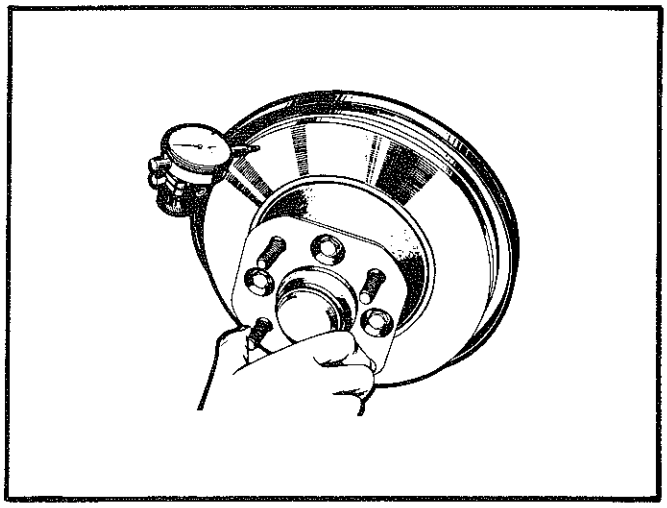


Fig. 8—Checking disc runout

SECTION 1D — GIRLOCK SLIMLINE COLETTE CALIPER

SPECIFICATIONS

DISC BRAKE

Type	Girlock Slimline Colette Caliper
Location	Front Wheels Only

CALIPER ASSEMBLY

Lining Thickness	9,5 mm (0.374")
Lining Replacement Thickness	0,80 mm (0.031") minimum
Lining Area	4174 mm² (6.46 in.²) (each pad)
Lining Material Type	BM7161A
Number of Pistons	1 per Caliper Assembly (inner side)
Piston Diameter	54,00 mm (2.126")
Piston Bore Diameter	54,07 mm (2.128")

BRAKING DISC

Type	Solid—Cast Iron
Diameter	255 mm (10.04")
Thickness—Standard	13,1 mm (0.515")
—Minimum	11,4 mm (0.450")
Max. Run-out Allowable	0,15 mm (0.006")
Disc Surface Finish—Circumferential	2,5 microns
Braking Surface Thickness Variation	0,25 mm (0.001")

TORQUE SPECIFICATIONS

	Nm	lbs./ft.	lbs./in.
Bleeder Screw	8-14		71-124
Brake Hose to Caliper	12-16	9-12	108-144
Brake Line Union Nut	11-13		95-115
Caliper Self Locking Bolts	38-43	28-32	
Caliper Mounting Bolts	69-88	51-65	
Caliper Mounting Bracket to Knuckle Bolts	39-49	29-36	
Dust Shield Bolts	5-6		44-53
Hub to Disc Bolts	34-39	25-29	
Wheel Stud Nut—Progressively	75	55	

GENERAL INFORMATION

The single piston, sliding caliper disc brake assembly consists of the hub and disc assembly, caliper, brake pads and a splash shield.

When the wheel is in motion, the rotation of the disc cools the braking surface of the disc and prolongs lining life. The braking disc is protected from road splash (inboard side) by a shield bolted to the steering knuckle and by the wheel and tyre on the outboard side.

The caliper consists of two main components a cast iron anchor plate (2) and an aluminium alloy housing (1). The anchor plate is attached to the stub axle, whilst the housing slides within the anchor plate by means of two guide pins (10) bolted to the housing. Moulded rubber boots (3) are fitted to the guide pins to prevent dirt ingress.

NOTE: Early model caliper assemblies were attached to a mounting bracket bolted to the stub axle.

Operation

The caliper operates on the single piston principle with the housing incorporating the hydraulic piston (6) and seal (5). When hydraulic pressure is applied, the single piston forces the inner pad (9) against the disc with the housing reacting to pull the outer pad (8) towards the disc. The pressure on both sides of the disc is then equalized, thus providing a clamping force on the disc.

When the pressure is released, the piston seal (5), fitted in the bore of the housing, retracts the piston a small amount, which allows the moving components to relax sufficiently for the pads to remain in close proximity to the disc, without dragging, and ready for the next brake application.

Adjustment for lining wear is therefore automatic.

Identical inner and outer pad assemblies take the rotational thrust directly onto the anchor plate. Each pad incorporates a torsional spring to eliminate housing and pad rattles.

Bleeding Disc Brake System

Bleeding the brake system is described in Section 1, of this group.

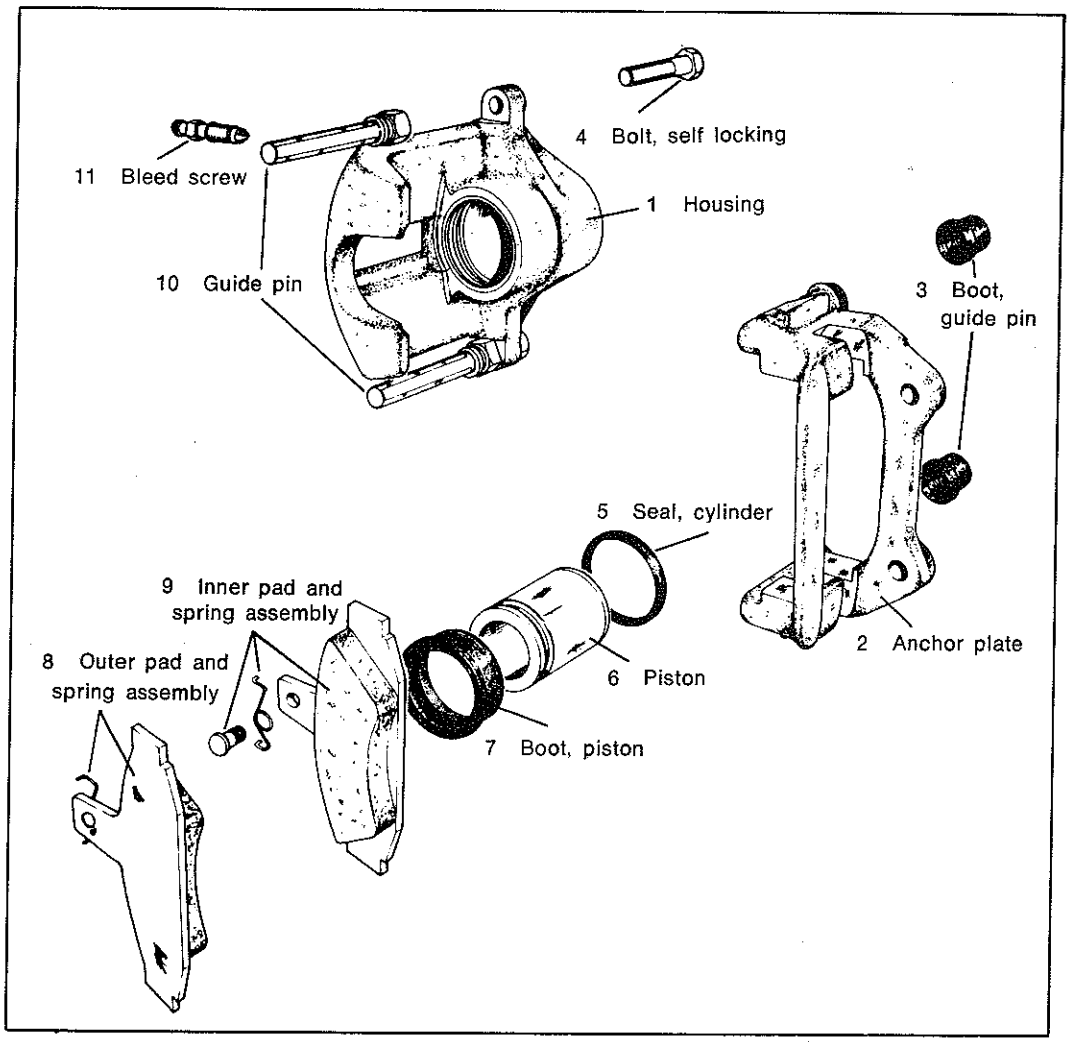


Fig. 1—Caliper assembly—disassembled view

ROUTINE MAINTENANCE

Check Brake Lines, Hose and Linings

Raise all four wheels. Remove front wheel and tyre assemblies and inspect the braking disc, linings and caliper. Inspect brake flexible hose and tubing according to procedure outlined in paragraph entitled "Brake Hose and Tubing", (the wheel bearings should be inspected at this time and repacked if necessary).

Do not get oil or grease on the braking disc or linings. If the brake pad linings are worn to the minimum specification, replace both the inboard and outboard pads on each front wheel. It is necessary that both front wheel sets be replaced whenever a respective brake pad is worn beyond specifications or damaged.

Check all brake tube connections for possible leaks. Install new flexible hoses as required

NOTE: Ensure that the hose is not twisted during fitment — always point the wheels straight ahead before fitting the hose to the bracket and ensure that the hose is not twisted more than 15° after the final fitment.

Brake Pad Wear

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tyre assemblies. Remove the brake pad assemblies (see "Pad Replacement" paragraph). Three thickness measurements with a micrometer should be taken across the centre of each shoe and lining assembly; one reading at each end and on reading in the centre.

Brake Roughness

The most common cause of brake roughness (or chatter) with disc brakes is excess variation in disc thickness and/or excessive disc face run-out. These can be easily checked with a dial indicator and a micrometer (vernier type preferred). If either of the measurements are out of specification, the disc must be resurfaced or replaced.

Other less prevalent causes of roughness can be the use of some type of non-standard lining and extreme abrasion of the disc faces. Vehicles which stand unused for periods of time in areas of high humidity or salt air may incur rust on the disc which could cause a temporary brake surge and roughness. Normally, however, this condition should correct itself after a short period of usage. If rust is severe enough, roughness will not clear up and the disc must be resurfaced or replaced.

DISC BRAKES SERVICE PRECAUTIONS

(1) During service procedures grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub. Handling the braking disc and caliper should be done in such a way as to avoid deformation of the disc and scratching or nicking the brake pad linings.

(2) The brake caliper self locking bolts **must not** be re-used. New bolts must be fitted at each caliper disassembly.

(3) If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

(4) During removal and installation of a wheel and tyre assembly, use care not to strike the caliper.

(5) The front wheel bearing end play is important and must be within specifications.

(6) Be sure the vehicle is centred on the hoist before servicing any of the front end components to avoid bending or damaging the disc splash shield on full right or left hand turns.

(7) Before the vehicle is moved after any brake service work, **be sure and obtain a firm brake pedal** by using correct bleeding procedures.

(8) Dragging the brakes (common result of left foot application on vehicles with automatic transmission) should be avoided during vehicle operation.

(9) The wheel, tyre, hub and disc assembly cannot be removed as an assembly. The pads and pad support must be removed before removal of the hub and disc assembly.

(10) As the brake pad wears the master cylinder reservoir level will go down. If fluid has been added between relines, then reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided in this case by removal of a small amount of fluid before overflow occurs.

PAD REPLACEMENT

Removal

(1) Raise the front of the vehicle and support on jack stands.

(2) Remove the wheel and tyre assembly.

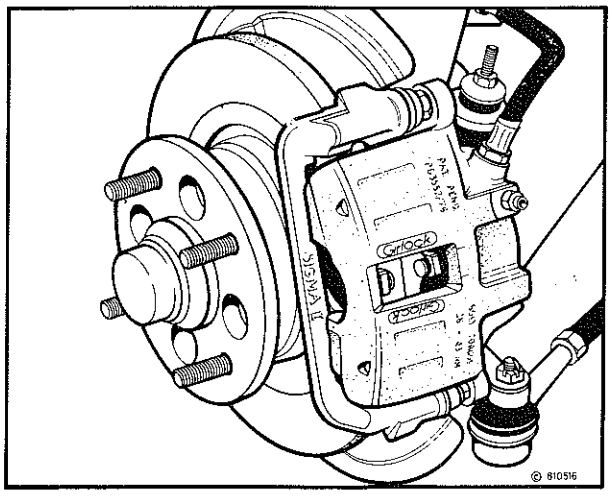


Fig. 2—Front brake assembly

(3) Remove the lower caliper self locking bolt.

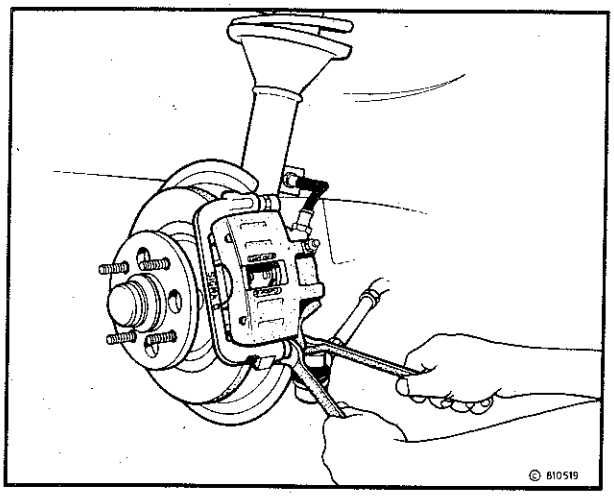


Fig. 3—Removing lower self locking bolt

(4) Swing the housing up and away from the anchor plate.

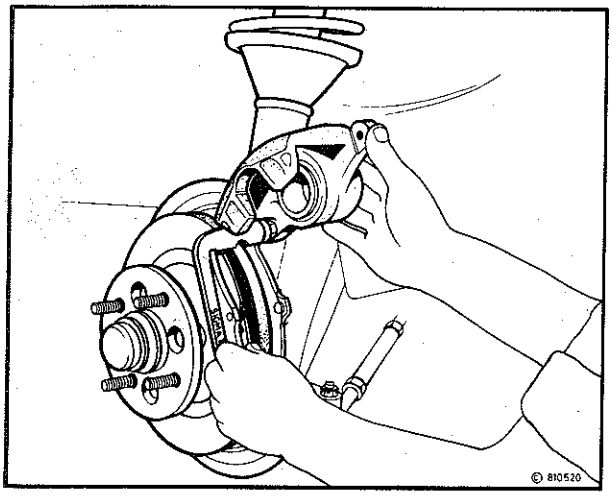


Fig. 4—Removing front brake pads

(5) Remove the pads from the anchor plate.

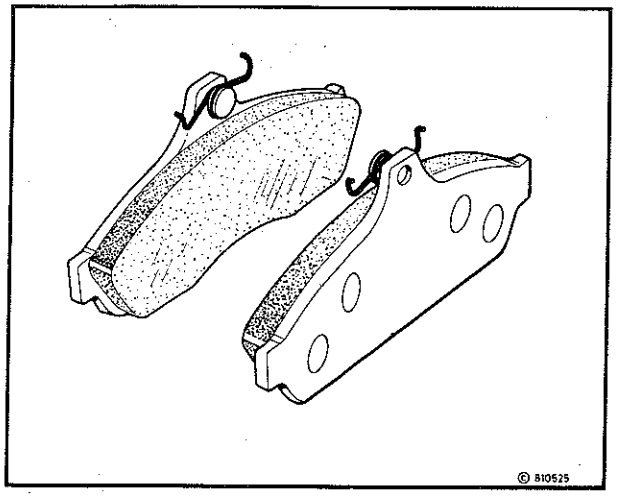


Fig. 5—Brake pad assemblies

Cleaning and Inspection

(1) Check for piston seal leaks (evident by brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged or fluid is evident, it will be necessary to disassemble the caliper assembly and install a new seal, boot and piston if damaged or corroded. (Refer to "Disassembling Caliper Assembly").

(2) Check the guide pins (item 10 Fig. 1) for freedom of movement, also the condition of the rubber boots (item 3, Fig. 1).

(3) If the guide pins cannot be moved freely by hand, these should be removed and cleaned. Also renew the rubber boots if they are found to have deteriorated.

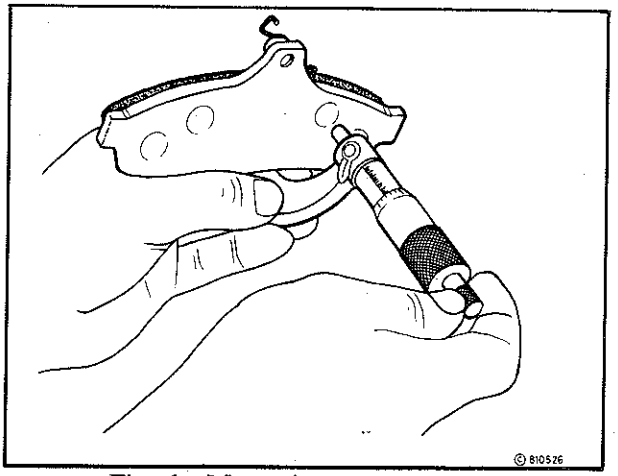


Fig. 6—Measuring pad thickness

Installation

NOTE: Ensure replacement pads are of the specified material type.

(1) If the guide pins have been removed, lubricate with silicon grease prior to fitting the guide pins to the anchor plate.

(2) Connect a brake bleeding hose to the bleed screw (item 11 Fig. 1).

(3) Insert the end of the hose in a partially filled glass jar of brake fluid and open the bleed screw.

(4) Press the piston by hand, evenly into the bore of the housing until the piston is fully bottomed.

(5) Tighten the bleed screw and disconnect the brake bleeding hose.

(6) Install new pads into the mounting bracket.

(7) Lower the housing over the disc pads, ensuring that the pad springs are correctly located in the housing and **install a new self locking bolt** (item 4 Fig. 1).

(8) Hold the guide pin (item 10 Fig. 1) with a suitable spanner and tighten the self locking bolt to 38-43 Nm (28-32 lbs./ft.).

(9) Depress the brake pedal several times to actuate the caliper piston to bring the pad assemblies into position against the disc. Check the fluid level in the master cylinder reservoir and top up if necessary.

(10) Install the wheel and tyre assembly and tighten the nuts to the specified torque.

CALIPER ASSEMBLY

Removal

(1) Raise front of vehicle and support on jack stands.
(2) Remove the wheel and tyre assembly.
(3) Discharge the brake fluid via the caliper bleed screw, (item 11 Fig. 1) by pumping the brake pedal.
(4) Disconnect the fluid supply pipe from the caliper hose and remove the hose retaining clip from the body and suspension strut bracket.
(5) Disconnect the hose from the caliper.
(6) Plug the brake pipe and caliper to prevent ingress of dirt.
(7) Detach the caliper housing from the mounting bracket by removing the two caliper self locking bolts (item 4 Fig. 1).

NOTE: It is not necessary to remove the mounting bracket from the vehicle for normal caliper overhaul.

Installation

Install by reversing removal procedure and bleed the brake system as described in Section 1.

NOTE: New caliper self locking bolts (item 4 Fig. 1) must be fitted and tightened to the specified torque.

Disassembly

(1) Remove the caliper as previously described.
(2) Withdraw guide pins (item 10 Fig. 1) and rubber boots from the mounting bracket.
(3) Hold the caliper housing and place a piece of wood between the outer end of the piston and housing outboard legs, apply air pressure at the brake hose port to eject the piston.

CAUTION: Apply light air pressure, increasing it progressively until the piston is forced out of the bore. Keep fingers clear when removing the piston with air pressure as the piston may be ejected with considerable force.

(4) Remove the rubber boot from the housing.

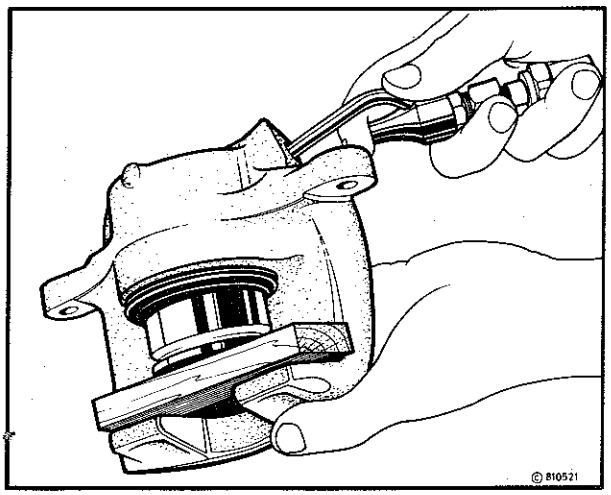


Fig. 7—Removing caliper piston

(5) Using a blunt tool, remove the piston seal from the groove in the housing bore. Care must be taken not to damage the seal groove in the bore.
(6) Remove the bleeder screw.

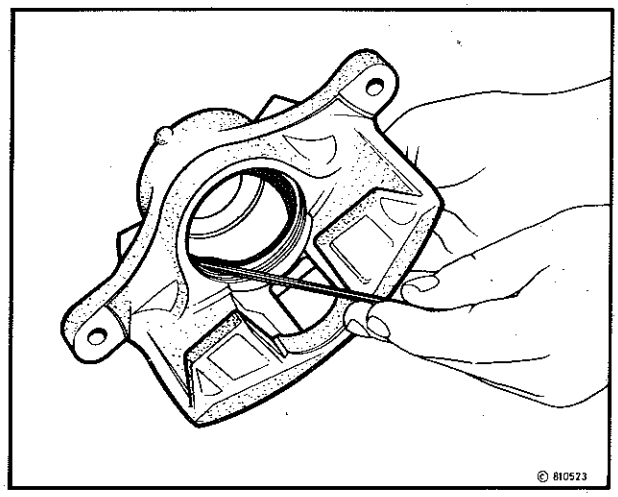


Fig. 8—Removing piston seal from caliper bore

*Cleaning and Inspection

(1) Clean all metal parts thoroughly with methylated spirits. Use clean dry compressed air to dry off the parts.
(2) Examine the housing bore and piston carefully for signs or damage, abrasion scoring or corrosion. Renew the piston if any of these factors exist, or if there is any doubt on its condition.
(3) If the housing bore is unserviceable, a new housing must be fitted.

NOTE: The housing bore must not be honed.

Assembly

NOTE: When using a repair kit, install all the parts supplied in the kit.

(1) Lubricate the new piston seal with clean brake fluid and install the seal in the housing bore groove. Ensure the seal is correctly seated in the groove.
(2) Lubricate the inside of the housing bore and the outside of the piston with clean brake fluid.

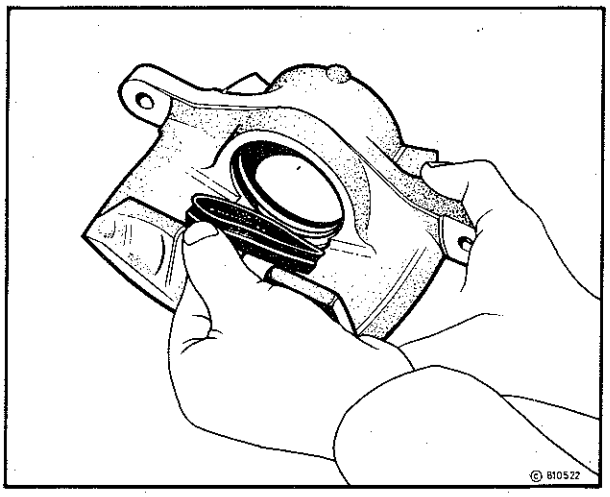


Fig. 9—Installing rubber boot

(3) Install a new boot into the outer groove of the housing ensuring the flange of the boot is squarely and firmly seated in the groove.

(4) Locate the piston in the housing bore and push it to the bottom of the bore by hand. Spread the boot over the piston as the piston is installed, taking care not to disturb the seal in the groove. Ensure the outer lip of the boot is located in the groove of the piston.

(5) Replace the bleed screw.

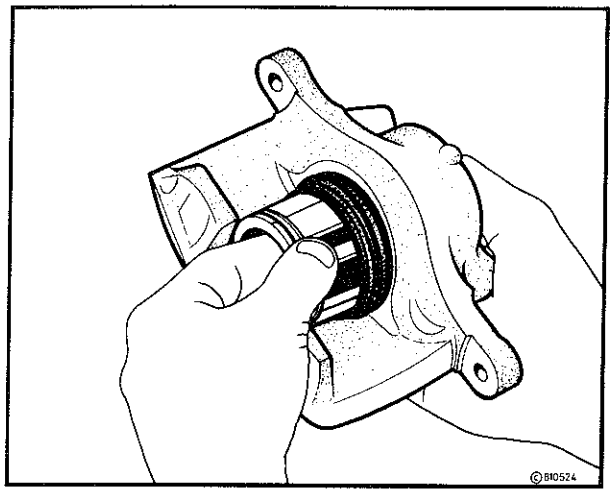


Fig. 10—Installing caliper piston

BRAKE DISC

Removal

(1) Raise the front of the vehicle and support on jack stands.

(2) Remove the wheel and tyre assembly.

(3) Remove the caliper mounting bolts and lift the caliper assembly away from the steering knuckle.

NOTE: Support the caliper assembly with a wire hook. Do not allow the brake hose to take the weight of the caliper.

(4) Remove the hub dust cap, split pin, lock cap and nut, then remove the disc and hub assembly.

(5) If necessary the disc can be separated from the hub by clamping the disc in a vice equipped with soft jaws and removing the bolts securing the disc to the hub.

NOTE: Failure to use soft jaws in the vice will result in damage to the braking surface of the disc.

Inspection

(1) Check the disc for wear and damage and if necessary resurface the braking surface. A disc that is excessively damaged or worn will have to be replaced.

Installation

(1) Tighten the disc to hub mounting bolts to the specified torque.

(2) Install the disc assembly onto the stub axle and install the hub bearing retaining nuts as described in Group 22 — Wheels, Bearings and Tyres.

(3) Check the disc run-out to specification. If the run-out exceeds the specified dimension, change the relative position of the disc to the hub. If this does not correct the run-out, replace the disc.

(4) Lower the caliper assembly over the brake disc and install the mounting bolts, tighten to 69-88 Nm (51-65 lbs. ft.).

(5) Depress the brake pedal several times to actuate the caliper piston to bring the pad assemblies into position against the disc. Check the fluid level and top up if necessary.

(6) Install the wheel and tyre assembly and tighten the stud nuts in a diagonal sequence as described in Section 1.

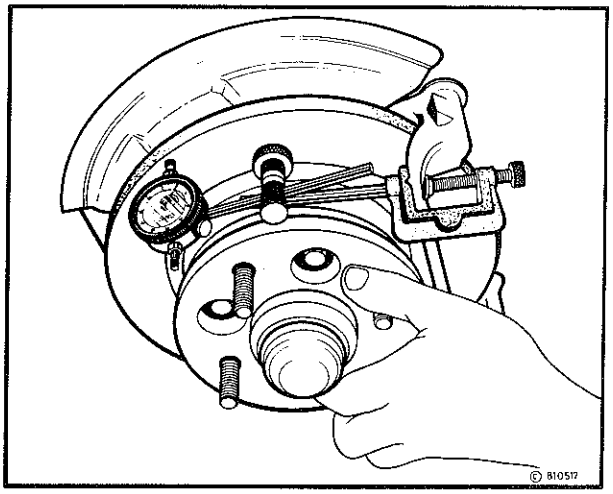


Fig. 11—Checking disc run-out

DISC MACHINING

The condition of the disc is a vital factor in the efficient functioning of the brake.

The disc should run true between the pads. The maximum run-out permissible is 0,15 mm (0.006") and if this tolerance is exceeded, it will cause knock back of the piston which will, in turn, be recognised as pedal flutter.

It is also essential, that thickness variation is maintained at less than 0,02 mm (0.001"). The surface of the disc should be smooth. The scratches and light scoring which appear after normal use, are not detrimental, but a heavily scored disc will impair efficiency and increase pad wear.

If the disc run-out exceeds 0,15 mm (0.006"), or is heavily scored, it is permissible to machine the disc, but the thickness of the disc must not under any circumstances be reduced below 11,4 mm (0.449"). The minimum disc thickness must be obtained by removing equal amounts from both disc faces.

NOTE: Under NO circumstances should the maximum machining allowance be taken from only one face.

In cases where the disc does not clean up within these tolerances, a new disc must be fitted.

SECTION 2 — LEADING TRAILING SHOE REAR BRAKES AND PARKING BRAKE (Imported Type)

SPECIFICATIONS

Type	Leading trailing
Adjustment	Automatic activated by use of footbrake

DRUM

Diameter	229,0 mm (9.0")
Maximum oversize diameter	230,6 mm (9.079")

SHOES AND LININGS

Lining length x width x thickness	243 x 40 x 4,3 mm (9.570" x 1.570" x 0.169")
Lining service replacement thickness	1 mm (0.040")
Lining type	Akebono B515
Lining to drum clearance	0,30 to 0,47 mm (0.012" to 0.018")

WHEEL CYLINDER

Number	One double ended per side
Bore diameter	19,050 to 19,102 mm (0.7500" to 0.7521")
Piston outside diameter	18,997 to 19,030 mm (0.7479" to 0.7492")
Piston to bore clearance	0,020 to 0,105 mm (0.0008" to 0.0041")
Service replacement clearance	0,15 mm (0.006")

PARKING BRAKES

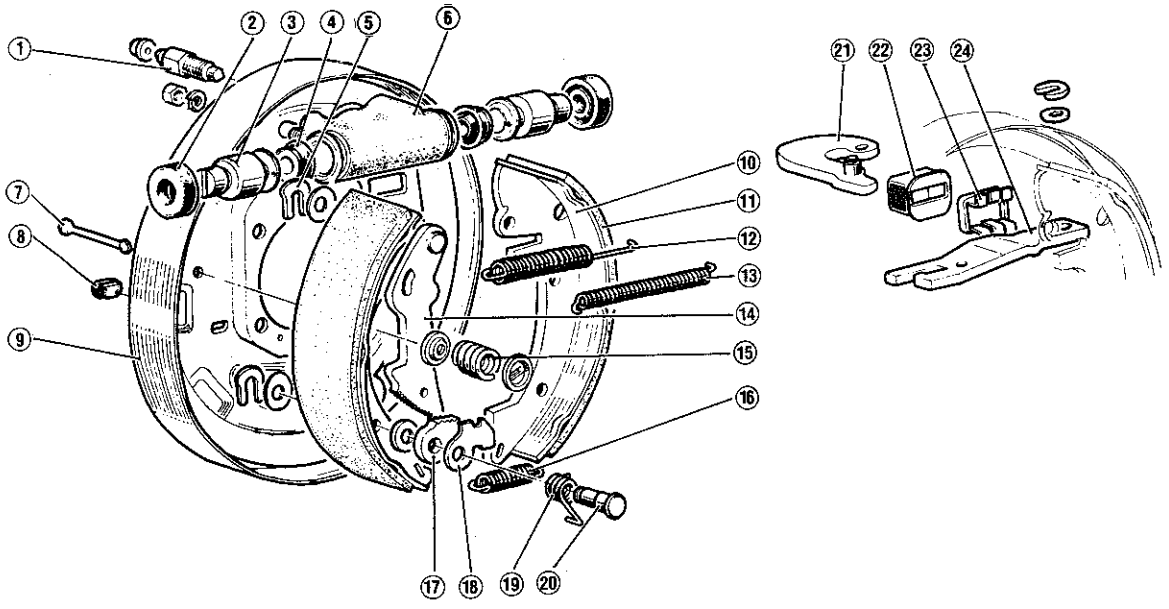
Extension lever to stopper clearance	2,50 mm (0.10") or less
Lever stroke	5 to 7 notches

SPECIAL TOOLS

Piston cup installer set	MB 990618

TORQUE SPECIFICATIONS

	Nm	lb./ft.
Wheel cylinder retaining bolts	8-12	6-9
Brake tube flared nuts	12-16	9-12
Bleeder screw	7-8,5	5-6,5
Wheel nuts (in diagonal sequence) — Sedan	69-79	51-58
— Two Door	78-98	57-72



1 Bleeder screw
2 Wheel cylinder boot
3 Wheel cylinder piston
4 Wheel cylinder cup
5 Retainer
6 Wheel cylinder body
7 Shoe hold-down pin
8 Adjusting wheel cover
9 Backing plate
10 Brake shoe assembly
11 Brake lining
12 Shoe return spring (upper)
13 Strut to shoe spring
14 Adjusting lever
15 Shoe hold-down spring
16 Shoe return spring (lower)
17 Adjusting latch
18 Stopper
19 Latch spring
20 Pin
21 Parking brake extension lever
22 Parking brake extension lever cup
23 Parking brake extension lever retainer
24 Parking brake strut

Fig. 1—Exploded view of brake assembly

BRAKE LININGS

Removal

(1) Raise the rear of the vehicle and support on jack stands. Remove the wheel and tyre assembly and remove the brake drum.

(2) Remove the shoe hold-down spring.

(3) Detach the strut-to-shoe spring and shoe return spring (upper) end hook from the trailing shoe. Then remove the brake shoe assembly together with the shoe return spring (lower).

(4) Holding the adjusting latch downward, pull the adjusting lever toward the centre of the brake, and remove the leading shoe assembly.

(5) Remove the shoe return spring (upper) and the strut-to-shoe spring.

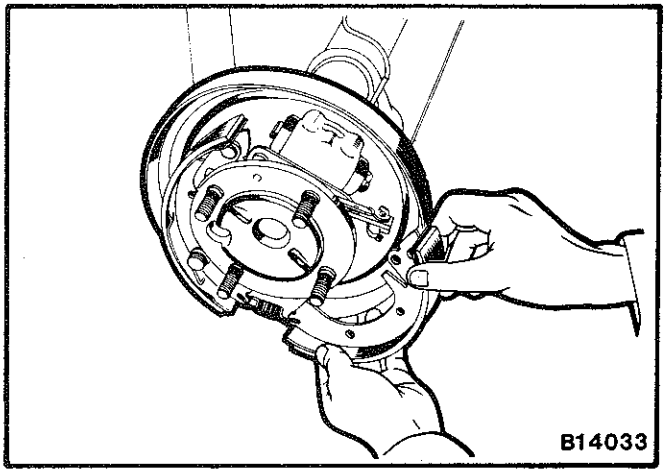


Fig. 2—Removing the trailing brake shoe

(6) After disconnecting the brake pipe/s from the wheel cylinder, remove the wheel cylinder from the backing plate.

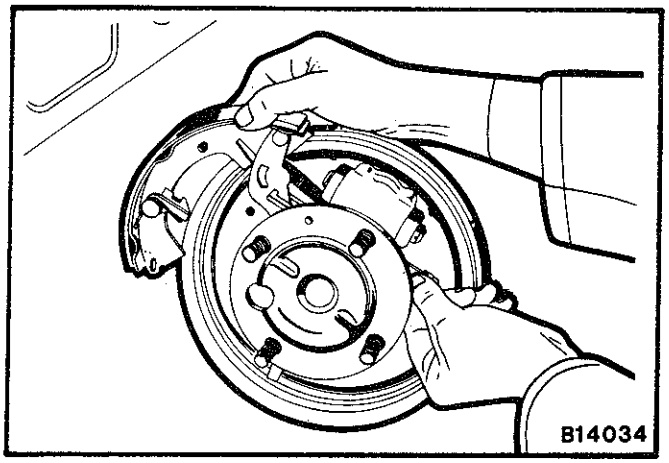


Fig. 3—Removing the leading brake shoe

(7) Disconnect the parking brake cable from the extension lever by pulling off the clevis pin.

(8) Remove the parking brake strut and parking brake extension lever from the backing plate.

(9) If removal of the backing plate is necessary, refer to Group 3 for details of axle shaft removal.

Inspection

(1) Checking the Brake Shoe Wear.

Check each lining for proper thickness, uneven wear and presence of oil. Replace any defective linings.

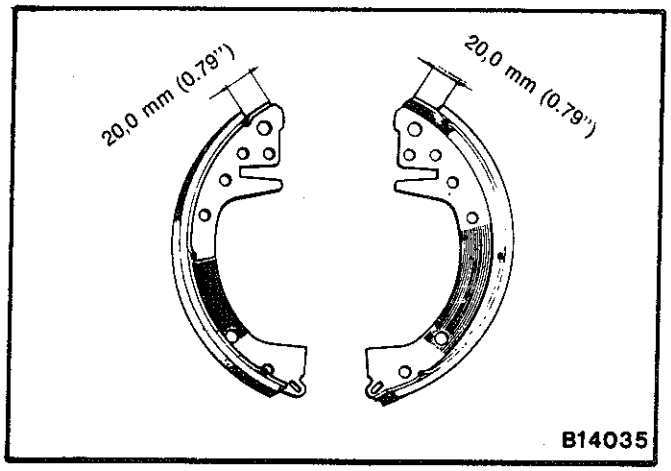


Fig. 4—Lining bonding points

(2) Checking the Wheel Cylinders.

Check the cylinder I.D. and piston O.D. for flaws. Replace any defective parts. Replace the wheel cylinder and piston if the piston-to-wheel cylinder clearance exceeds the specified limit. Check the piston cup and cylinder boot. Replace the parts that have been damaged, worn or deformed.

NOTE: Replace the piston cup and boot at every major brake overhaul.

(3) Replacing the Piston cup.

To replace the piston cup, use a genuine wheel cylinder kit and proceed as follows.

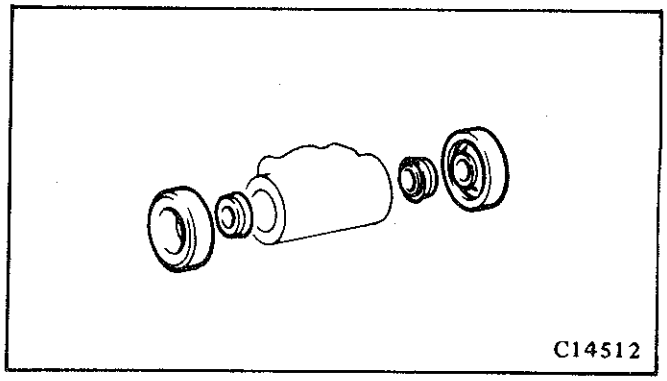


Fig. 5—Wheel cylinder components

When a new piston cup is installed use the Piston Cup Installer with a stamped identification mark A furnished in the Piston Cup Installer Set. (Special Tool MB990618).

Apply the specified lubricant (furnished in the kit) to the piston cup and installer, fit the piston cup on the installer and push the cup slowly and evenly by fingers (without stopping) until it is assembled to the piston.

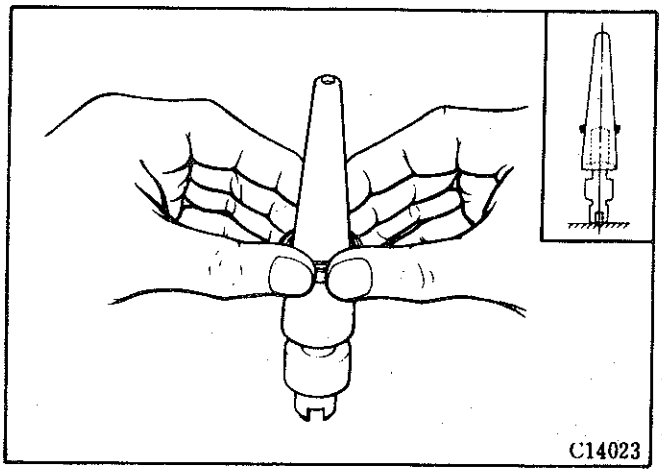


Fig. 6—Installing piston cup

(4) Check the adjusting lever and adjusting latch for wear and damage. Replace any defective parts.

(5) Checking the Brake Drum.

Check the inner wall of the brake drum for groove wear and presence of oil. Correct or replace the drum if it is defective.

Installation

Install by reversing removal procedure noting the following:

(1) When the wheel cylinder is assembled, apply brake fluid to the inside surface of the cylinder and the entire peripheral surface of the piston cup.

(2) After installing the dust boots to the piston, apply the orange rubber grease (supplied in the repair kit) to the piston as shown, refer Fig. 7.

Assemble the parts being careful not to damage the cylinder, piston, piston cup, etc.

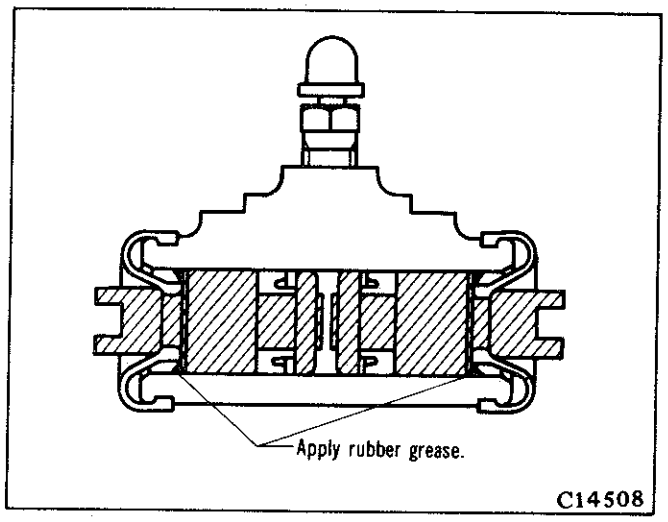


Fig. 7—Rubber grease application

(3) Install the wheel cylinder to the backing plate and tighten it to the specified torque.

(4) Use a high melting point grease to sparingly lubricate the backing plate ledge surface, wheel cylinder, anchor plate shoe contact surfaces, parking strut joints and contact surfaces.

(5) Pull the adjusting lever fully towards the centre of the brake and ensure the adjusting lever engages with the strut.

NOTE: The left adjusting lever is colour coded white and the right is yellow. The left latch spring is coloured black and the right light blue.

(6) After the hold-down spring has been installed, install the shoe to shoe spring and install one end of the strut-to-shoe spring to the strut and the other end to the shoe with the adjusting lever in the fully released position.

NOTE: The difference between the right and left strut-to-shoe springs is that the left spring is colour coded white while the right is plain.

(7) Return the adjusting lever until it touches the shoe rim.

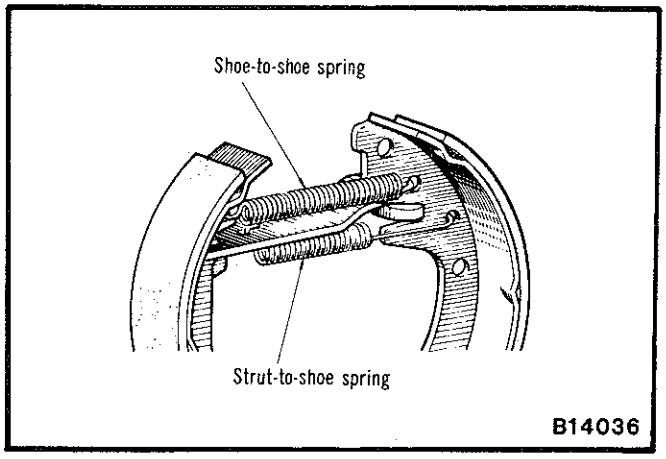


Fig. 8—Installing strut-to-shoe spring

(8) After tightening the brake tube to the specified torque, bleed the brake hydraulic system as described in Section 1.

(9) The brake shoe lining-to-drum clearance is automatically adjusted simply by depressing the brake pedal several times. The automatic adjuster is designed to operate approximately every 0.08 mm (0.0031 in.) wear of the linings.

PARKING BRAKE

Adjustment

Check if the parking brake lever has the standard amount of stroke (5 to 7 notches). Adjust the stroke if necessary as follows:

(1) Release the parking brake lever fully.

(2) Adjust the extension lever-to-stopper clearance to the specified dimension by loosening the cable adjusting nut and then positioning left hand cable to set the specified clearance.

(3) Adjust the right hand cable clearance by means of the adjusting nut and then tighten the lock nut.

NOTE: After the adjustment has been made, the parking brake lever must have the specified stroke. If the stroke is larger than specified the rear brake automatic adjusters are faulty and must be repaired.

Removal

(1) Remove the clevis pins from both rear brake levers and disconnect the cable from the extension lever.

Remove the rubber hanger from the centre of axle housing.

(2) Remove the parking brake lever and remove the clevis pin linking the lever and cable.

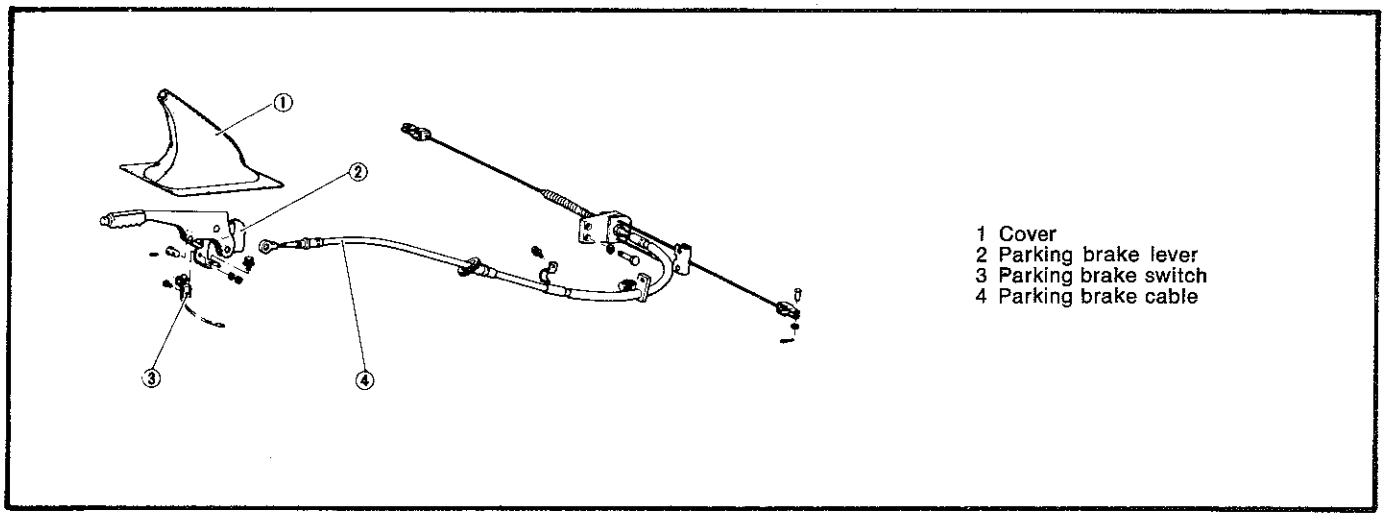


Fig. 9—Parking brake components

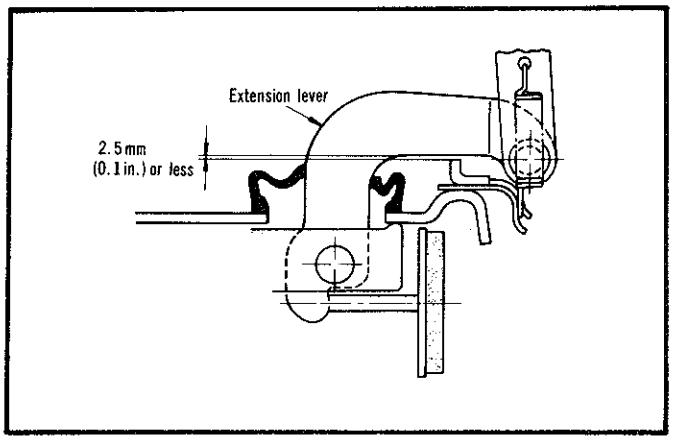


Fig. 10—Extension lever adjustment

(3) Remove the clips under the floor and draw the cable out.

Inspection

(1) Check the parking brake lever for ratchet wear, damage and movement of cable. Replace any faulty components.

Installation

Install by reversing removal procedure noting the following:

(1) Apply an appropriate amount of grease to each sliding part.

(2) Install each cable clip, and make sure the cable does not interfere with any rotating parts.

(3) Fit the cable grommet positively in the floor.

SECTION 2A

GIRLOCK LEADING TRAILING SHOE REAR BRAKES AND PARKING BRAKE

SPECIFICATIONS

Type	Leading trailing
Adjustment	Automatic activated by use of footbrake

DRUM

Diameter	228,6 mm (9.0")
Maximum oversize diameter	229,5 mm (9.035")

SHOES AND LININGS

Lining length x width x thickness	218 x 44 x 4 mm (8.582" x 1.732" x 0.157")
Lining service replacement thickness	1 mm (0.040")
Lining type	HF2626

WHEEL CYLINDER

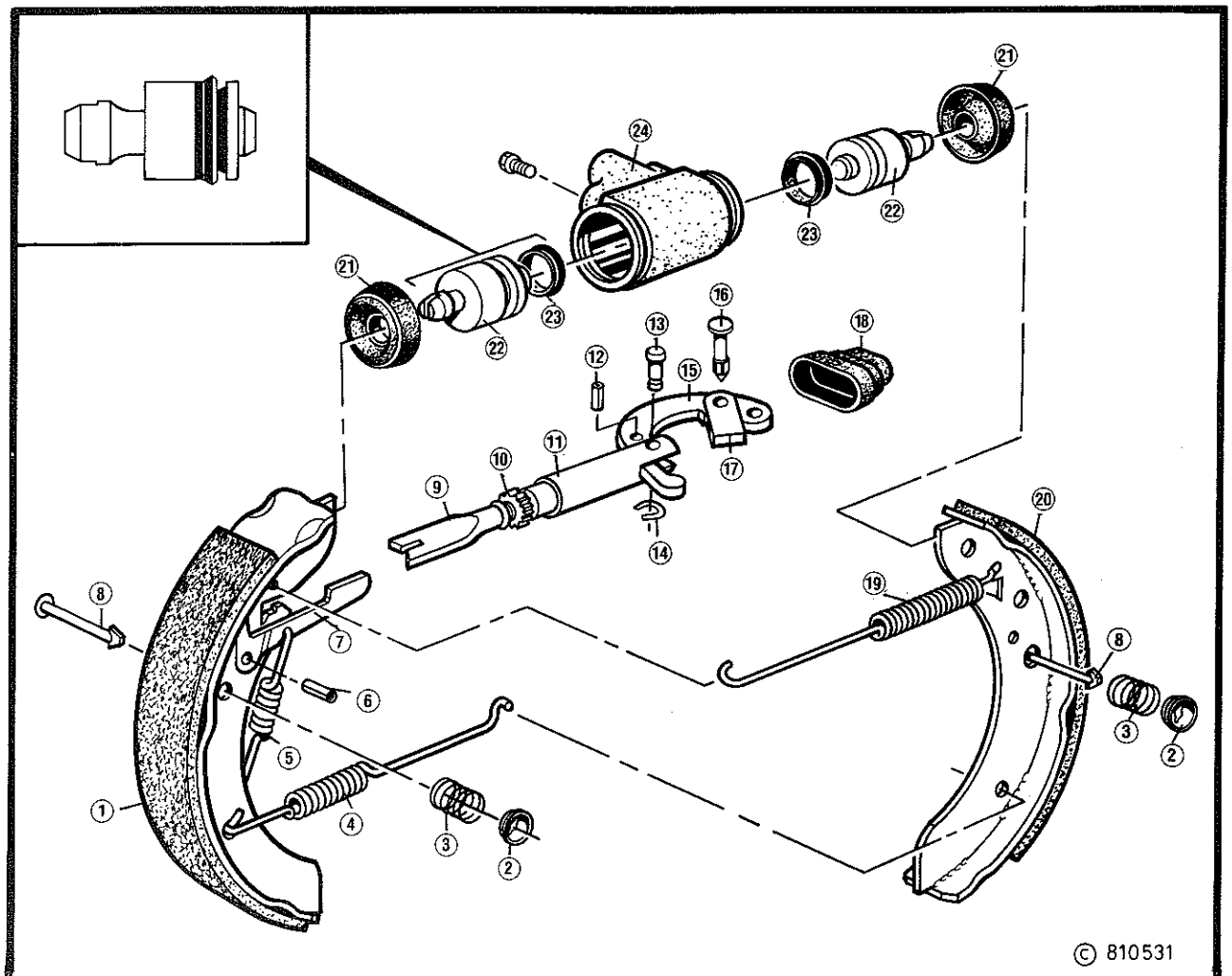
Number	One double ended per side
Bore diameter	20,635 mm (0.812")
Piston outside diameter	20,575 mm (0.810")

PARKING BRAKE

Lever stroke	4 to 6 notches

TORQUE SPECIFICATIONS

	Nm	lb./ft.
Wheel cylinder retaining bolts	8-12	6-9
Brake tube flared nuts	10-12	7-9
Bleeder screw	7-8,5	5-6,5
Wheel nuts (in diagonal sequence)	69-79	51-58



1	Leading shoe	9	Push rod, male	17	Lever stop
2	Hold-down washer	10	Adjuster nut	18	Rubber boot
3	Hold-down spring	11	Push rod, female	19	Spring, upper
4	Spring, lower	12	Roll pin	20	Trailing shoe
5	Spring, lever pawl	13	Pivot pin	21	Rubber boot
6	Roll pin	14	Circlip	22	Piston
7	Lever pawl	15	Operating lever	23	Seal
8	Hold-down pin	16	Lever stop pin	24	Wheel cylinder body

Fig. 1—Exploded view of brake assembly

BRAKE SHOES AND WHEEL CYLINDERS

Removal

(1) Raise the rear of the vehicle and support on jack stands. Remove the wheel and tyre assembly.

(2) Remove the brake drum.

NOTE: If the brake drum is difficult to remove due to scoring or grooving, increase the clearance between the drum and linings by disconnecting the parking brake cable clevis pin, plug fastener and lever stop. With the lever stop removed and cable disconnected, the lever will move towards the backplate, thus retracting the brake shoes and increasing the clearance between the linings and drum thereby allowing drum removal.

(3) Remove the upper and lower brake shoe return springs, hold down washers, springs and pins.

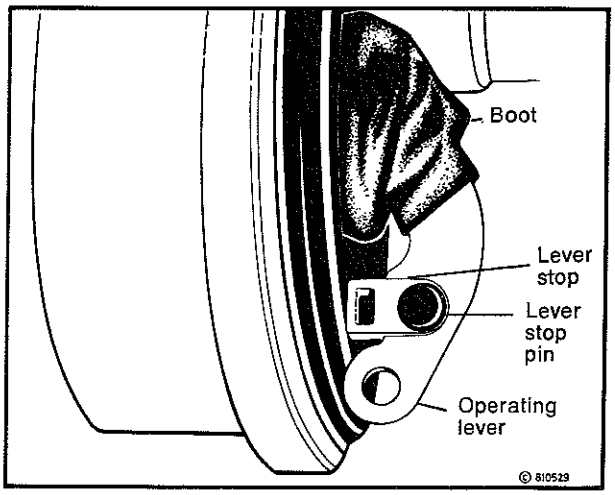


Fig. 2—Parking brake operating lever

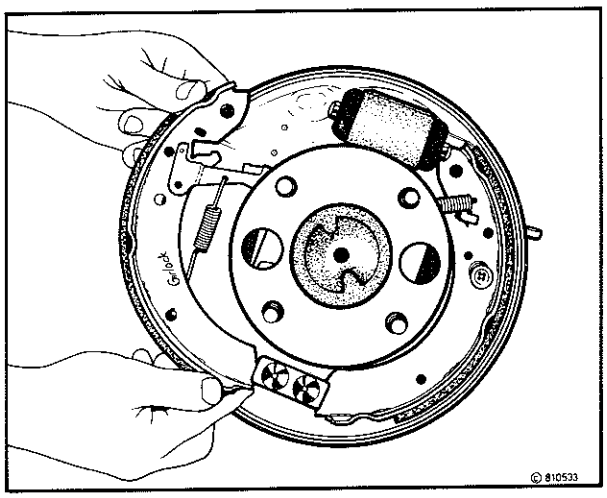


Fig. 3—Removing leading shoe

(4) Remove the brake shoes from the backplate, leaving the parking brake operating lever in the backplate.

(5) Withdraw the male push rod from the automatic brake adjuster assembly.

(6) Disconnect the brake pipe/s from the wheel cylinder, remove the wheel cylinder from the backing plate.

(7) If removal of the backing plate is necessary, refer to Group 3 for details of axle shaft removal.

Inspection

(1) Examine the rubber boot on the parking brake operating lever and replace if worn or damaged.

(2) Examine the male adjuster push rod for damage and wear and ensure the serrated nut is free to run the full length of the thread.

(3) Checking the brake shoe wear.

Check each lining for correct thickness, uneven wear and presence of oil. Replace defective shoes in complete sets if necessary.

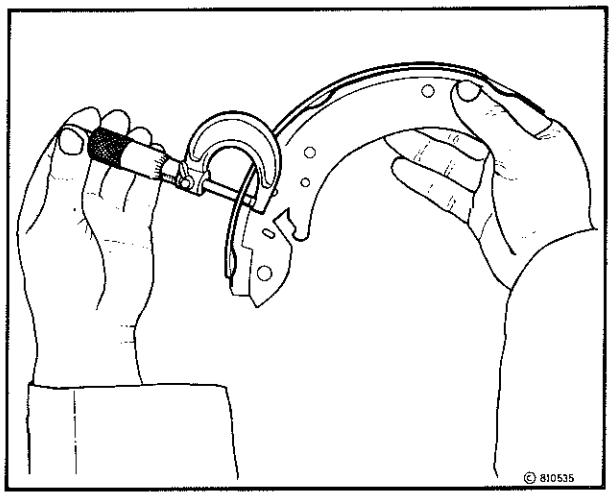


Fig. 4—Measuring lining thickness

(4) Checking the wheel cylinders.

Remove the dust covers and pistons. Remove the seals from the pistons and remove the bleed screw from the cylinder body. Clean all parts in methylated spirits and examine the cylinder bore and pistons for corrosion and score marks, hone the cylinder if necessary.

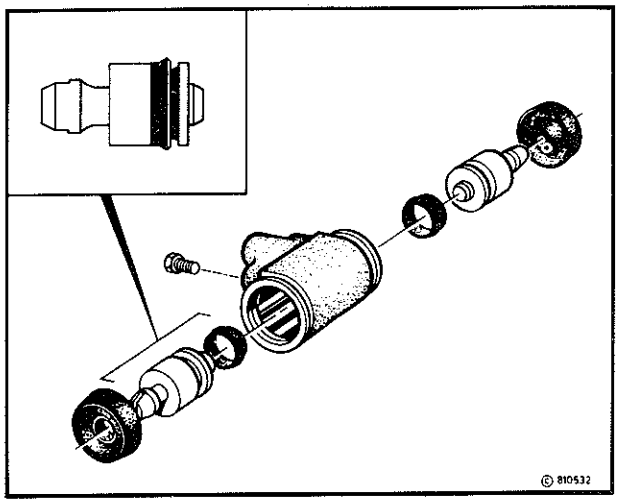


Fig. 5—Wheel cylinder components

Replace the wheel cylinder and pistons if the piston to wheel cylinder clearance exceeds the specified limit.

NOTE: Replace the piston cups and boots at every major brake overhaul.

(5) Checking the brake drum.

Check the inner wall of the brake drum for grooving, wear and presence of oil. Machine or replace the drum if found to be defective.

NOTE: If the drum requires machining, do not exceed the maximum of 0,8 mm (0.032") oversize on diameter.

Installation

Install by reversing the removal procedure noting the following:

Wheel Cylinder

(1) Fit the new piston seals with the flat back leading over the projecting boss of the pistons, see inset Fig. 5.

(2) Lubricate the piston seals and cylinder bore with clean brake fluid.

(3) Assemble the parts being careful not to damage the cylinder, piston, piston cup, etc.

(4) Install the wheel cylinder to the backing plate and tighten the bolts to the specified torque.

(5) Connect the brake pipe/s and tighten to the specified torque.

Brake Shoes

(1) Use a high melting point grease to sparingly lubricate the backing plate shoe pads, tips of the brake shoes, thread of the male adjuster push rod and all contact surfaces.

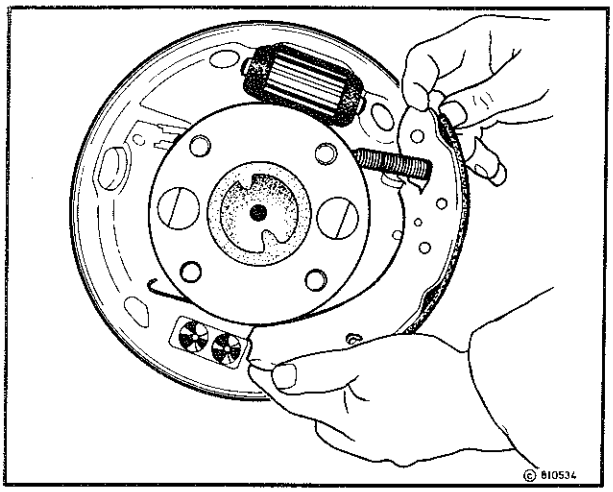


Fig. 6—Installing trailing shoe

(2) Assemble the automatic adjuster and install the leading and trailing brake shoe to the backing plate. Hold in position with the hold down pin and spring assemblies.

(3) Fit the lower shoe spring with the swan neck of the spring located in the trailing shoe. The top shoe spring is fitted with the long plain shank to the leading shoe, refer Fig. 7.

(4) Place the lever pawl onto the roll pin on the leading shoe, ensuring the short leg locates on the groove in the end of the automatic adjuster fork. The lever pawl spring is fitted with the longer shank between the shoe and back plate, refer Fig. 7.

(5) Offer the drum to the brake assembly and adjust the automatic adjuster until it is only just possible to fit the drum over the brake shoes.

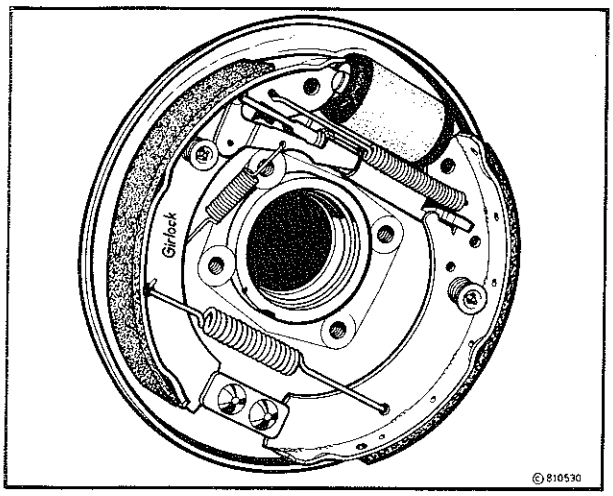


Fig. 7—Assembled brake components

(6) Check and ensure the lever pawl is in contact with the serrated nut on the adjuster and fit the brake drum.

(7) With both brake drums fitted, bleed the brake hydraulic system as described in Section 1.

(8) The brake shoe lining to drum clearance is automatically adjusted simply by depressing the brake pedal several times.

PARKING BRAKE

Adjustment

Check if the parking brake lever has the standard amount of stroke (4 to 6 notches).

Adjust the stroke if necessary as follows:

(1) Release the parking brake lever fully.

(2) Loosen the cable adjusting nuts located at the centre of the rear axle housing.

(3) Move the rubber hanger to the right to remove any "slack" in the left hand cable.

(4) Adjust the right hand cable by means of the adjusting nut and then tighten the lock nut, **ensuring that the lever stops are against the back plate.**

NOTE: After the adjustment has been made, the parking brake lever must have the specified stroke. If the stroke is larger than specified the rear brake automatic adjusters are faulty and must be repaired.

Removal

(1) Remove the clevis pins from both rear parking brake levers at the backing plates.

(2) Remove the rubber hanger from the centre of the axle housing.

(3) Remove the parking brake lever and remove the clevis pin linking the lever and cable.

(4) Remove the clips under the floor and draw the cable out.

Inspection

(1) Check the parking brake lever for ratchet wear, damage and movement of cable. Replace any faulty components.

Installation

Install by reversing removal procedure noting the following:

(1) Apply an appropriate amount of grease to all contact and sliding surfaces.

(2) Install new split pins where necessary.

(3) Install the cable grommet positively in the floor.

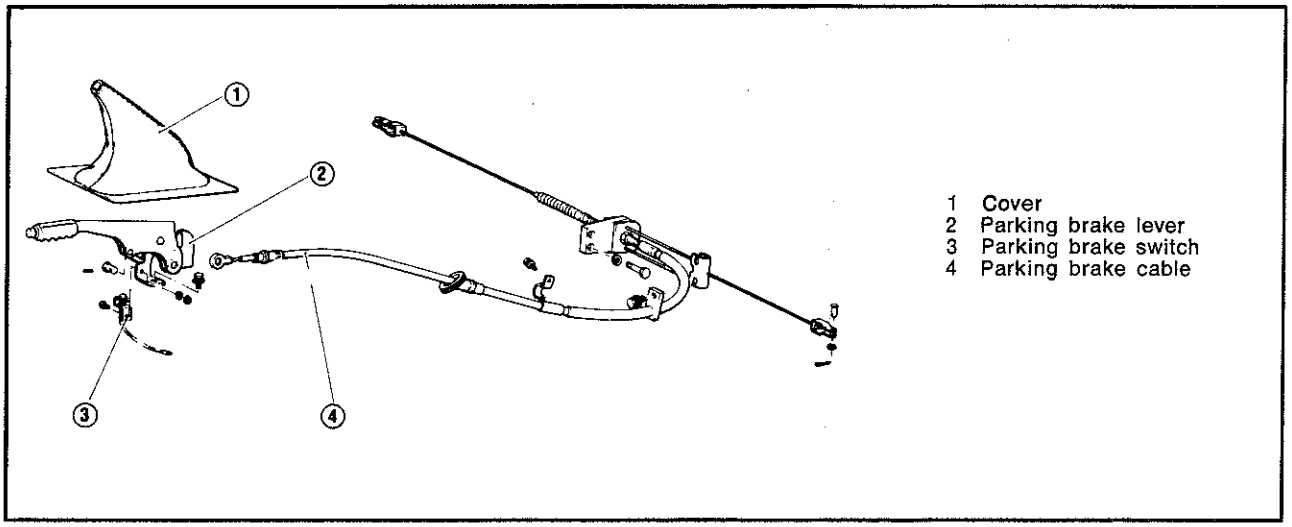


Fig. 8—Parking brake components

SECTION 2B — FLOATING HEAD CALIPER ('F' TYPE) REAR DISC BRAKE AND PARKING BRAKE

SPECIFICATIONS

DISC BRAKE

Type	Floating head caliper 'F' type with solid disc and parking brake mechanism
Location	Rear wheels

CALIPER ASSEMBLY

Lining Thickness — New	8,5 mm (0.330")
— Wear Limit	2,0 mm (0.080")
Lining Area (per caliper)	6420 mm² (9.951 in.²)
Lining Material	AKS 26GF
Number of Pistons	1 per caliper
Piston Diameter	34,80 to 34,85 mm (1.370" to 1.372")
Piston Bore Diameter	34,93 to 34,98 mm (1.375" to 1.377")
Piston to Automatic Adjuster Spindle Clearance	0,335 to 0,425 mm (0.0132" to 0.0167")

BRAKING DISC

Type	Solid disc
Diameter	247 mm (9.72")
Thickness — Standard	10,0 mm (0.390")
— Minimum	8,4 mm (0.330")
Maximum Run Out (On Face)	0,165 mm (0.0065") or less
Disc Surface Finish — Circumferentially	3030 micro mm (119.3 micro inch) centre line average
— Radially	3030 micro mm (119.3 micro inch) centre line average
Disc Parallelism	0,06 mm (0.0023") max.
Disc Swept Area	496,6 cm² (76.98 in.²)

TORQUE SPECIFICATIONS

	Nm	lbs./ft.	lbs./in.
Bleeder screw	5-9	4-7	48-84
Brake hose	12-16	9-12	108-144
Caliper support to axle housing	39-49	29-36	
Wheel nuts — Alloy wheels	78-98	57-72	

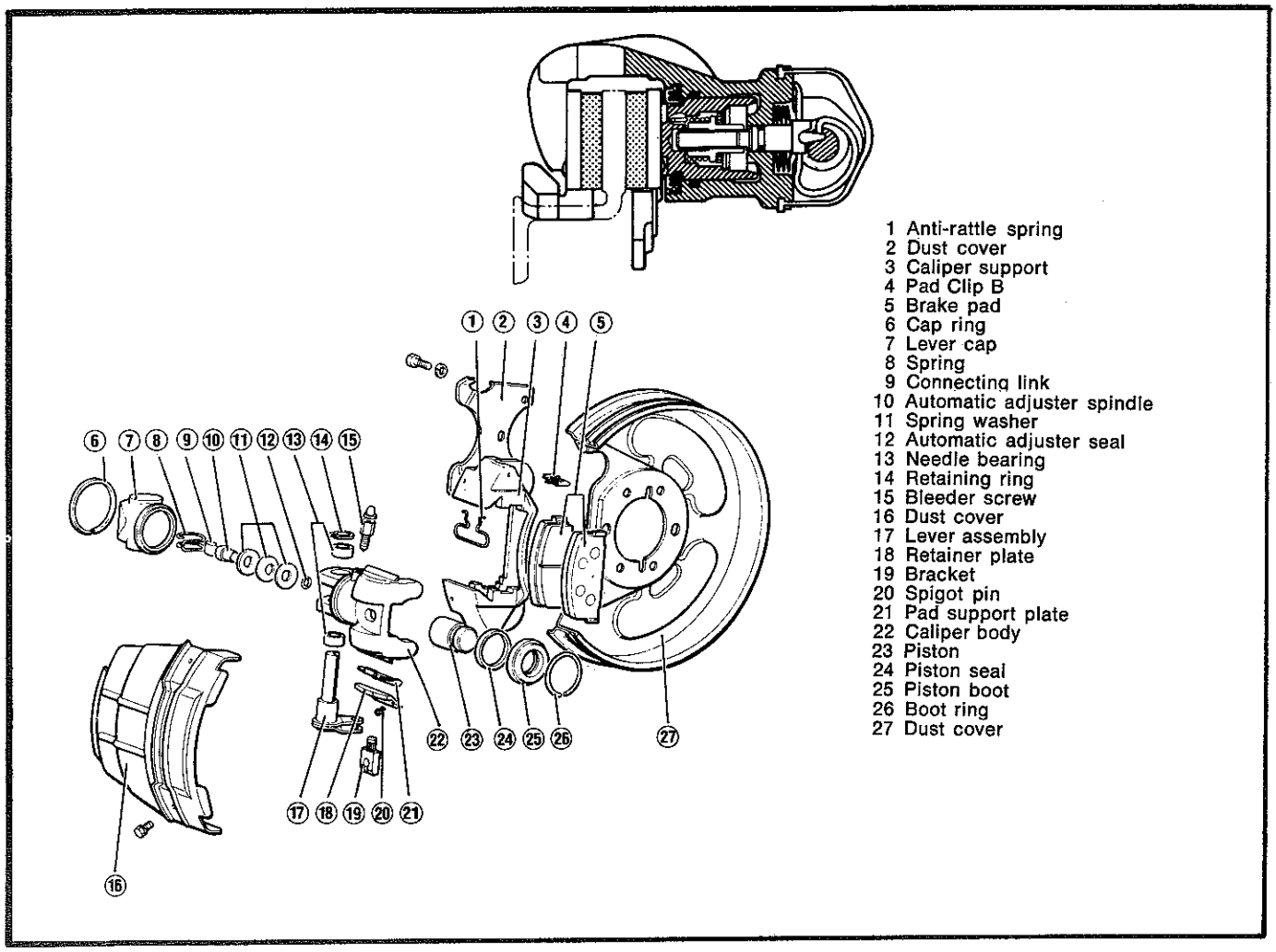


Fig. 1—Caliper assembly components

GENERAL INFORMATION

The single piston, floating head caliper, rear disc brake assembly consists of the disc assembly, the caliper, pad, support, dust covers and parking brake mechanism.

The caliper body slides on the support plate which is fixed to the axle housing. Anti rattle springs installed on the plate allow the caliper body to "float" and a stopper plate retains the caliper to the support plate. The caliper also has an automatic parking brake stroke adjuster.

Operation

Pressure Applied (Fig. 2)

When the hydraulic pressure is applied, the piston moves in the direction of the arrow deforming the piston seal and pressing the inboard pad against the disc. As force increases against the disc, the caliper body moves inboard, sliding on the caliper support, and forces the outboard pad against the disc, thus providing a clamping force on the disc.

As the piston stroke changes due to pad wear, the stopper plate, contacting the inner sleeve flange through the bearing, allows the sleeve to move in the direction of the arrow, by turning on the screw of the automatic adjuster.

The amount of movement is determined by the amount of pad wear, thus maintaining the same parking brake stroke.

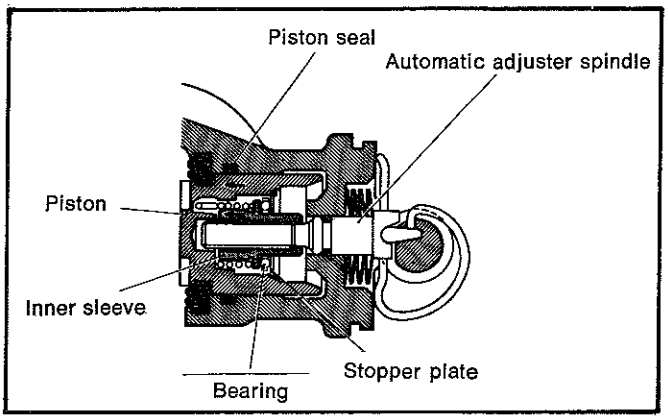


Fig. 2—Caliper operation during pressure application

Pressure Released (Fig. 3)

When the brake pedal is released the hydraulic pressure decreases to zero. The piston is returned by the amount of deformation of the piston seal, thus maintaining the same pad-to-disc clearance at all times.

If any pressure opposing hydraulic pressure is applied to the piston, i.e. caliper kickback, the piston will compress the coil spring and tend to rotate the inner sleeve on the screw of the automatic adjuster spindle. When this condition occurs, excessive spring friction locks the inner sleeve to the adjuster spindle thus preventing the piston from moving back.

The coil spring and inner sleeve contact area forms a oneway clutch, thus allowing the piston only to move forward and locking it in the opposite direction.

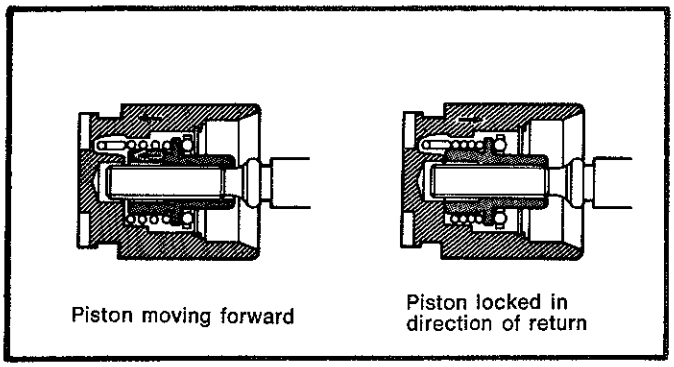


Fig. 3—Coil spring and inner sleeve operation

Parking Brake Application

When the parking brake lever is applied, braking force is transmitted to the piston through the connecting link, automatic adjuster spindle and inner sleeve thus clamping the pads against the disc as in hydraulic operation.

DISC PADS

Removal

(1) Raise the rear of the vehicle and support on jack stands.

(2) Remove the wheel and tyre assemblies.

(3) Remove the caliper dust cover.

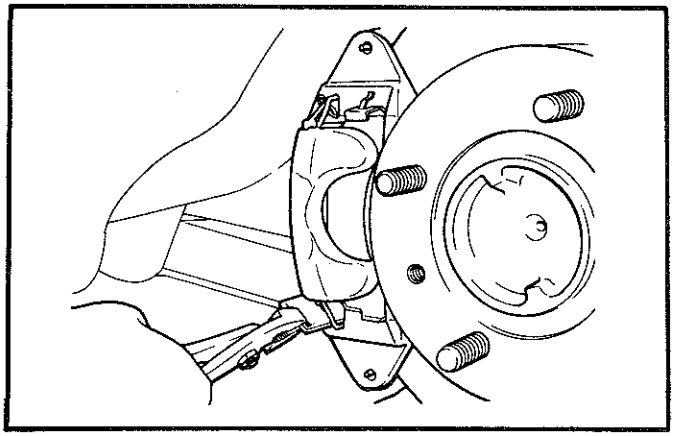


Fig. 4—Removing the retainer plate

(4) Disconnect the parking brake cable from the caliper assembly.

(5) Remove the spigot pins and remove the retainer plates.

(6) Remove the caliper assembly diagonally upward or downward and support it suitably.

NOTE: Do not allow the caliper to hang from the brake hose.

(7) Remove the pads from the caliper support.

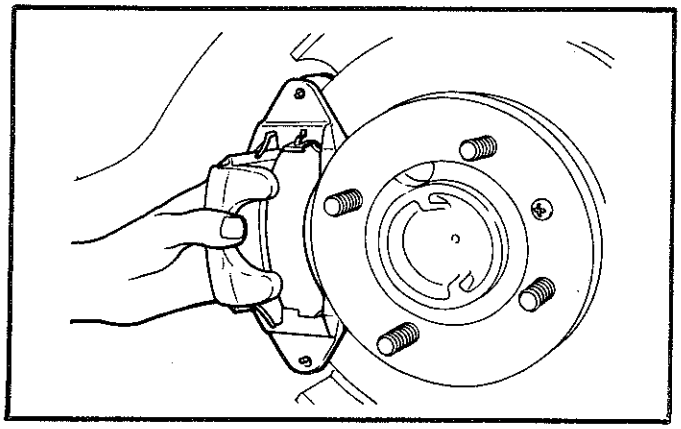


Fig. 5—Removing the caliper assembly

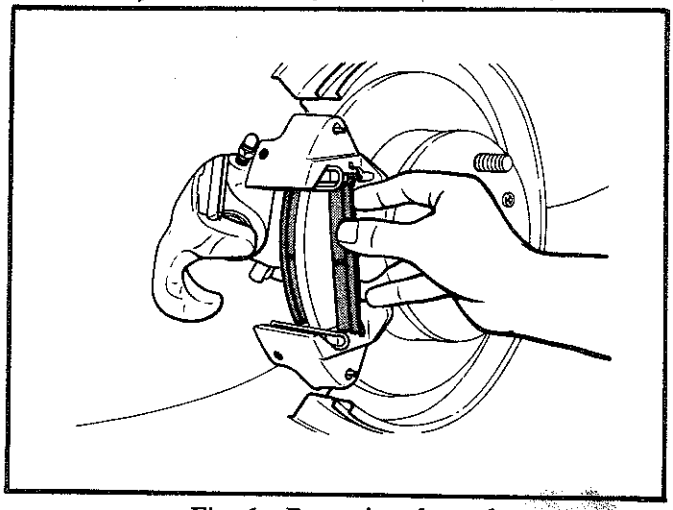


Fig. 6—Removing the pads

Inspection

(1) Check for piston seal leaks and for any ruptures of the piston dust boot. If the boot is damaged, or fluid is evident it will be necessary to disassemble the caliper and install a new seal, boot and piston if necessary.

(2) Check the pads for wear beyond the specified limit, replace if necessary.

NOTE:

- **If the pads on one wheel require replacing, both rear wheels should have the pads replaced.**
- **The groove in the centre of the pad is not a wear indicator, but provides a means of escape for lining dust.**

(3) Check the disc for wear and damage.
(4) Check the anti-rattle spring and pad clip B for damage.
(5) Check the retainer plates and pad support plate for wear and damage.

Installation

Install by reversing removal procedure noting the following:
(1) If necessary clean the exposed piston area.
(2) If new pads have been installed it will be necessary to push the piston back into its bore.

Using a suitable tool that fits the slots in the piston end, rotate the piston in a clockwise direction. Use of a screwdriver is not recommended as damage to the piston end may result with a subsequent increase in pedal stroke created by point contact of the pad backing plate and the piston end. Pushing the piston into place without the turning action may damage the screw of the automatic adjuster spindle.

Opening the bleeder valve will be necessary to facilitate piston displacement.
(3) Install the pad clips B as shown in Fig. 7.
(4) Ensure the piston recess aligns with the raised section of the pad backing.
(5) Sparingly lubricate the retainer plates and caliper slides with high melting point grease.

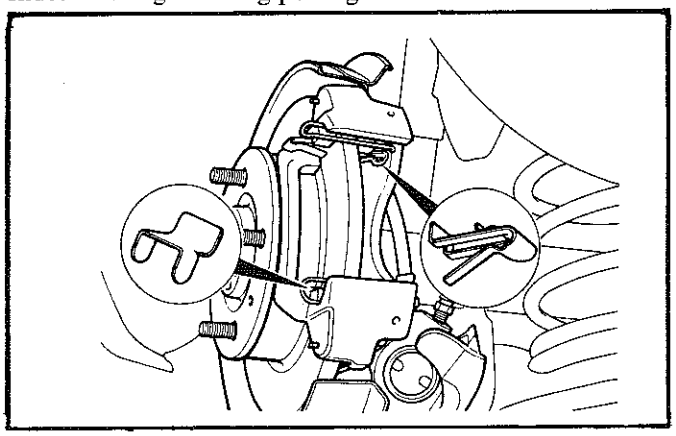


Fig. 7—Installing pad clips

CALIPER ASSEMBLY

Removal

(1) Remove the brake pads as previously described.
(2) Disconnect the fluid supply hose and remove the caliper from the vehicle. If necessary the caliper support can be removed.

NOTE: To prevent brake fluid loss from the hose, block the brake pedal in the applied position.

Installation

Install by reversing the removal procedure and bleed the brake system as described in Section 1 — Bleeding The Brake System. Tighten all bolts to the specified torque.

Disassembly

(1) With the caliper removed from the vehicle remove the cap ring and then the parking brake lever cap.
(2) Remove the snap ring and spring, then remove the lever assembly.

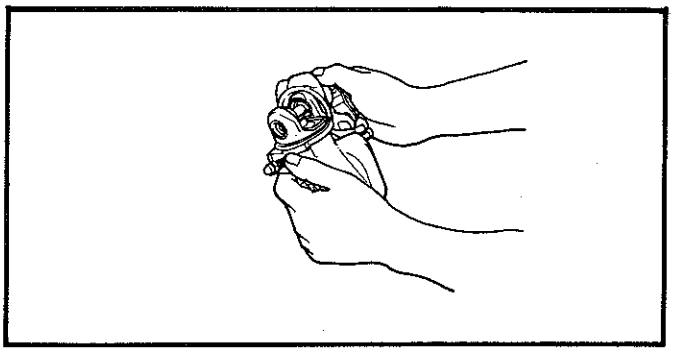


Fig. 8—Removing the lever assembly

(3) Remove the automatic adjuster spindle by rotating it by hand or with a pair of pliers.

NOTE: Use pliers with care to avoid damage to the spindle.

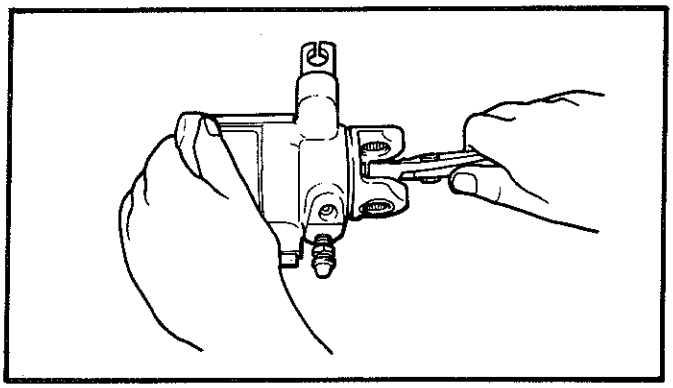


Fig. 9—Removing automatic adjuster spindle

(4) Using a suitable tool, press out the parking brake lever bearings.
(5) Remove the piston dust boot, then using a screw driver remove the piston being careful not to damage any components.

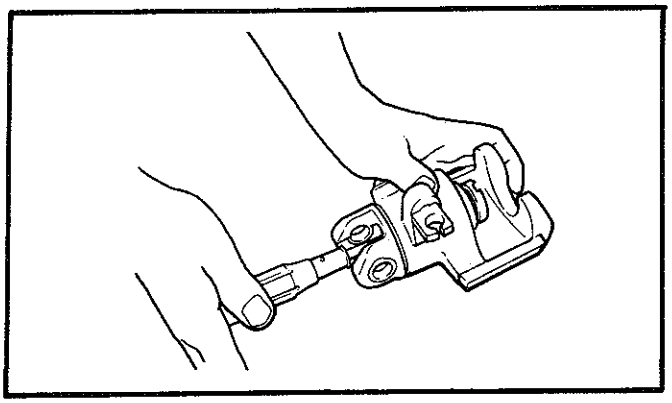


Fig. 10—Removing the piston

(6) Remove the piston seal being careful not to damage the caliper bore.

Cleaning and Inspection

(1) Clean all parts in methylated spirits and dry with compressed air. The piston seal and boot should not be immersed in the cleaning fluid for more than 30 seconds.

(2) Check the caliper bore and piston for wear, damage and rust.

(3) Check the bearing, connecting link, automatic adjuster spindle and lever assembly for wear, damage and rust.

(4) Check the springs for damage and deterioration.

(5) Check the lever assembly for excessive free play between the shaft and bearing.

(6) Ensure the piston to automatic adjuster spindle clearance is within specification and check the punched condition of the piston inner sleeve to stopper plate.

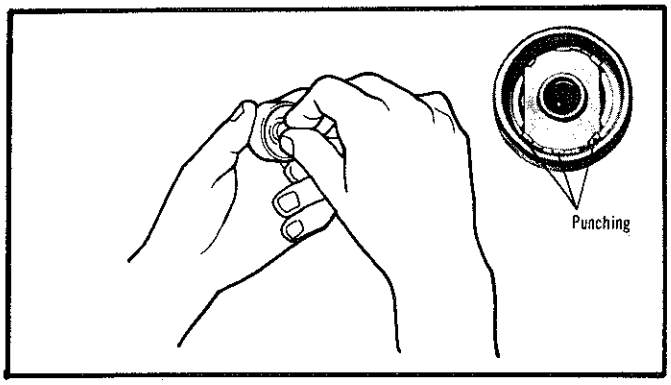


Fig. 11—Checking piston-to-automatic adjuster spindle clearance

Assembly

Assemble by reversing disassembly procedure noting the following:

(1) Replace the piston seal, automatic adjuster seal and piston boot with new parts and lubricate them with grease supplied in the repair kit.

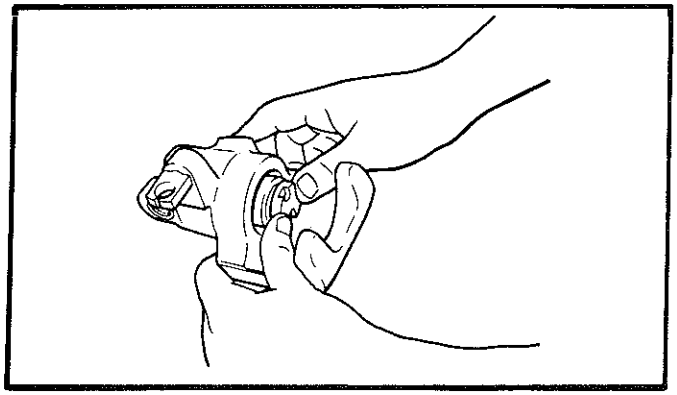


Fig. 12—Installing piston

(2) When installing the piston assembly into the caliper do not twist or damage the piston seal.

(3) Using a suitable tool, press in the parking lever bearings until they are flush with the caliper body.

NOTE: The bearings should be installed with the markings on the end of the bearings facing outward.

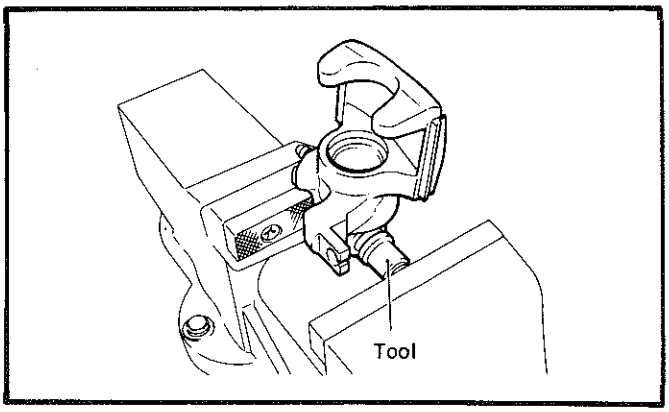


Fig. 13—Installing parking lever bearings

(4) Lubricate the automatic adjuster seal and spindle thrust with the red translucent rubber grease.

(5) Assemble the automatic adjuster spindle spring washers as shown in Fig. 14 and lubricate them with the orange grease supplied in the repair kit.

(6) Install the spindle into the caliper; it is correctly installed when it rotates freely.

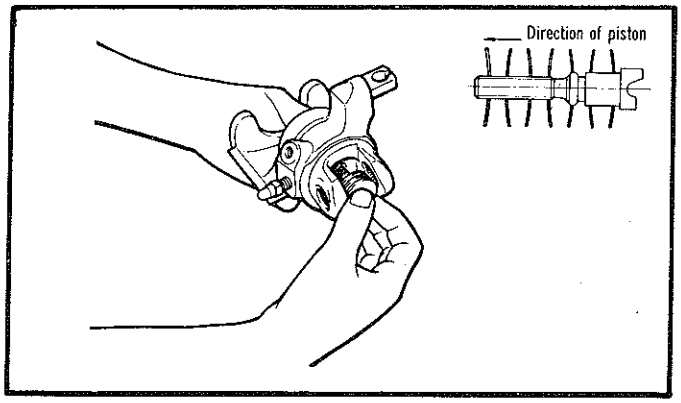


Fig. 14—Installing automatic adjuster spindle

(7) With the spindle positioned in the caliper, compress the spindle and spring washers and install the parking brake lever and cap onto the caliper. This can be achieved by using a drill press and a suitable tool to compress the spindle while allowing access for parking brake lever installation, Fig. 15.

(8) Liberally lubricate the spring washers, spindle head, connecting link, bearings and lever cap lip area with the orange grease supplied in the repair kit.

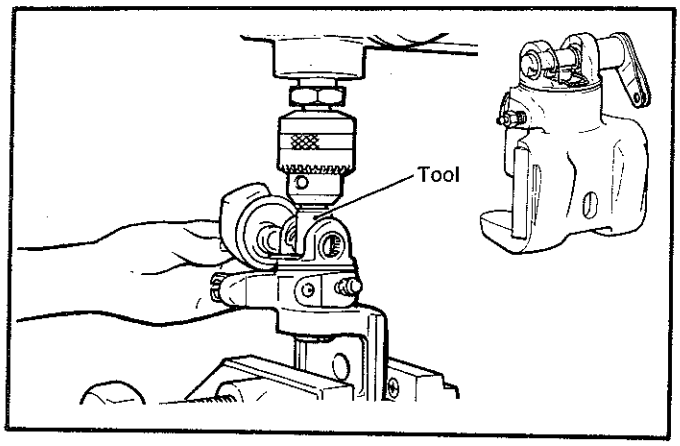


Fig. 15—Installing parking brake lever

BRAKE DISC

Removal

(1) Remove the pads as previously described.

(2) Remove the caliper support to axle housing bolts and remove the support.

(3) Remove the disc retaining screw and remove the disc from the axle shaft.

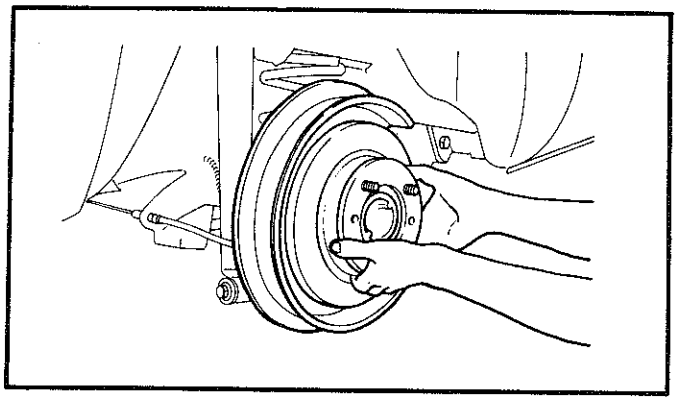


Fig. 16—Removing brake disc

Inspection

Check the disc for wear and damage, correct or replace if necessary.

Installation

Install by reversing removal procedure noting the following:

(1) Thoroughly clean the disc and axle flange mounting surface prior to installing the disc.

(2) Tighten all bolts to the specified torque.

(3) Check the disc runout to specification. If the runout exceeds the specified dimension, change the relative position of the disc to the axle flange. If this does not correct the runout, replace the disc.

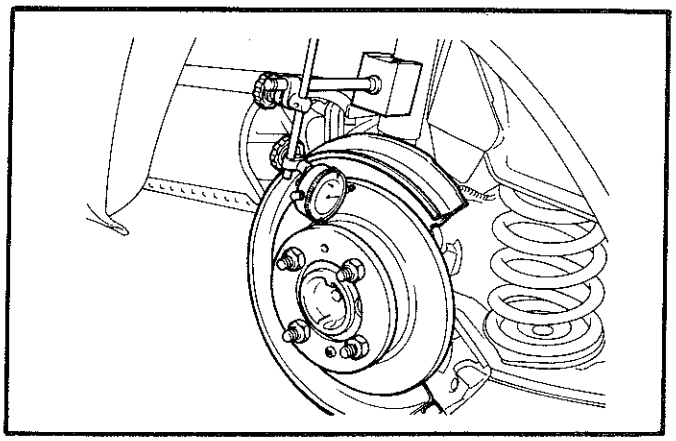


Fig. 17—Checking disc runout

NOTE: When checking disc runout the wheel nuts must be installed to retain the disc securely.

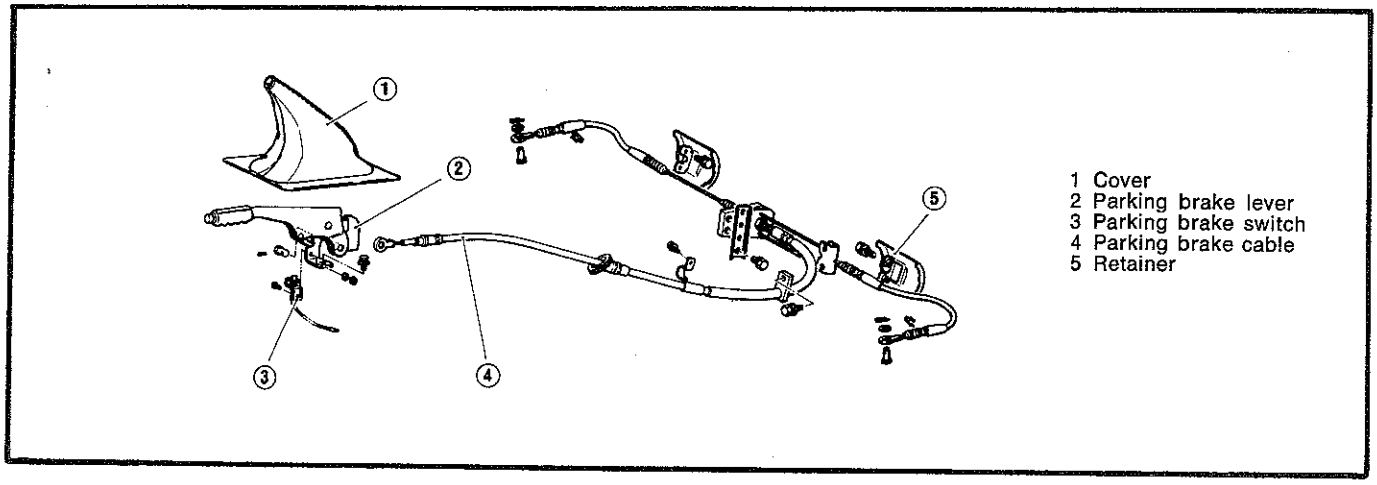


Fig. 18—Parking brake components

PARKING BRAKE

Adjustment

(1) Release the parking brake lever fully and depress the brake pedal several times.

(2) Loosen the cable adjusting nut located at the centre of the rear axle housing.

(3) Move the rubber hanger to the right to remove any "slack" in the left hand cable.

(4) Adjust the right hand cable by means of the adjusting nut and then tighten the lock nut.

(5) Check that the parking brake lever stroke is within 5 to 7 notches, if not, readjust the cable.

Removal

(1) Remove the clevis pin from both rear brake levers and disconnect the cable from the extension lever.

Remove the rubber hanger from the centre of axle housing.

(2) Remove the retainer and clips.

Remove the parking brake lever and remove the clevis pin linking the lever and cable.

(3) Remove the clips under the floor and draw the cable out.

Inspection

(1) Check the parking brake lever for wear of latch and damage and movement of the cable. Replace anl faulty components.

Installation

Install by reversing removal procedure noting the following:

(1) Apply appropriate amount of grease to each sliding part.

(2) Install each cable clip, and make sure the cable does not interfere with any rotating parts.

(3) Fit the cable grommet positively in the floor.

SECTION 3 — MASTER CYLINDER AND COMBINATION VALVE
(Imported Type)

SPECIFICATIONS

MASTER CYLINDER

Type	Tandem master cylinder, dual reservoir, compensating type
Master Cylinder Bore — Except two door	20,64 to 20,69 mm (0.8126" to 0.8146")
— Two door	22,22 to 22,27 mm (0.8748" to 0.8768")
Piston Diameter — Except two door	20,569 to 20,600 mm (0.8097" to 0.8110")
— Two door	22,147 to 22,180 mm (0.8719" to 0.8732")
Piston to Cylinder Clearance — Standard	0,040 to 0,125 mm (0.0016" to 0.0049")
— Wear limit	0,15 mm (0.006")
Push Rod to Master Cylinder Piston End Clearance	0 to 0,75 mm (0 to 0.030")
Recommended Brake Fluid	Chrysler Heavy Duty Brake Fluid (or any fluid conforming to DOT 3)

COMBINATION VALVE

Split Point — Except two door	2411 kPa (350 p.s.i.)
— Two door	2940 kPa (427 p.s.i.)
Reducing Ratio	0.37
Wheel Cylinder/Master Cylinder Pressure Difference	2940 ± 190/4410 kPa (427 ± 28/640 p.s.i.)

TORQUE SPECIFICATIONS

	Nm	lbs./ft.	lbs./in.
Check valve cap	23-34	17-25	
Check valve case	39-49	29-36	
Piston stopper	1,5-3,0		13-26
Fluid reservoir band	2,25-4,0		20-35
Master cylinder to booster	8-12	6-9	
Bolt brake line connector to master cylinder	24-34	18-25	
Brake tube flared nuts	12-16	9-12	
Pedal support to support member	8-12	6-9	
Pedal support to booster	8-12	6-9	
Bleeder screws	7-9	5-7	
Brake hose	12-16	9-12	
Combination valve attaching bolts	8-12	6-9	

GENERAL INFORMATION

The master cylinder is of the compensating type, the body is made of alloy and is fitted with plastic clamp on reservoirs. The unit consists of front and rear pistons (in tandem), the front piston actuates the front brakes and the rear piston actuates the rear brakes.

A combination valve connected in the hydraulic circuit acts as a rear brake proportioning valve, is fitted with the pressure failure warning lamp switch and also increases the pressure available to the rear brakes when a front hydraulic circuit failure occurs.

MASTER CYLINDER

Operation

The tandem master cylinder unit separates the front and rear brake hydraulic system. If one hydraulic system fails, the other, either front or rear, will operate to retard the vehicle.

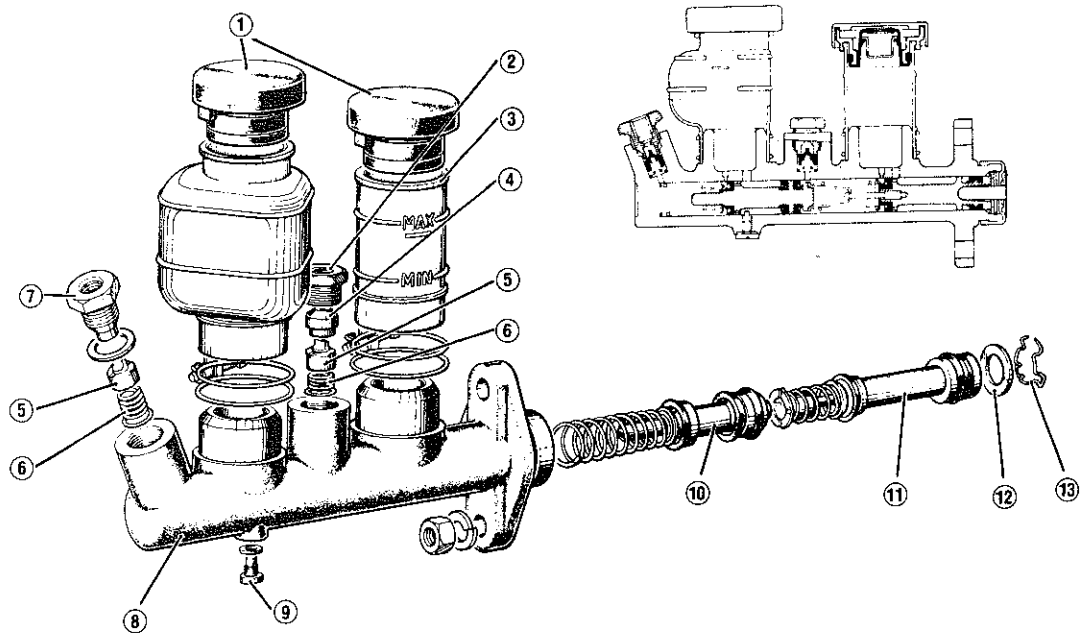
Normal Operation

When the brake pedal is depressed the primary piston moves forward compressing the primary return spring and simultaneously moving the secondary piston. This occurs because of the difference in spring tension between the primary and secondary piston return spring (the primary is stronger.)

As the pistons and seals move past each compensating port, the fluid is displaced from the master cylinder outlets to the wheel cylinders and pressure in each of the hydraulic circuits increases. Under normal conditions the fluid pressure developed in the primary rear brake circuit (between the secondary and primary pistons) supplies the force required to operate the secondary (front brake) circuit. The fluid pipes to the front and rear brakes are separated completely and both systems operate simultaneously with rear circuit hydraulic pressure being regulated by the proportioning valve in the combination valve.

Rear Brake Failure

As the brake pedal is depressed the primary piston and spring moves forward. Since there is no hydraulic pressure in the primary circuit the primary spring will begin to move the secondary piston. The hydraulic pressure in the secondary, front circuit, will cause the primary spring to compress and allow the primary piston to contact the secondary piston and provide a mechanical actuation of the secondary piston. The mechanical actuation of the secondary piston will pressurize the secondary circuit and apply the front brakes only. An increase in pedal travel and effort will be experienced.



1 Reservoir cap
2 Check valve cap
3 Fluid reservoir
4 Outer pipe seat
5 Check valve
6 Check valve spring
7 Valve case
8 Master cylinder
9 Piston stopper
10 Secondary piston assembly
11 Primary piston assembly
12 Piston stopper
13 Stopper ring

Fig. 1—Exploded view of master cylinder

Front Brake Failure

As the brake pedal is depressed the primary piston and spring will move forward and cause the secondary piston to bottom in the bore due to lack of hydraulic pressure. Once the secondary piston has bottomed, pressure is developed in the primary circuit and operates the rear brakes only. An increase in pedal travel and effort will be experienced.

Removal

(1) Disconnect the brake tubes from the master cylinder and install plugs in the outlet holes.

NOTE: Position a clean absorbent cloth to prevent any brake fluid leaking onto the vehicle paintwork during this operation.

(2) Remove the nuts retaining the master cylinder to the brake booster, then remove the master cylinder.

Installation

(1) Prior to installing the master cylinder it is advisable to "bleed" the master cylinder of air bubbles as described in Section 1.

(2) Check the push rod to master cylinder piston clearance as described in Section 4.

(3) Install the master cylinder onto the booster and tighten the mounting nuts to specification.

(4) Install the brake tubes and tighten the nuts to specification.

(5) Bleed the brake system as described in Section 1, "Bleeding Hydraulic Brake System".

Disassembly

(1) Clean the outside of the master cylinder, remove the reservoir caps and discard the old brake fluid.

(2) Hold the cylinder by its mounting flange, in a vice equipped with soft jaws.

(3) Remove the reservoir retaining clamps and remove the reservoirs.

(4) Remove the brake line unions, check valve and spring from the front and rear outlet port.

(5) Remove the piston retaining clip and washer. The primary piston and spring can now be removed.

NOTE: Do not disassemble the primary piston assembly as it is pre-set to a standard length.

(6) Using a suitable tool to hold the secondary piston down the bore, unscrew the secondary piston stopper from the cylinder body.

(7) Remove the secondary piston and spring, if necessary, compressed air may be required to remove the piston from the bore.

Inspection

(1) Clean all parts in clean methylated spirits and inspect for chipping, excessive wear or damage.

(2) Check all recesses, openings and internal passages, ensuring they are open and free from foreign matter. Use compressed air to blow dirt and cleaning solution from all components.

(3) Check the bore for etching, pitting or scoring. If the bore is unsatisfactory in any way, it must be replaced.

Assembly

NOTE: When using a repair kit, all new parts must be installed.

(1) Install the new seals onto the primary and secondary piston ensuring they are fitted the correct way.

(2) Lubricate the cylinder bore with clean brake fluid, insert the secondary spring and piston into the bore.

(3) Using a suitable tool, partially compress the secondary piston and spring assembly and install the piston stopper.

(4) Install the primary piston and spring assembly and install the washer and retaining clip.

(5) Install the reservoirs and tighten the retaining clamps to the specified torque.

(6) Install the check valves, springs and unions into the outlet ports.

NOTE: On models equipped with rear drum brakes ensure the check valves are installed correctly into the master cylinder.

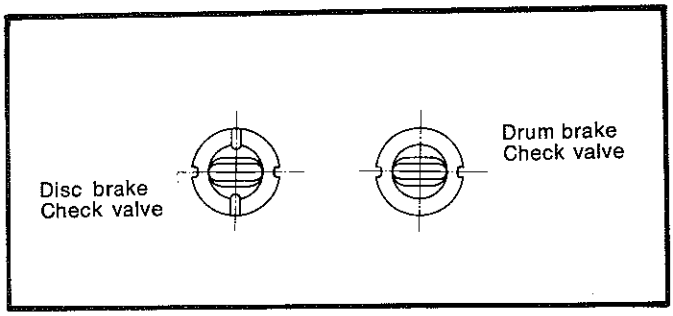


Fig. 2—Check valve identification

COMBINATION VALVE

The combination valve has the following three functions:

- Acts as a rear hydraulic circuit proportioning valve.
- Houses and operates the hydraulic failure warning lamp switch.
- Supplies unrestricted pressure to the rear circuit in the event of a front circuit failure.

Operation

Under normal conditions the spool valve is held stationery in the centre position due to the equal forces acting on each end of the valve. Fluid supplied by the rear circuit of the master cylinder passes through the proportioning valve to the rear brakes. The fluid also acts on the proportioning valve piston. When the fluid pressure overcomes the spring force the valve will move and restrict any further flow to the rear circuit thus providing a better balance between front and rear brakes.

If a hydraulic failure occurs in the front circuit the unbalance in pressure on the spool valve will cause the valve to move to the right. This activates the warning lamp switch and opens a by-pass to the rear hydraulic circuit thus supplying unrestricted pressure to the rear circuit.

If a hydraulic failure occurs in the rear circuit the unbalance in pressure on the spool valve will cause the valve to move to the left thus activating the warning lamp switch. Fluid pressure will continue to be supplied to the front hydraulic circuit.

After the hydraulic circuit has been repaired the spool valve will centralize during the bleeding operation or when the pedal is firmly depressed. Centralization will occur because valve area A is less than B which in turn is less than C.

Testing

Testing of the valve is achieved by connecting two pressure gauges of 10500 kPa (1500 p.s.i.) capacity to the rear hydraulic circuit. One gauge must be connected between the master cylinder and the valve and the second gauge connected after the valve. The valve is faulty if it does not reduce the rear circuit pressure to that specified.

Check the function of the hydraulic failure warning lamp switch by loosening a bleeder screw of any one wheel, depress the brake pedal and the lamp should light (the ignition must be ON). If the lamp fails to operate, check all components and connections, replace any faulty components.

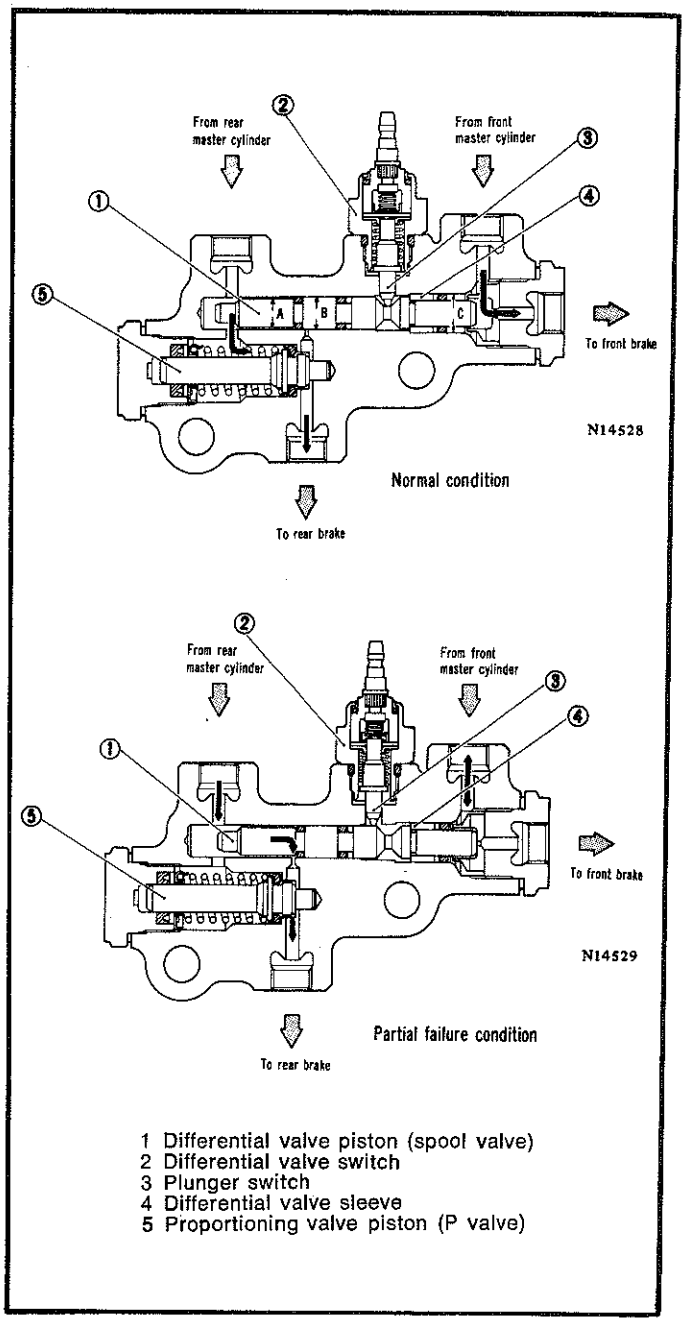


Fig. 3—Combination valve operation

BRAKE FLUID LEVEL SENSOR (Two Door Models)

General Information

The brake fluid level sensor (Fig. 4) is located in the master cylinder fluid reservoirs. A low fluid level allows the float on the sensor to fall to the lower end of the shaft some 23 to 27 mm (0.920 to 1.080") below the maximum fluid level where a magnet in the float closes a reed switch in a tube in the centre shaft (Fig. 5).

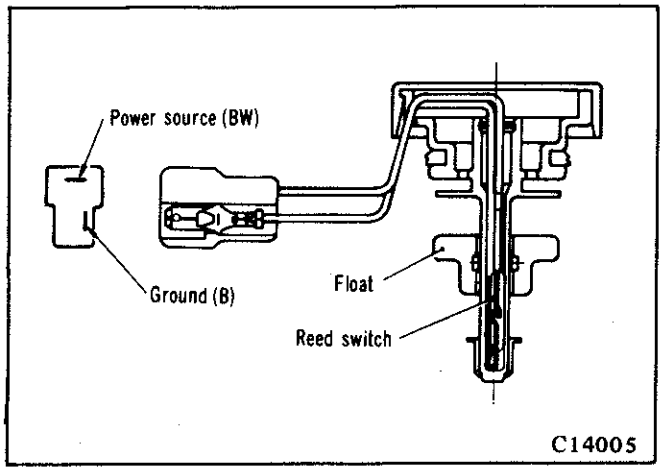


Fig. 4—Brake fluid lever sensor

When the reed switch closes the electrical circuit is completed and the BRAKE indicator lamp is lit.

Inspection

Remove the cap and move the float up and down the shaft.

Providing the wiring circuit is complete and in good condition the warning lamp should come on when the float is moved to the lowest level. If it doesn't, replace the cap and level sensor assembly and repeat the test.

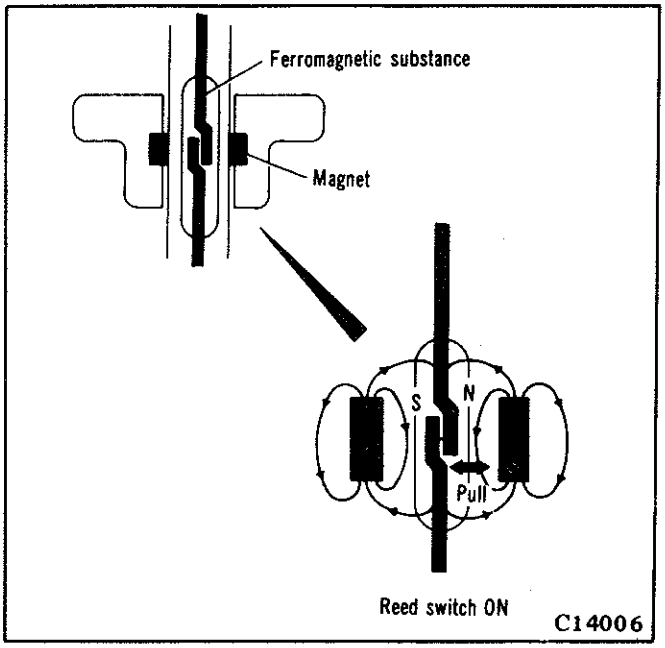


Fig. 5—Operation of fluid level sensor

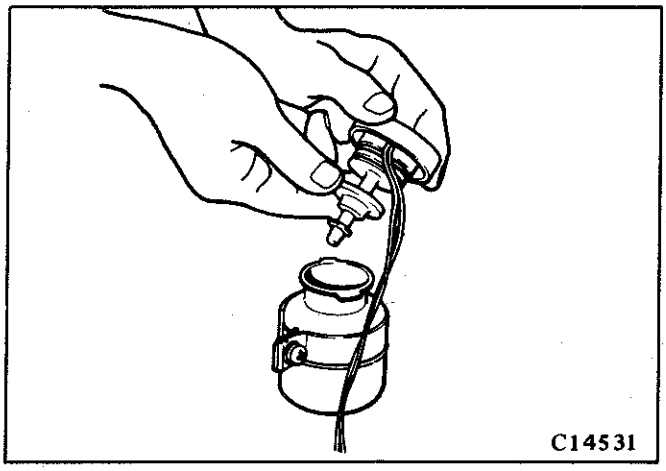


Fig. 6—Checking the fluid level sensor

SECTION 3A — PBR TANDEM BRAKE MASTER CYLINDER

SPECIFICATIONS

Brake Master Cylinder Assembly	PBR Tandem circuit with proportioning valve	
Type	Dual reservoir, compensating type, without residual pressure valves.	
	Early Models (up to KG30)	Late Models (after KG30)
Identification	13/16" moulded in body	7/8" moulded in body
Bore	20,64 mm (0.813")	22,23 mm (0.875")
Stroke — Total	31,0 mm (1.220")	30,70 mm (1.208")
Split — Front brakes	57.15%	56.75%
— Rear brakes	42.85%	43.25%
Proportioning valve crack point	2392 kPa	<———
Displacement — Primary (rear brakes)	4,45 ml (0.271 in.³)	4,95 ml (0.301 in.³)
— Secondary (front brakes)	5,92 ml (0.361 in.³)	6,40 ml (0.390 in.³)
Brake Tube Seat type	Inverted	Drill Point
Thread Size — Front Port	M10	<———
— Rear Port	M12	M10
Recommended Brake Fluid	Chrysler Heavy Duty Brake Fluid (or any fluid conforming to DOT 3)	

NOTE: Early models up to JH17 incorporated a residual line pressure valve.

SPECIAL TOOLS

E5C15	Tool — Tube Cutting
E5C15B	Tool — Tube Flaring

TORQUE SPECIFICATIONS

	Nm	lb/ft.	lb/in.
Secondary piston stop bolt to master cylinder	7		60
Safety warning switch	2		16
Proportioning valve end plug	40	30	
Master cylinder support bracket bolt	18	13	150
Brake tube fittings to master cylinder	18	13	150
Master cylinder to booster	14	10	120
Reservoir attaching nut	6		50

GENERAL INFORMATION

The PBR tandem master cylinder is of the compensating type with bolt on dual plastic reservoirs. The master cylinder consists of a front and rear pistons (in tandem), the front outlets actuate the front brakes. The rear outlet actuates the rear brakes.

Provision is also made for a brake failure warning light switch which is activated by a spool valve when a hydraulic failure occurs in either front or rear circuit.

A feature of the master cylinder is an integral rear brake circuit proportioning valve which regulates the maximum pressure applied to the rear circuit. In the event of a front circuit hydraulic failure the proportioning valve is by-passed allowing all available pressure to be transmitted to the rear hydraulic circuit.

MASTER CYLINDER OPERATION

The tandem master cylinder unit separates the front and rear brake hydraulic system. If one hydraulic system fails, the other, either front or rear, will operate to retard the vehicle.

Normal Operation

When the brake pedal is depressed the primary piston moves forward. Fluid pressure developed in the primary

rear brake circuit (between the secondary and primary pistons) supplies the force required to operate the secondary (front brake) piston. As the pistons and primary seals move past each compensating port, the fluid is displaced from the master cylinder outlets to the wheel cylinders and pressure in each of the hydraulic circuits increases.

The fluid pipes to the front and rear brakes are separated completely and both systems operate simultaneously with rear circuit hydraulic pressure being regulated by the proportioning valve.

Rear Brake (Primary Circuit) Failure

As the brake pedal is depressed the primary piston and spring moves forward. Since there is no hydraulic pressure in the primary circuit, the hydraulic pressure in the secondary front circuit will cause the primary spring to compress and allow the primary piston to contact the secondary piston to provide a mechanical actuation of the secondary piston. The mechanical actuation of the secondary piston will pressurize the secondary circuit and apply the front brakes only.

The unbalance of the hydraulic pressure will activate the spool valve and light the brake failure warning lamp. An increase in pedal travel and effort will also be experienced.

Front Brake (Secondary Circuit) Failure

As the brake pedal is depressed the primary piston and spring will move forward and cause the secondary piston to bottom in the bore due to lack of hydraulic pressure. Once the secondary piston has bottomed, pressure is developed in the primary circuit and operates the rear brakes only.

The unbalance of hydraulic pressure will activate the spool valve and light the brake failure warning lamp. The movement of the spool valve will also pull back the proportioning valve poppet valve. This allows the

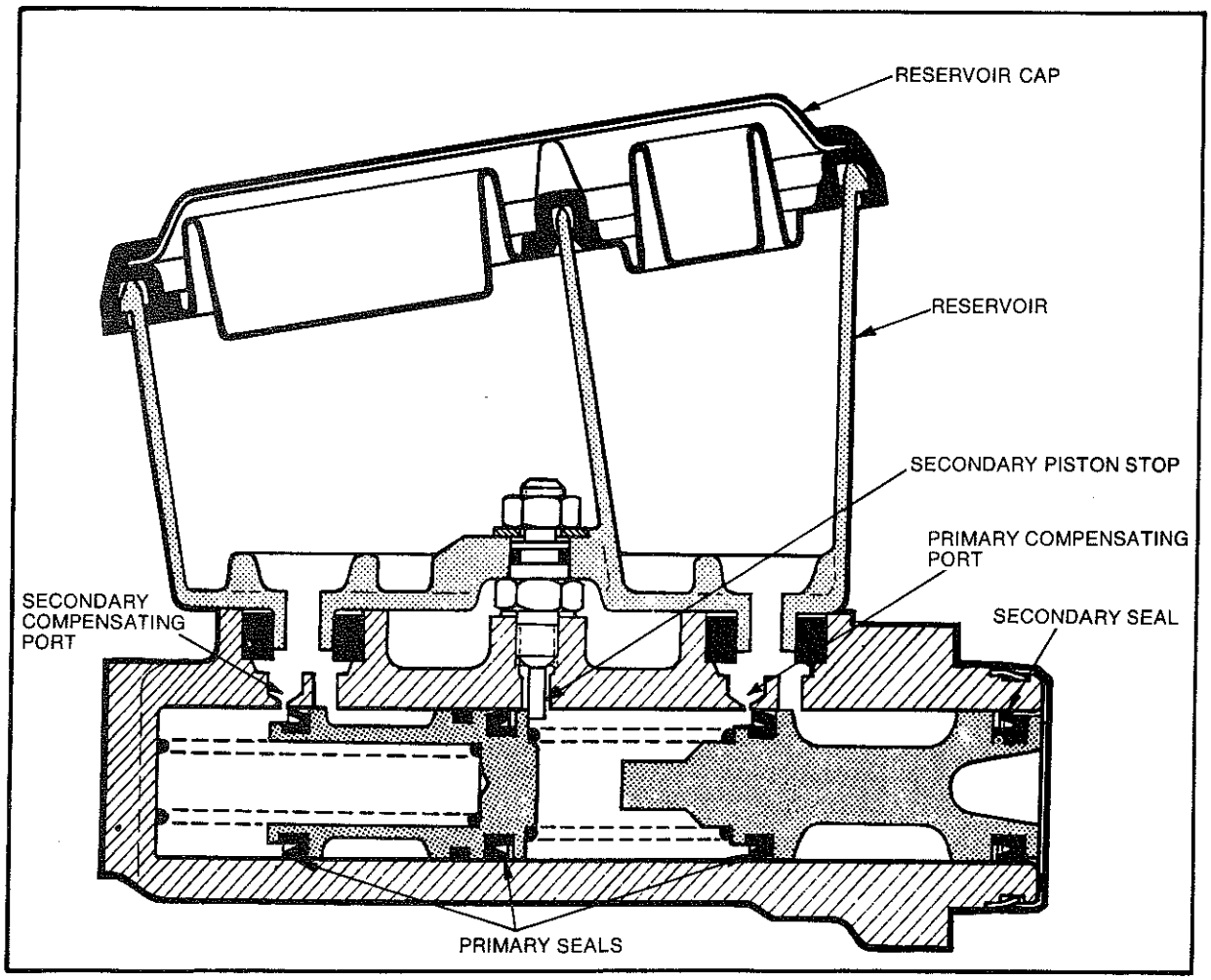


Fig. 1—Cross sectional view of PBR tandem brake master cylinder

hydraulic pressure to be applied to the rear circuit. An increase in brake pedal travel and effort will be experienced.

BRAKE MASTER CYLINDER

Removal

(1) Disconnect the brake tubes from the master cylinder and install plugs in the outlet holes.

NOTE: Position a clean absorbent cloth to prevent any brake fluid leaking onto the vehicle paintwork during this operation.

(2) Remove the nuts retaining the master cylinder to the booster and loosen the bottom master cylinder support bolt.

(3) Disconnect the warning light switch lead and remove the master cylinder.

Installation

(1) Prior to installing the master cylinder it is advisable to "bleed" the master cylinder of air bubbles as described in Section 1.

(2) Position the master cylinder to the booster and loosely install the retaining nuts.

(3) Remove the plugs from the outlet ports and connect the brake tubes to the master cylinder.

(4) Tighten the master cylinder retaining nuts, support bracket bolt and brake tube fittings to the specified torque.

(5) Bleed the brake system as described in section 1 "Bleeding Hydraulic Brake System".

MASTER CYLINDER OVERHAUL

Disassembly

(1) Clean the outside of the master cylinder and remove reservoir cap. Pour out any brake fluid that remains in the cylinder and discard the old brake fluid.

(2) Hold the cylinder by mounting flange in a vice equipped with soft jaws.

(3) Unscrew and remove the nut and washer located inside the plastic reservoir.

(4) Separate the plastic reservoir from the master cylinder and remove the rubber seal grommets from the body.

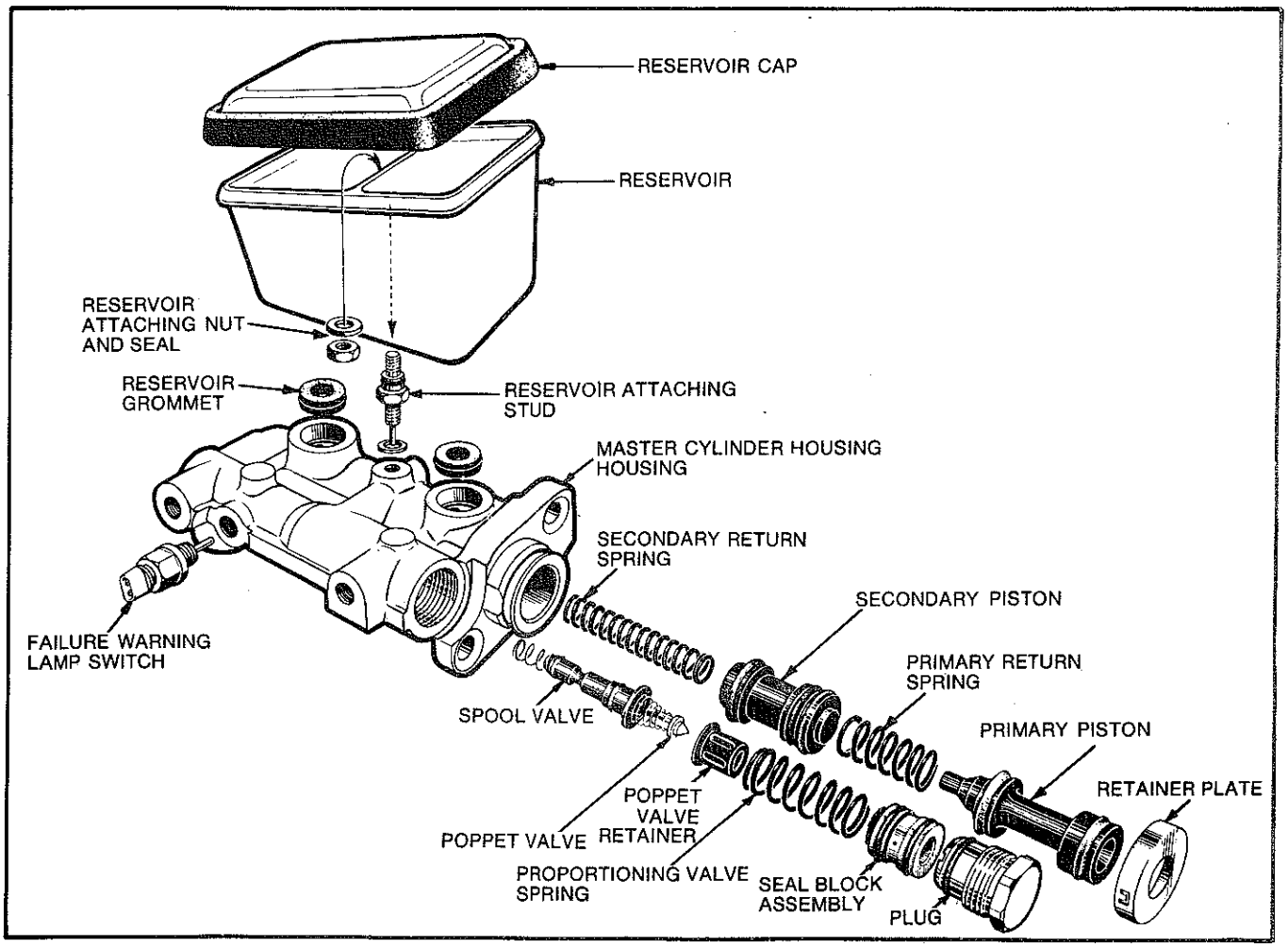


Fig. 2—Disassembled view of master cylinder

(5) Remove the pressed steel end cap fitted to the opening of the main bore by prising up the two locating lugs.

NOTE: Hold the cap firmly with one hand during this operation, to ensure that the primary piston does not spring out of the bore when the cap is removed.

(6) Remove the primary piston and return spring.
(7) Fully depress and hold the secondary piston down the bore and then remove the reservoir attaching bolt from the cylinder body.
(8) Remove the secondary piston and return spring by using compressed air or lightly tapping the open end of the cylinder bore squarely on a soft piece of wood.
(9) Unscrew and remove the brake failure warning light switch.
(10) Unscrew and remove the hexagon plug located at the flange end of the cylinder.
(11) Remove the seal block and piston assembly. If the assembly is stuck in the bore, tapping the flange end of the cylinder on a soft wooden block will assist removal.
(12) Remove the large spring and pressed steel poppet retainer, if necessary, long nose pliers will assist in removal.
(13) Withdraw the poppet valve and spool valve assembly using long nose pliers.

NOTE: The poppet valve must be gripped on the outer diameter, not on the cone section, otherwise the surface will be damaged.

If the poppet valve separates from the spool valve assembly, remove the spool valve assembly, using long nose pliers to grip the poppet valve retaining extension on the spool valve.

Inspection

(1) Clean all parts in clean methylated spirits and inspect for chipping, excessive wear or damage.
(2) Check all recesses, openings and internal passages, ensuring they are open and free from foreign matter. Use compressed air to blow dirt and cleaning solution from all parts.
(3) Inspect the master cylinder bores for signs of etching, pitting or scoring. If the bores are unsatisfactory in any of these respects, the master cylinder **MUST** be replaced.

NOTE: The cylinder MUST NOT be honed.

Assembly

NOTE: When using a master cylinder repair kit, all the new parts must be installed. The proportioning valve seal block and piston assembly is pre-lubricated and MUST NOT be washed, it must be assembled as supplied.

(1) Before assembly, lubricate all parts (see note) and master cylinder bores with clean brake fluid.

(2) Install "O" ring seal into the smaller of the two grooves at the end of the secondary piston.

(3) Install one of the three identical cup seals into the second groove, ensuring that the seal lip faces away from the "O" ring seal (refer Fig. 2).

(4) Install one of the three identical cup seals into the shallow seal groove at the return spring end of the secondary piston, ensuring that the seal lip faces away from the "O" ring previously installed (refer Fig. 1). Locate part of the plastic cup seal retainer in the groove on the piston and hold in position with thumb (refer Fig. 3). Using a small pointed tool, clip the retainer into the remaining part of the groove ensuring complete location is achieved and that damage to the piston or cup seal is avoided.

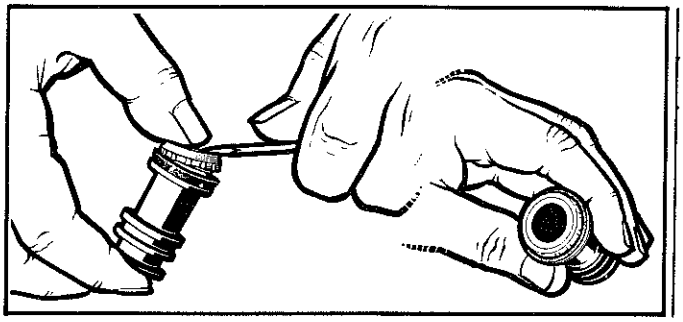


Fig. 3—Fitting plastic cup seal retainer

NOTE: Retainers should be discarded if pistons do not have locating groove as shown in Fig. 4.

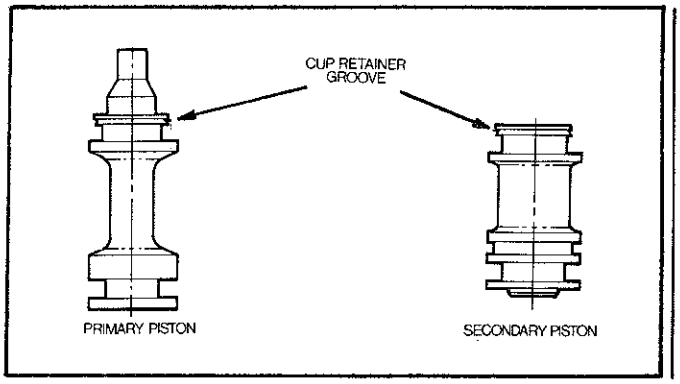


Fig. 4—Pistons with cup retainer groove

(5) Install the third identical cup seal into the primary piston groove located on the return spring end of the piston. The seal must face away from the push rod end of the piston (refer Fig. 1). Fit the remaining plastic retainer to the primary piston as detailed previously.

(6) Install the secondary seal into the groove at the push rod end of the primary piston, ensuring the seal lip faces away from the push rod end of the piston (refer Fig. 1).

(7) Fit the secondary return spring into the end of the secondary piston and spring end first, carefully install the piston assembly into the bore.

(8) Fully depress the secondary piston and install the reservoir attaching bolt and new gasket. Hand screw the bolt into position and then tighten to the specified torque.

(9) Fit the primary return spring to its piston and spring end first, install the piston assembly into the main bore.

(10) Depress the piston until the end of the piston is flush with the front end of the bore, install the retainer plate over the end of the bore and secure by bending the two fixing lugs into the machined groove on the master cylinder body locating spigot.

(11) Fit the "O" ring seal into the groove located at end of the spool valve.

(12) Install the small spring securely onto the small spigot diameter at the "O" ring seal end of the spool. The last coil of the spring may have to be closed in to firmly grip the small spigot diameter.

(13) Install the narrowest of the two metal sleeves to the spool valve and then fit the "O" ring and the wider sleeve. Push the sleeves and "O" ring against the shoulder.

(14) Install the retainer washer onto the thin spindle end of the spool valve.

(15) Fit the light conical spring, small end first, onto the poppet valve.

(16) Fit the poppet valve and spring onto the thin spindle end of the spool valve. A click should be heard when the poppet valve is fully seated.

(17) With the master cylinder vertically positioned, carefully lower the spool assembly, small spring first, into the bore, ensuring the spring remains assembled to the spool.

(18) Install the pressed steel poppet retainer, large end first, into the bore and over the poppet valve. Push with finger on the poppet valve retainer until the spool assembly is correctly located down the bore. The correct dimension from the small end of the poppet valve retainer to the top of the bore is 44 mm (1.75").

(19) Fit large spring over poppet valve retainer and carefully install seal block assembly, washer end first, into the bore onto the spring.

(20) Screw plug into the end of bore.

NOTE: The plug must be hand screwed until the head of the plug is 1,6 mm (1/16") under the mounting flange, then tighten to specified torque.

(21) Install the brake failure warning lamp switch and tighten to specified torque.

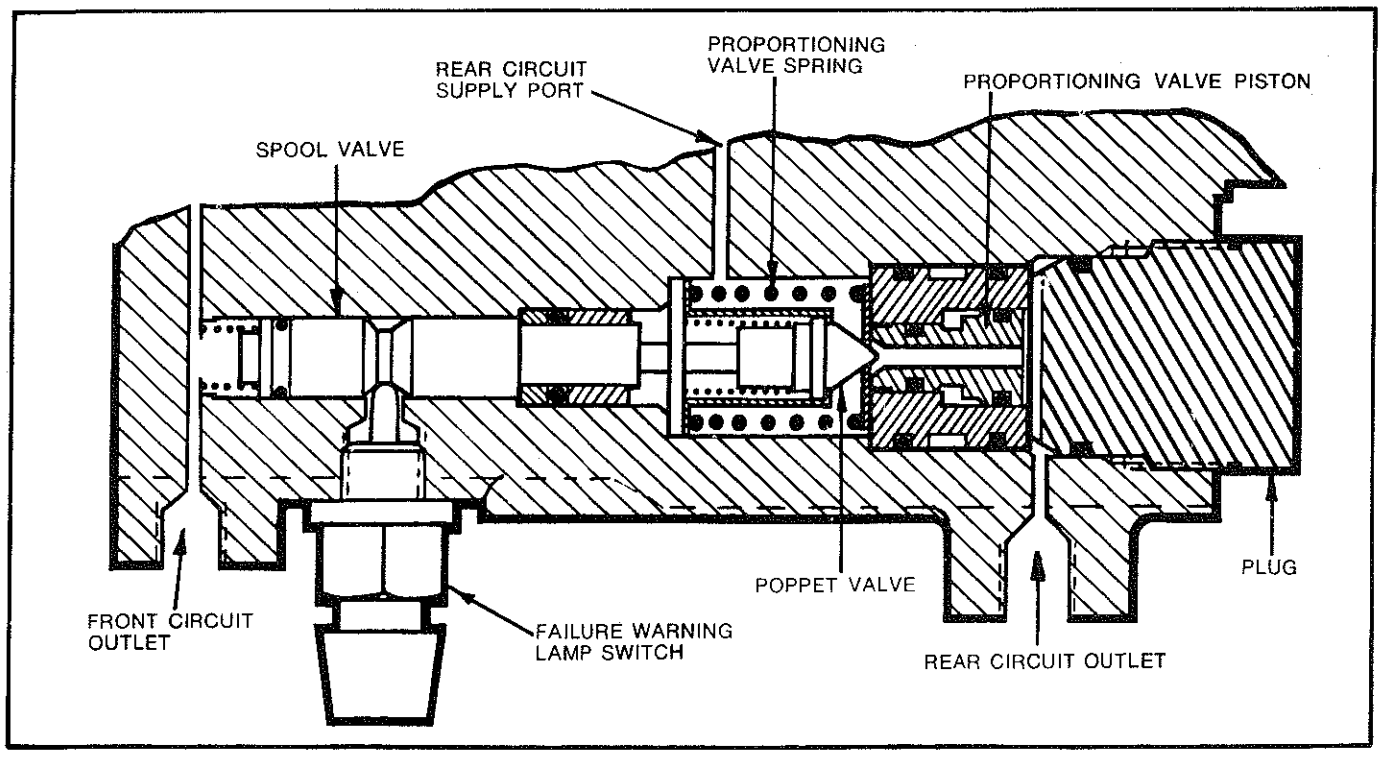


Fig. 5—Cross sectional view of spool valve and proportioning valve

(22) Fit the reservoir jointing grommets into the cylinder locations and fit the "O" ring onto the reservoir attaching bolt.

(23) Install the reservoir over the attaching bolt and onto the grommets.

(24) Fit the reservoir attaching washer and nut and tighten to the specified torque.

(25) Assemble the reservoir cover metal plate and rubber seal with the "front" markings aligned.

(26) Fit the cap to the reservoir with the "front" mark to the front of the vehicle, ensuring that the outside lip of the rubber seal fits over the locating bead on the reservoir.

TESTING MASTER CYLINDER

Checking if the master cylinder compensates at both ports can be achieved by applying the pedal lightly and observing for a geyser of fluid squirting up in the reservoirs. This will occur first in the rear reservoir and will immediately be followed by the front reservoir.

HYDRAULIC SYSTEM FAILURE WARNING SWITCH

The hydraulic system warning switch is used to warn the vehicle operator that one of the hydraulic systems has failed.

A failure in one circuit does not result in a failure of the entire brake system.

As pressure in one circuit falls, the unbalance in pressure on the spool valve forces the valve to move and contact the switch terminal thus lighting the brake failure warning lamp on the instrument cluster.

The warning lamp switch components are installed in the master cylinder in the same bore as the proportioning valve, Fig. 5.

The warning lamp switch spool valve is self neutralizing, thus it is not necessary to remove the switch to allow the valve to centralize.

The switch can be removed or replaced without loss of fluid.

PROPORTIONING VALVE

The proportioning valve is integral with the master cylinder. Its purpose is to regulate the amount of fluid pressure transmitted to the rear hydraulic circuit thus preventing premature rear wheel "lock-up" resulting in improved braking and steering control under braking.

The valve contains a stepped piston working against a pre-loaded spring and poppet valve (refer Fig. 5). This allows the front and rear hydraulic pressure to increase at the same rate until the piston overcomes the spring force. At this point the piston will begin to move across to the poppet valve thus restricting the pressure increase to the rear brakes.

In the event of a front circuit failure, the poppet valve will be pulled away from the proportioning valve piston by the spool valve, allowing all available pressure to be transmitted to the rear brakes unrestricted.

Testing

When a premature rear wheel "lock up" is obtained on brake application, it usually is an indicator that a malfunction has occurred within the proportioning valve; test as follows:

(1) Remove the rear brake tube from the master cylinder and "T" a 13800 kPa (2000 p.s.i.) gauge between the master cylinder and brake tube, "T" a similar gauge onto one of the front tubes.

NOTE: Ensure all joints are fluid tight.

(2) With an assistant exerting pressure on the brake pedal, obtain a front circuit pressure output of approximately 4826 kPa (700 p.s.i.).

(3) While pressure is being held at above, reading on rear circuit gauge should be 3150 to 3480 kPa (457 to 505 p.s.i.).

SECTION 4 — BRAKE BOOSTER M60 AND M75
(Imported Type)

SPECIFICATIONS

	M60	M75
Type	Direct acting vacuum type	<———
Effective diameter of power cylinder	152,4 mm (6.0")	190,5 mm (7.5")
Boosting ratio	2,2 @ 25 kg (55 lbs.) pedal pressure	2,9 @ 25 kg (55 lbs.) pedal pressure
Non Boosting Function Test @ — 10 kg (22 lbs.)	1310 kPa (190 p.s.i.) max.	1137 kPa (165 p.s.i.) max.
— 30 kg (66 lbs.)	3940 kPa (572 p.s.i.) max.	3404 kPa (494 p.s.i.) max.
Boosting Function Test @ — 10 kg (22 lbs.)	1571 to 2549 kPa (228 to 370 p.s.i.)	<———
— 30 kg (66 lbs.)	6077 to 7055 kPa (882 to 1,024 p.s.i.)	<———
Push rod to master cylinder piston end clearance	0 to 0,75 mm (0 to 0.030")	<———

TORQUE SPECIFICATIONS

	Nm	lb./ft.
Booster to dash panel	8-12	6-9
Master cylinder to booster	8-12	6-9
Brake tube flared nuts to master cylinder	12-16	9-12
Check valve attachment	15-17	11-13

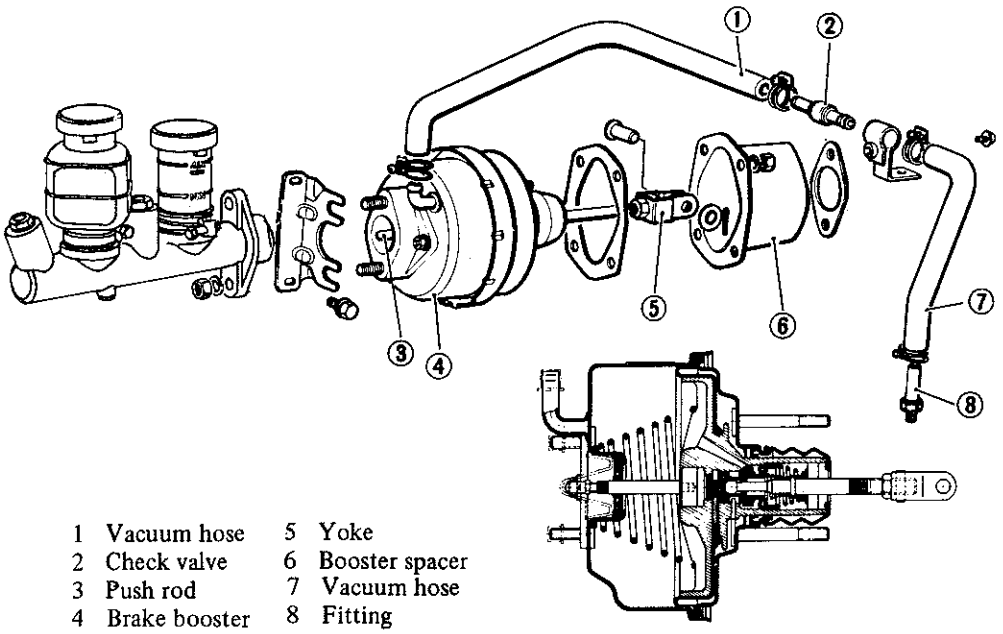


Fig. 1—Exploded view of brake booster

BRAKE BOOSTER

Operating Test Without Using a Tester

The functions of the brake booster can be roughly tested by the following method:

(1) Run the engine for a minute or two, then switch it off. Depress the brake several times with normal application pressure. If the brake pedal stroke is largest when depressed the first time and decreases with the following applications, the brake booster is good. If the pedal stroke remains unchanged, the brake booster is defective.

(2) With the engine off, depress the brake pedal several times, then, with the brake pedal depressed, start the engine. If the pedal goes down slightly, the brake booster is good. If it does not go down, the brake booster is defective.

(3) With the engine operating depress the brake pedal. Then with the pedal kept depressed, stop the engine. If the pedal height does not change for approx. 30 seconds, the the booster is good. If the pedal height increases, the brake booster is defective.

Perform these three checks. If they all turn out to be good, the brake booster is functioning properly.

If one or more of the three tests fail, a defective check valve, vacuum hose or brake booster is suspected.

Operating Test Using Gauges

Connect a vacuum gauge, pressure gauges and foot pressure gauge as shown, bleed the pressure gauges, and proceed as follows:

(1) No-load Air Tightness Test

Start the engine, when the vacuum gauge registers approx. 500 mm Hg (20 in. Hg), switch the engine off.

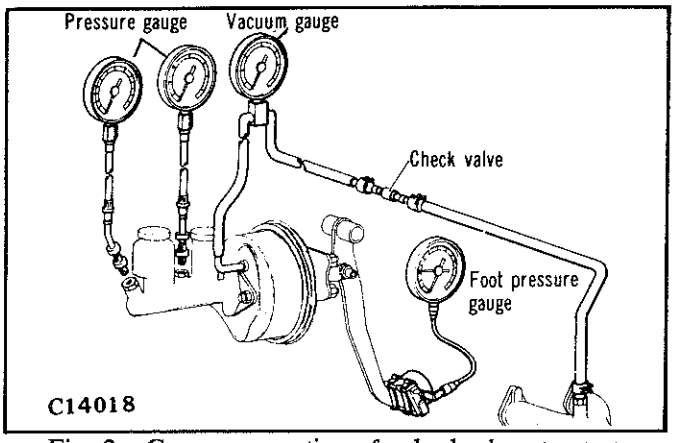


Fig. 2—Gauge connections for brake booster test

If the vacuum fall in approx. 15 seconds after the engine shutdown does not exceed 25 mm Hg (1 in. Hg), the brake booster is good.

(2) Loaded Air Tightness Test

Start the engine and depress the brake pedal with a pressure of 20 kg (44 lbs.). When the vacuum gauge registers approx. 500 mm Hg (20 in. Hg) switch the engine off.

If the vacuum fall, approx. 15 seconds after the engine shutdown, does not exceed 25 mm Hg (1 in. Hg), the brake booster is good.

If either one of the above two tests fails a defective check valve, vacuum hose or brake booster is suspected.

(3) Non-boosting Function Test

Stop the engine and wait until the vacuum gauge indicates 0 mm Hg (0 in. Hg).

Apply a pressure of 10 kg (22 lbs.) and then 30 kg (66 lbs.) to the brake pedal. The brake booster is good if the output fluid pressures are as specified.

(4) Boosting Function Test

Start the engine, when the vacuum gauge reading is approx. 500 mm Hg (20 in. Hg) depress the brake pedal. Apply a pressure of 10 kg (22 lbs.) and then 30 kg (66 lbs.) to the brake pedal. The brake booster is good if the output fluid pressure readings are as specified.

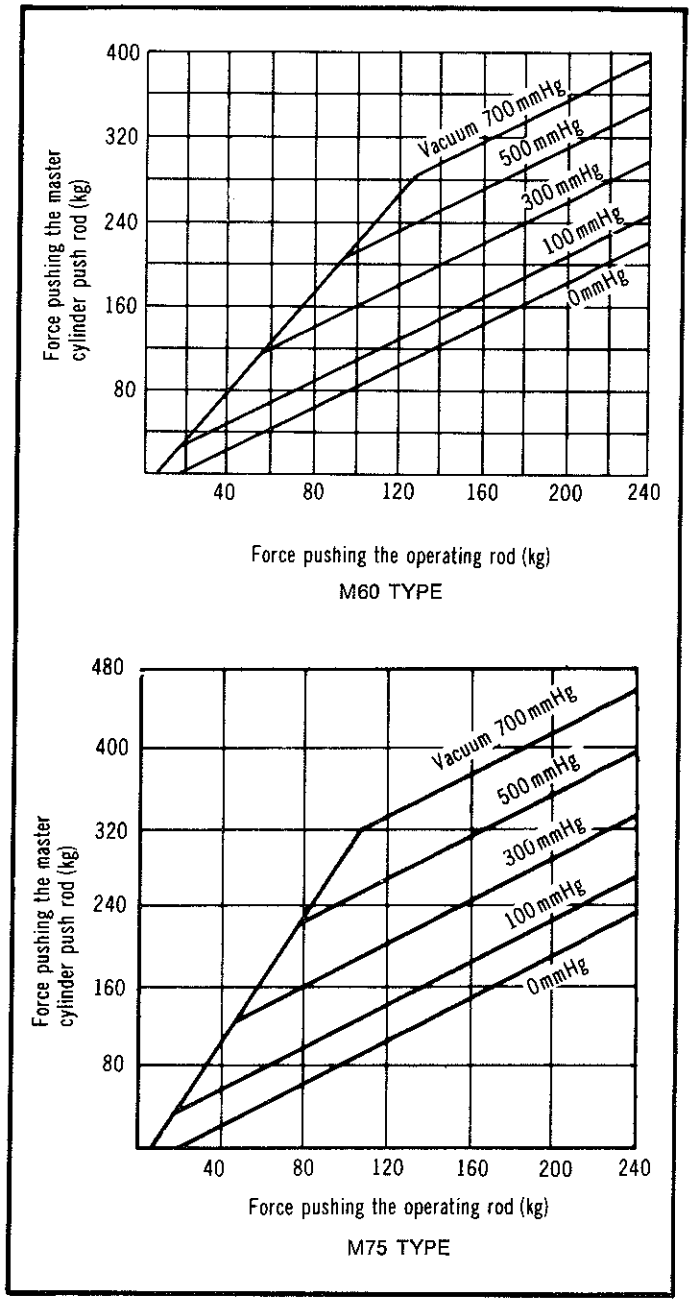


Fig. 3—Brake booster performance

Checking the Check Valve

Before disassembling the brake booster, test the operating condition of the check valve, as brake booster problems are easily confused with a faulty check valve.

With the brake booster vacuum hose disconnected at the check valve, crank the engine. Cover the end of the check valve with a finger. If a vacuum is produced and maintained, the valve is good, if not, replace the valve.

Removal

(1) Remove the master cylinder as described in the appropriate section.
(2) Disconnect the vacuum hose from the brake booster.
(3) Remove the pin connecting the brake booster operating rod with the pedal.
(4) Remove brake booster attaching nuts (fastened together with the pedal support), and then remove the brake booster.

Disassembly

Clean the outside surface of brake booster. When reassembling the unit, ensure the work area is clean thus preventing entry of dust and other impurities into the booster.

(1) Secure the front shell flange in a vice.
(2) Remove the yoke and lock nut.
(3) Scribe mating marks on the front and rear shells, this will assist in reassembly.
(4) Holding the neck of the rear shell from both sides with pipes, remove the rear shell by turning it anti-clockwise. The diaphragm spring can be removed at the same time (Fig. 4).
(5) Remove the diaphragm plate from the rear shell.

CAUTION: The diaphragm plate is made of plastic and should be handled carefully.

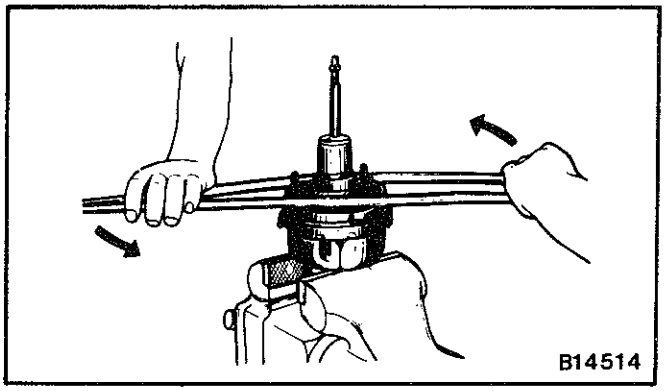


Fig. 4—Separating booster

(6) The brake booster can be disassembled into the following sub-assemblies:

- Rear shell and seal assembly
- Diaphragm plate assembly
- Front shell assembly

(7) Disassemble the rear shell and seal assembly by removing the retainer with a screw driver, then remove the bearing and the valve body seal.

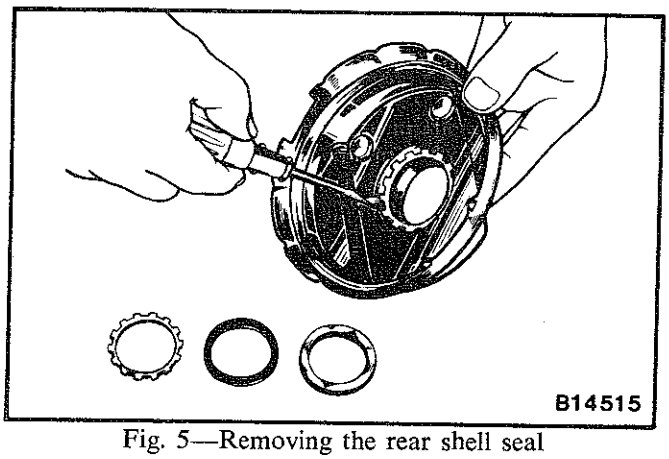


Fig. 5—Removing the rear shell seal

(8) Disassemble the diaphragm plate assembly as follows:

(a) Remove the diaphragm from the diaphragm plate.
(b) Remove the silencer retainer from the diaphragm plate with a screw driver, and then remove the silencer filter and the silencer.
(c) Remove the valve plunger stop key, and then slowly pull off the valve rod and plunger assembly. To remove the key, hold the valve plunger with the key hole facing down and remove the key by lightly pushing the rod while shaking the assembly (Fig. 6).
(d) Remove the reaction disc.

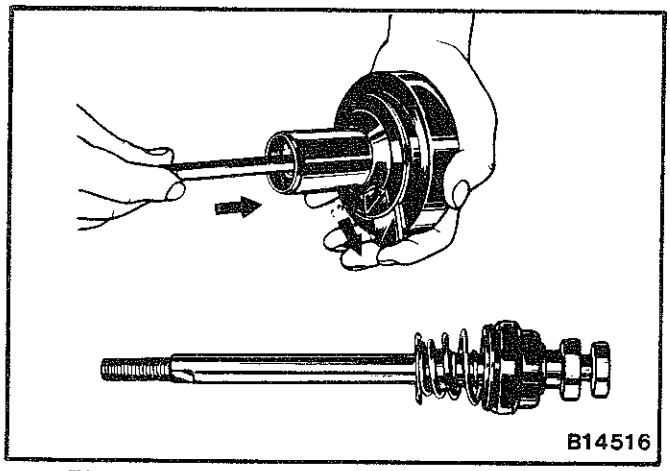


Fig. 6—Removing the valve rod and plunger

NOTE: The valve rod plunger assembly cannot be disassembled.

(9) Disassemble the front shell by removing the flange from the front shell, then remove the plate and seal assembly.

Inspection

After disassembling brake booster, clean and dry each part (cups and plastic parts must be wiped), and then check them. Repair or replace any defective part.

(1) Check the vacuum hose for cracks and damage.
(2) Check the diaphragm plate for damage and cracks.
(3) Check the push rod for bend and damage.
(4) Check the front and rear shells for cracks, damage and deformation.
(5) Check the housing stud area for cracks, damage and deformation.
(6) Check the operation of the check valve as previously described and replace the valve if necessary.

Assembly

When assembling brake booster, observe the following items.

(1) Apply a sufficient amount of silicone grease to the following parts:

NOTE: Silicone grease is furnished as part of the repair kit.

(a) Front shell seal and push rod sliding surfaces
(b) Push rod and seal contact surfaces
(c) Diaphragm lug-to-rear shell contacting surface
(d) Outside surface of the reaction disc (apply a thin coat of grease)
(e) Reaction disc inserting part of diaphragm plate
(f) Rear shell seal and diaphragm plate sliding surfaces
(g) Interior of piston plate into which plunger assembly is inserted and seal sliding surfaces.

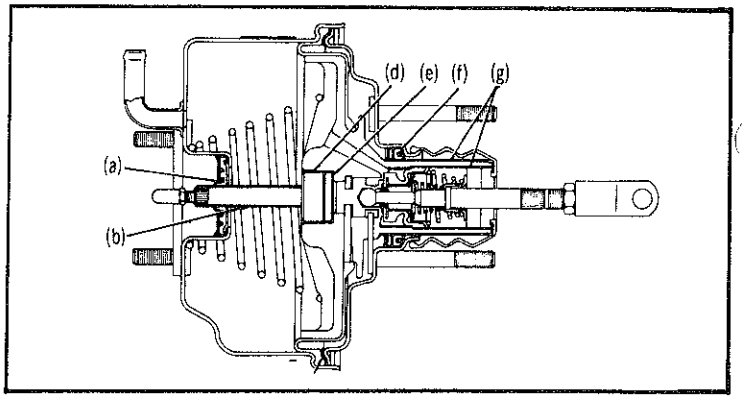


Fig. 7—Silicon grease lubrication points

(2) Insert the seal, bearing and retainer (in that order) into the rear shell, and then press in the retainer, do not apply too much pressure to the retainer.

(3) Gently install the valve rod and plunger assembly to the diaphragm plate.

(4) Insert the valve plunger stop key with its chamfered end toward the piston side.

After installation, pull the plunger assembly to make certain the valve plunger is securely locked by the key.

CAUTION: If the stop key is reversed at installation it may be difficult to pull out when next disassembling the booster.

(5) Install the reaction disc and diaphragm to the diaphragm plate. After installation, make certain that the diaphragm has been securely inserted in the groove in the plate.

NOTE: When installing the diaphragm, use care not to spill oil, etc. on the diaphragm.

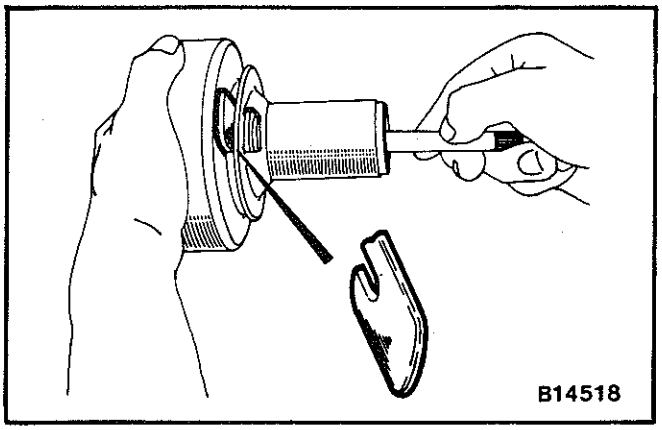


Fig. 8—Installing the valve plunger stop key

(6) Insert the silencer filter (material: urethane foam) and then the silencer (material: felt) into the rear of the diaphragm plate, and then press in the retainer.

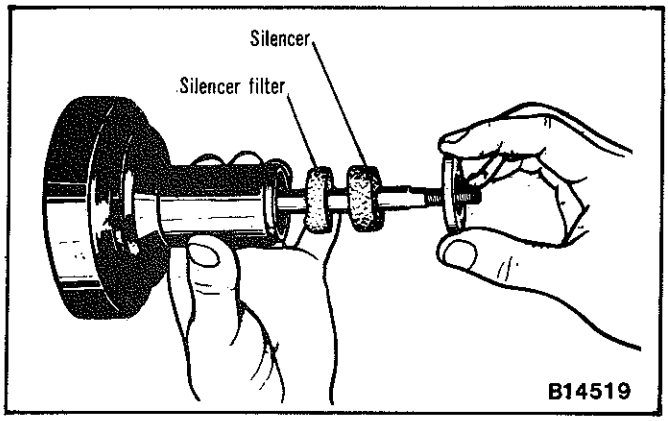


Fig. 9—Installing the silencer filter and silencer

CAUTION: If the silencer filter and the silencer are installed incorrectly, the function of the diaphragm will be adversely affected. (The silencer should not be inserted first, otherwise felt fibre will be caught by the valve.)

(7) Install the diaphragm plate into the rear shell, then install the valve body guard to the rear shell.

When installing the valve body guard, insert the rear of the guard into the end of the retainer.

(8) Insert plate and seal assembly into the front shell, then install the push rod and the flange.

The flange can be pressed in the same manner as the front shell seal.

(9) Holding the rear shell with its mating mark aligned with the mating mark on the front shell, turn the rear shell until its notch fully touches the stopper.

(10) Check for clearance between the brake booster push rod and the back of the master cylinder piston. They should be assembled only after making certain that the specified amount of clearance exists.

Check the clearance as follows:

- Measure the master cylinder piston end gap (dimension B-C fig 10). This dimension should be 8 to 8,5 mm (0.315 to 0.335 in.).
- Measure the amount of protrusion of the booster push rod (dimension A fig. 10). Deduct this figure from the result of B-C. If the calculated result fails to fall within the specified clearance adjust the push rod length accordingly.

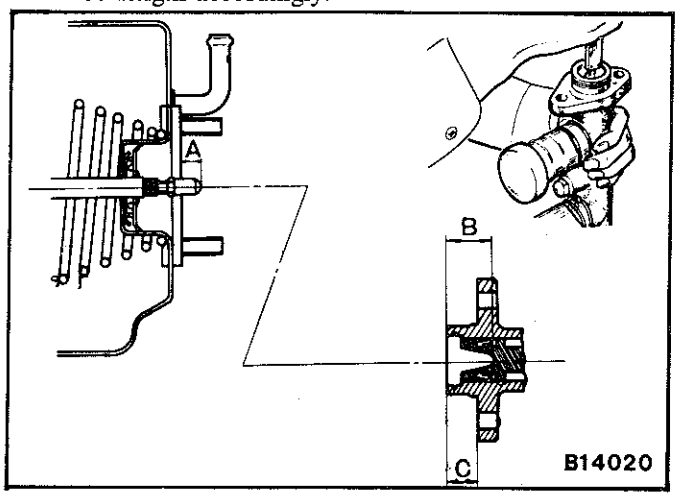


Fig. 10—Checking booster push rod to master cylinder piston clearance

(11) Install the yoke onto the threaded end of the operating rod.

Installation

Install by reversing removal procedure noting the following:

(1) Install new gaskets between the dash panel and booster surfaces and tighten the booster (assembled to the cylinder) to the specified torque.

(2) When installing the check valve, observe the installation instructions on the valve.

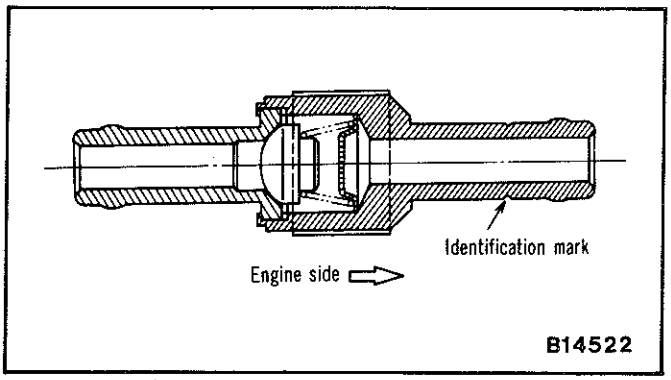


Fig. 11—Installing the check valve

(3) To install the valve apply liquid sealant to the fitting to prevent air leaks and then tighten it to the specified torque.

(4) Install vacuum hoses securely so that each connection will not leak air.

(5) Connect the brake booster operating rod to the brake pedal and adjust the brake pedal.

NOTE: For the pedal adjustment, refer to Section 1.

(6) After bleeding the brake hydraulic system, perform an operation test as previously described in this Section.

SECTION 4A — MASTER-VAC PBR

SPECIFICATIONS

Master-Vac Assembly

Manufacturer	P.B.R.
Model	VH293 (1,85ℓ and 2,0ℓ sedans and wagons up to V.I.C. JH22) VH412 (1,85ℓ and 2,0ℓ sedans and wagons after V.I.C. JH22) VH418 (2,6ℓ sedans and wagons)
Boost ratio — VH293	2.29:1
— VH411	3.5:1
— VH418	3.0:1
Nominal diameter	229 mm (9.0")
Hydraulic push rod (non-adjustable)	Recessed 4,45 to 4,69 mm (0.175" to 0.185") from face

Recommended Lubricants

Amoco Rycon 'Grade O' Grease	As specified (not on the diaphragm)
P.B.R. Rubber Grease	Sealing edges of rubber diaphragm

SPECIAL TOOLS

E79-D	Master-Vac separating press

TORQUE SPECIFICATIONS

	Nm	lb. ft.	lb. ins
Master cylinder to Master-Vac	28	20	
Master-Vac to pedal assembly to body	28	20	
Brake tubing flared end (male) fittings	15		130

GENERAL INFORMATION

The Master-Vac is fitted between the brake pedal and the brake master cylinder and supplements the driver's pedal effort. It derives power from permanent use of the depression or vacuum existing in the intake manifold of the engine and controlled application of atmospheric pressure.

The Master-Vac consists of a vacuum chamber divided by a diaphragm and pressure plate, a valve assembly connected to the brake pedal to control the application and release, and a push rod to apply the developed force to the brake master cylinder which is bolted to the front of the Master-Vac.

Engine intake manifold vacuum is relayed to the unit through a hose and a vacuum check valve fitted to the front shell of the vacuum chamber.

NOTE: Late model vehicles are fitted with an in-line check valve and have an adaptor marked "NOT CHECK VALVE" fitted in the front shell of the vacuum chamber.

When manifold vacuum falls below that in the power brake system the non-return valve closes to prevent loss of vacuum from the constant vacuum chamber.

In case of engine failure and consequent loss of engine vacuum, **two** applications of the brakes are possible by using vacuum retained in the power unit. In case of complete vacuum loss, brakes can be applied in the conventional manner, although more effort is required due to loss of power assistance.

Construction (Fig. 1)

The Master-Vac consists of front and rear shells '6' and '15' locked together and retaining the diaphragm '12' diaphragm return spring '7' and diaphragm pressure plate '11' into which the valve body '10' is assembled. The rear shell seal '14' prevents air leaking between the rear shell and valve body.

The valve rod and plunger assembly '13' fits into and is retained in the valve body by a locking key '9'. The cavity inside the valve body hub contains an air cleaner element '16' which is assembled around the valve rod. Also assembled on the valve rod which connects to the brake pedal linkage, is a silencer '17' and a rubber boot '18'.

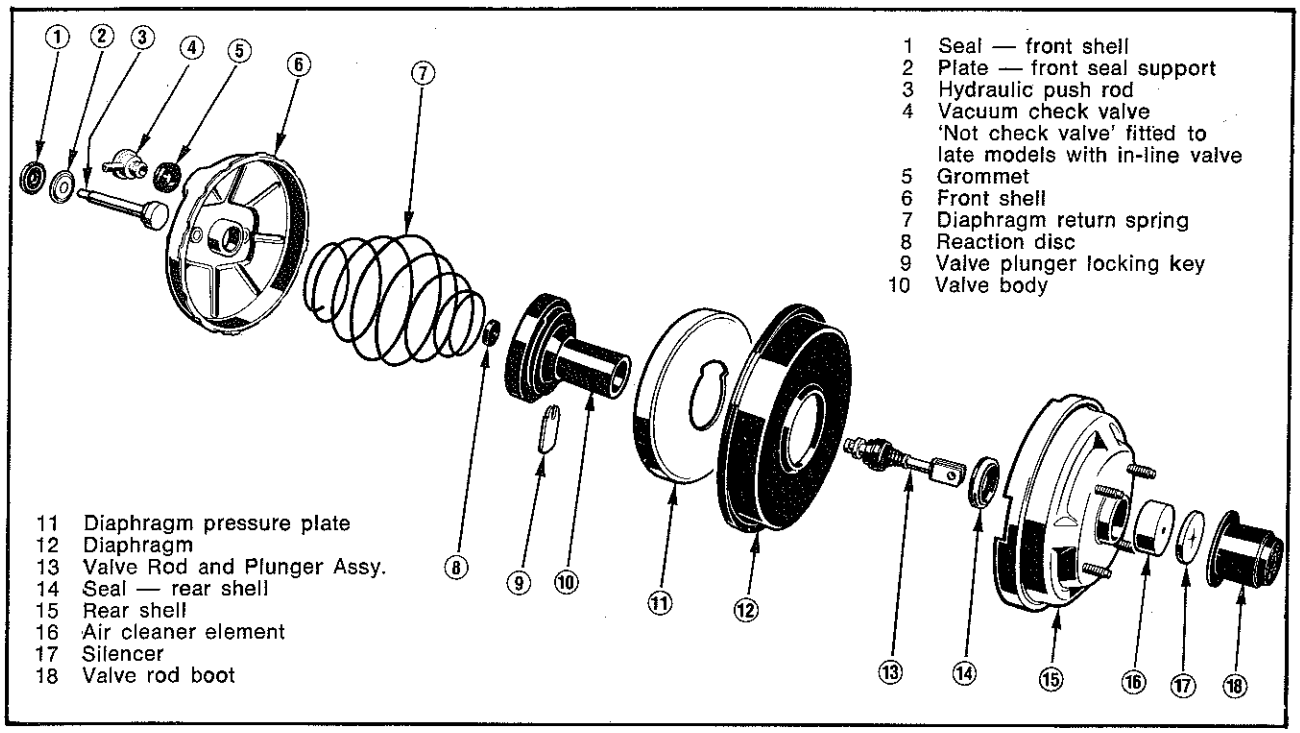


Fig. 1—Exploded view of the PBR Master-Vac

At the forward end of the unit is the hydraulic push rod '3' that operates the brake master cylinder through a rubber reaction disc '8'. The front shell seal '1' and the seal support plate '2' prevent air leaking between the front shell and hydraulic push rod. The vacuum check valve '4' (NOT CHECK VALVE fitted to late models with in-line valve) and sealing grommet '5' are also housed in the front shell which forms the constant vacuum chamber (Fig. 2).

OPERATION

Released Position (Fig 2)

With the engine running and the brake pedal released, vacuum created by the engine removes air from the Master-Vac constant vacuum chamber through the vacuum check valve and connecting hose to the engine intake manifold.

With the brake pedal assembly in the released position, the valve operating rod and valve plunger are held to the rear by the valve return spring, thereby closing the atmospheric port and opening the vacuum port 'V' This connects the control vacuum chamber to the constant vacuum chamber.

Thus vacuum is present on both sides of the diaphragm, and the diaphragm return spring holds the diaphragm pressure plate and valve body, valve rod and plunger assembly and the hydraulic push rod in the fully released position.

With the hydraulic push rod in the released position, the compensating ports in the master cylinder are open to permit brake fluid to either return from the brake system to the fluid reservoirs or enter the brake system from the fluid reservoirs to compensate for expansion or loss of fluid from the brake system.

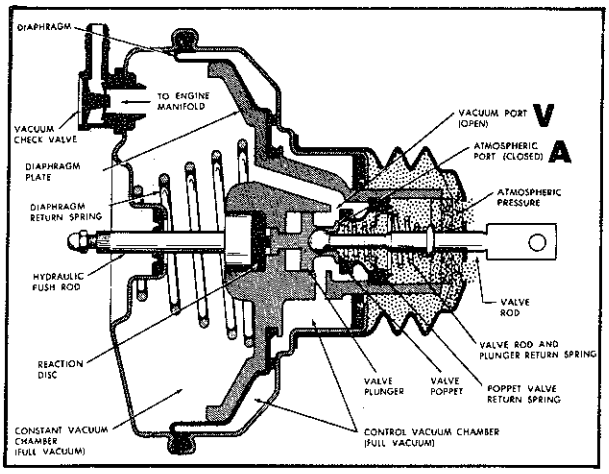


Fig. 2—Master-Vac released position (early models)

Applying Position (Fig. 3)

As the brake pedal is depressed the valve rod moves forward compressing the valve rod return spring which forces the floating poppet valve against the vacuum port seat 'V' in the valve body. This action disconnects the control vacuum chamber from the constant vacuum chamber in which there is still full vacuum.

Any additional movement of the valve rod in the applied direction pushes the valve plunger forward away from its seat 'A' on the floating poppet (control) valve admitting atmospheric pressure through the air cleaner element and silencer into the control vacuum chamber.

With the front side of the diaphragm exposed to vacuum and atmospheric pressure on the rear side, a force is developed which overcomes the diaphragm return spring force and moves the diaphragm pressure plate, valve body and hydraulic push rod (via the rubber reaction disc) forward to actuate the hydraulic brake master cylinder.

Entry of air pressure to the control vacuum chamber continues until the hydraulic pressure developed within the master cylinder creates a counter force (to the rear) acting through the hydraulic push rod and reaction disc against the valve rod and plunger. The rubber reaction disc distributes this force between the valve body and the valve plunger in proportion to their respective contact areas. (The proportion of reactive force applied to the valve plunger is controlled by design to ensure maximum power consistent with maintaining pedal "feel".) The resultant force acting against the valve rod and plunger moves the plunger slightly to the rear in relation to the valve body. This movement closes off the atmospheric port 'A' to control entry of air (at atmospheric pressure) into the control vacuum chamber.

Since this counter force or reaction force is in direct proportion to the hydraulic pressure developed within the brake system, the driver is able to maintain "feel" of the degree of brake application attained.

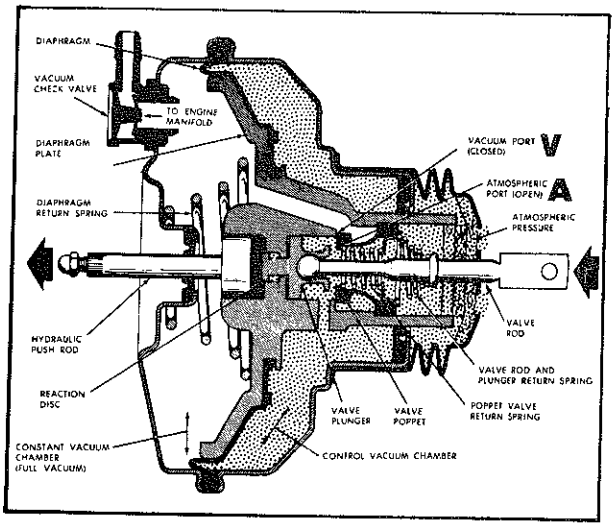


Fig. 3—Master-Vac applying position (early models)

Lap or Holding Position (Fig. 4)

During application of the brakes, the "reaction" against the air valve plunger is working against the driver to close the atmospheric port. With both atmospheric and vacuum ports closed, the Master-Vac is in the lap or holding position.

When both valves are closed, any degree of braking application attained will be held until either the atmospheric port 'A' is reopened, by depressing the brake pedal further, to increase the brake application, or by decreasing the pedal apply force to reopen the vacuum port 'V' and decrease the brake application.

Whenever the apply force on the brake pedal is held constant for a moment the valve returns to its lap or holding position.

However, upon reaching the fully applied position, the air valve plunger moves away from the floating poppet (control) valve to open the atmospheric port and admit maximum air pressure to the chamber at the rear of the diaphragm (as shown in Fig. 3). Hence with full vacuum in the constant vacuum chamber (at the front of the diaphragm) the maximum brake assistance or "boost" is obtained.

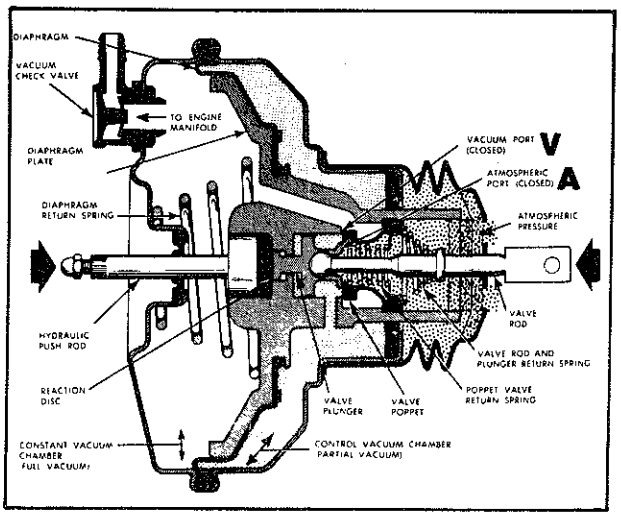


Fig. 4—Master-Vac "lap" or holding position (early models)

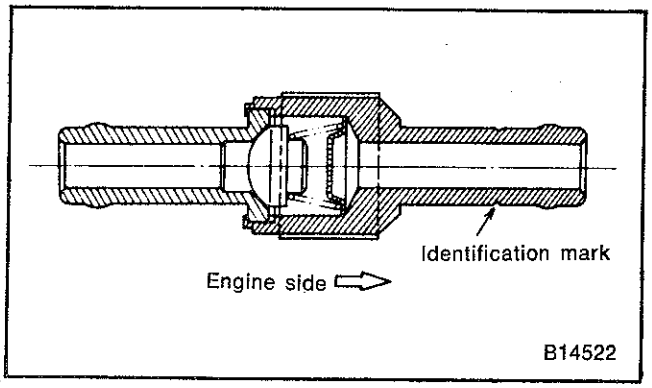


Fig. 4a—In-line check valve

No Vacuum Condition

In case of vacuum source interruption, as the brake pedal is pushed down, the valve rod and plunger assembly contacts the reaction disc which moves the hydraulic push rod and operates the master cylinder.

The pedal apply force required for manual application such as described, is considerably greater than with vacuum assistance.

MASTER-VAC OVERHAUL

Disassembly

Due to the design of the Master-Vac, a special tool E79-D must be used for dismantling and assembly. The following procedure is based upon the use of this tool (Fig. 5).

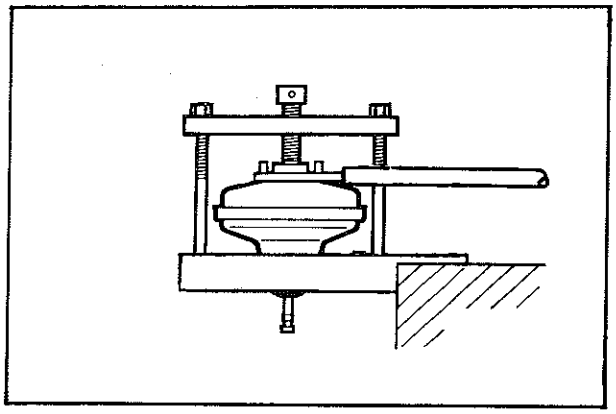


Fig. 5—Master-Vac separating press

(1) Remove master cylinder from front shell (if not previously removed).

(2) Lift out hydraulic push rod and seal assembly from the front shell.

(3) Scribe a line across the front and rear shells to facilitate positioning on reassembly.

(4) Secure base plate of separating tool in a vice and engage the studs of the rear shell in the base plate. Engage the two front shell studs in the tool lever assembly and secure with two master cylinder lock nuts.

(5) With the hold-down clamp in contact with the assembly to prevent the front cover from ejecting, rotate the lever anti-clockwise so that cut outs in front shell line up with the indentations of rear shell.

(6) Back off on hold down clamp sufficiently to remove front shell and return spring.

(7) Remove the rear shell from the tool base plate and remove rubber boot and silencer from valve body and valve rod.

(8) If check valve requires replacement, push it and the rubber grommet out of the front shell.

NOTE: "NOT CHECK VALVE" fitted to late models with in-line check valve.

(9) Remove valve body assembly from rear shell.

(10) Remove diaphragm by stretching it out of the locating groove in valve body.

(11) Carefully remove steel pressure plate from valve body ensuring that the thin back edge of the diaphragm groove is not damaged during this operation.

(12) Hold the valve body horizontally with the valve plunger locking key recess lowermost, depress valve rod and plunger assembly slightly to allow the locking key to fall out.

(13) Withdraw valve rod, plunger, air filter and silencer assembly from the valve body.

(14) Push out reaction disc with a blunt tool.

(15) Inspect rear vacuum seal, remove only if necessary and if a new seal is available.

(16) To remove seal, support rear shell on wooden block and drive out seal with a punch.

Cleaning and Inspection

(1) Wash all parts thoroughly in methylated spirits.

(2) Blow out all passages, orifices and valve holes. Air dry and place cleaned parts on clean paper or lint free clean cloth.

(3) If slight rust is found inside either the front or rear shells, polish clean with crocus cloth or fine emery paper, wash clean with methylated spirits.

(4) Inspect all rubber parts for cuts, nicks or other damage. Replace where necessary.

NOTE: The valve rod and plunger are only serviced as a complete assembly, replacing of individual parts must not be attempted.

(5) The air filter and silencer should be blown out with compressed air to remove any dust or dirt particles. If they are badly contaminated it is permissible to wash in soapy water and blow dry with compressed air.

Preparation for Re-assembly

Make sure all rubber parts are clean. Rewash in methylated spirits if there is any doubt of cleanliness. Ensure grease or mineral oil does not contact rubber parts of Master-Vac unit.

Before assembly, lubricate the following items with **Amoco Rykon 'Grade O' Grease:—**

(1) Valve plunger assembly.

(2) Reaction disc.

(3) Valve body hub — full length of bearing area in contact with the rear shell seal.

(4) Rear shell seal.

(5) Front shell seal and plate assembly — both inside and outside diameters prior to assembly.

(6) Hydraulic push rod — full length of bearing surface in contact with the front shell seal.

NOTE: This grease must not be used on the rubber diaphragm. The end of the hydraulic push rod protruding out of the front seal must be free from this grease, as it is detrimental to the master cylinder seals.

Assembly

(1) If rear vacuum seal was removed support rear shell on wooden block with studs facing downwards. Place new seal in cavity and drive in seal using a suitable piece of tubing.

(2) Insert valve rod and plunger assembly in valve body then press down to install valve plunger locking key (Fig. 6).

(3) Push reaction disc into valve body ensuring that it is installed with pimple to rear.

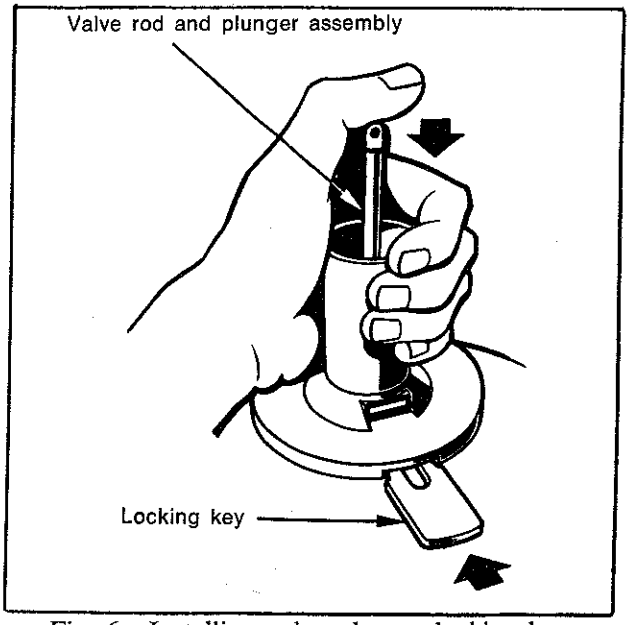


Fig. 6—Installing valve plunger locking key

(4) Carefully install pressure plate onto back of valve body. Lubricate inner sealing edge of the diaphragm with PBR Rubber Grease and then assemble it into the valve body groove to secure pressure plate in position.

(5) Insert valve body hub through seal in the rear shell, and lubricate outer edge of diaphragm with PBR Rubber Grease to facilitate easier assembly of the shells.

(6) Install rear shell on base plate of special tool E79-D and secure in position.

(7) Install return spring in rear shell.

(8) Position front shell on rear shell with scribe marks adjacent to one another, secure bar to front shell studs with the two attaching nuts.

(9) Tighten hold down clamp and compress the diaphragm return spring until the front shell is mated with the rear shell.

(10) Rotate bar clockwise until front and rear shells are locked together, then remove from tool.

(11) Install air filter element into valve body.

(12) Place silencer and rubber boot over valve rod and valve body.

(13) Install hydraulic push rod into front shell and ensure that end of push rod is located correctly in valve body.

(14) Position support plate into front seal, and install them into front shell recess.

(15) Check that hydraulic push rod recedes the specified distance from face of front shell (Fig. 7).

(16) Insert grommet and then fit vacuum check valve into the front shell.

NOTE: "NOT CHECK VALVE" fitted to late models with in-line check valve.

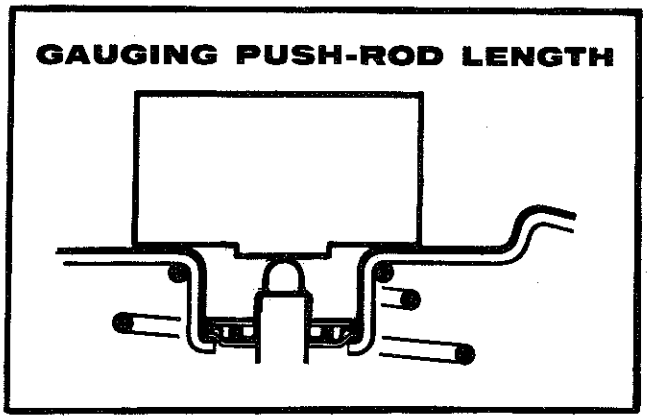


Fig. 7—Checking hydraulic push rod

MASTER-VAC TEST PROCEDURE

Connect gauges as shown in the illustration and use suitable gauge or tool for measuring the thrust applied to the valve rod of the Master-Vac (Fig. 8).

NOTE: It will be necessary to bleed all air from the hydraulic pressure lines to prevent incorrect gauge readings.

1. Vacuum Leak Test

Apply 70 kPa (20" Hg) vacuum to Master-Vac and 45 to 90 N (10 to 20 lbs.) force to the valve rod.

Close shut-off cock 'C' to cut-off vacuum and note the reading on vacuum gauge 'B'. The maximum permissible leak rate is 5 kPa (1.5 p.s.i.) in 15 seconds.

2. Operational Test

Apply 70 kPa (20" Hg) vacuum to Master-Vac and apply a known force to the valve rod. Note the line pressure on Gauge 'A'.

Compare with the valve rod thrust versus output line pressure graphs (Figs. 9, 10 and 11).

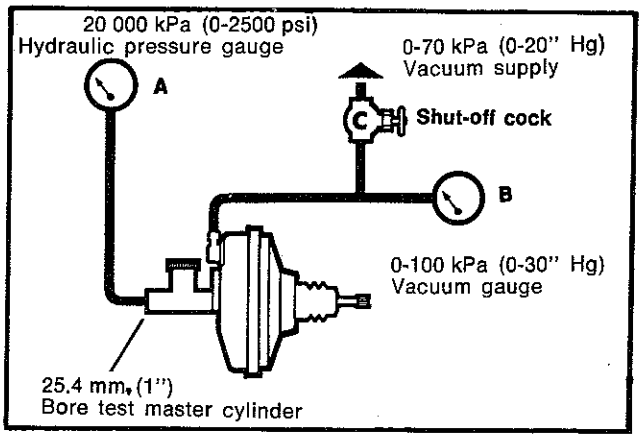


Fig. 8—Master-Vac testing equipment

NOTE: At least two readings are necessary, take one in the lower range and one in the higher output range to ensure the Master-Vac is operating within specification. Always repeat the test to ensure a consistent result.

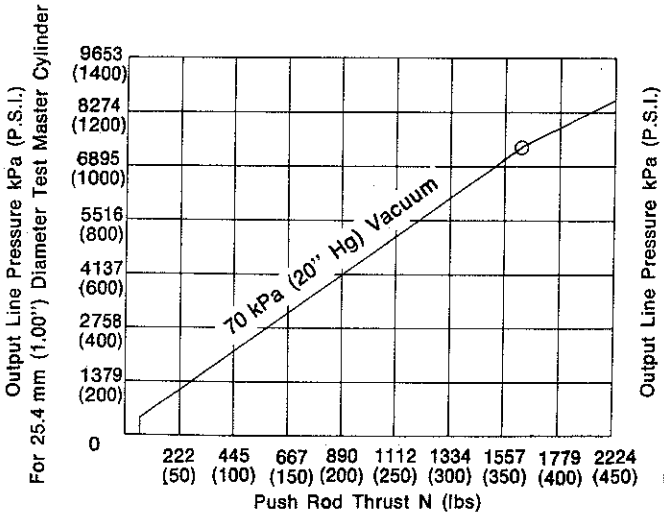


Fig. 9—VH293 (2.29:1 ratio) Master-Vac performance graph

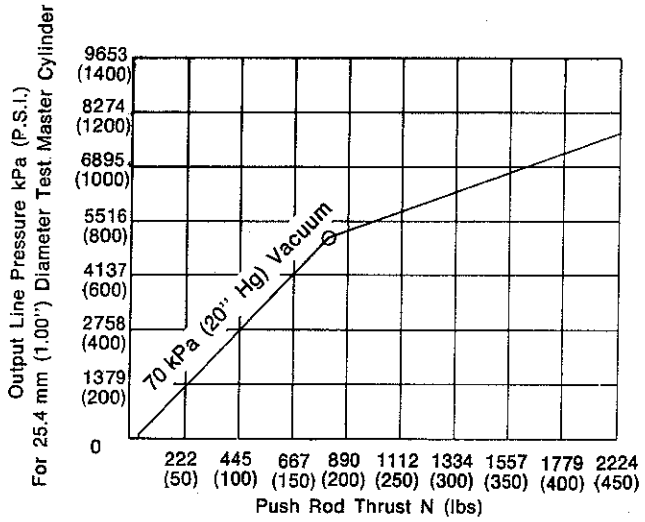


Fig. 10—VH412 (3.5:1 ratio) Master-Vac performance graph

MASTER-VAC UNIT

Removal

(1) Remove the nuts securing master cylinder to Master-Vac and disconnect vacuum hose.

(2) Remove the nuts retaining Master-Vac to dash panel and disconnect the operating rod from the brake pedal.

(3) Remove any brake pipe retaining clips and swing master cylinder assembly away to permit removal of the Master-Vac. Support the master cylinder assembly while the Master-Vac is removed.

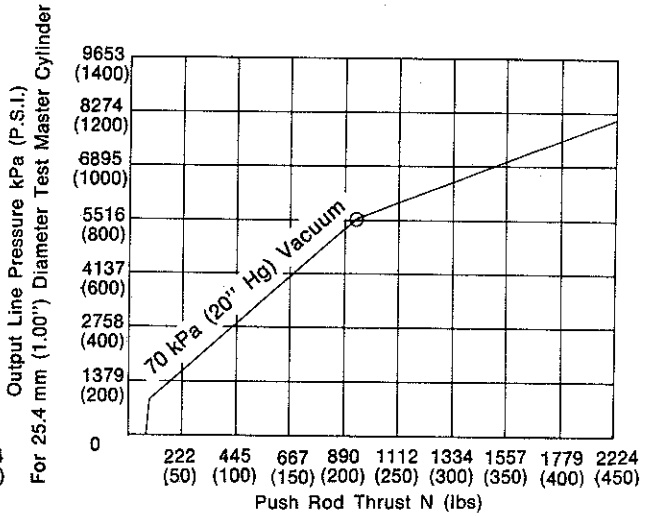


Fig. 11—VH418 (3.00:1 ratio) Master-Vac performance graph

Installation

(1) Position seal over mounting studs on Master-Vac and install unit to the dash panel.

(2) Position the master cylinder assembly to the Master-Vac.

(3) Tighten all retaining nuts to the specified torque and connect the operating rod to the brake pedal.

(4) Reconnect vacuum hose to Master-Vac.

(5) Check operation of Master-Vac.

Servicing Air Cleaning Element

(1) Remove Master-Vac as previously described.

(2) Remove rubber boot, felt air silencer and foam filter element from the rear end of the Master-Vac assembly.

(3) Shake filter and silencer free of dirt and blow clean. If badly contaminated it is permissible to wash with soap and water and then dry thoroughly. If the foam filter has deteriorated it should be replaced.

(4) Reinstall filter element, silencer and rubber boot.

(5) Install Master-Vac on vehicle as previously described.