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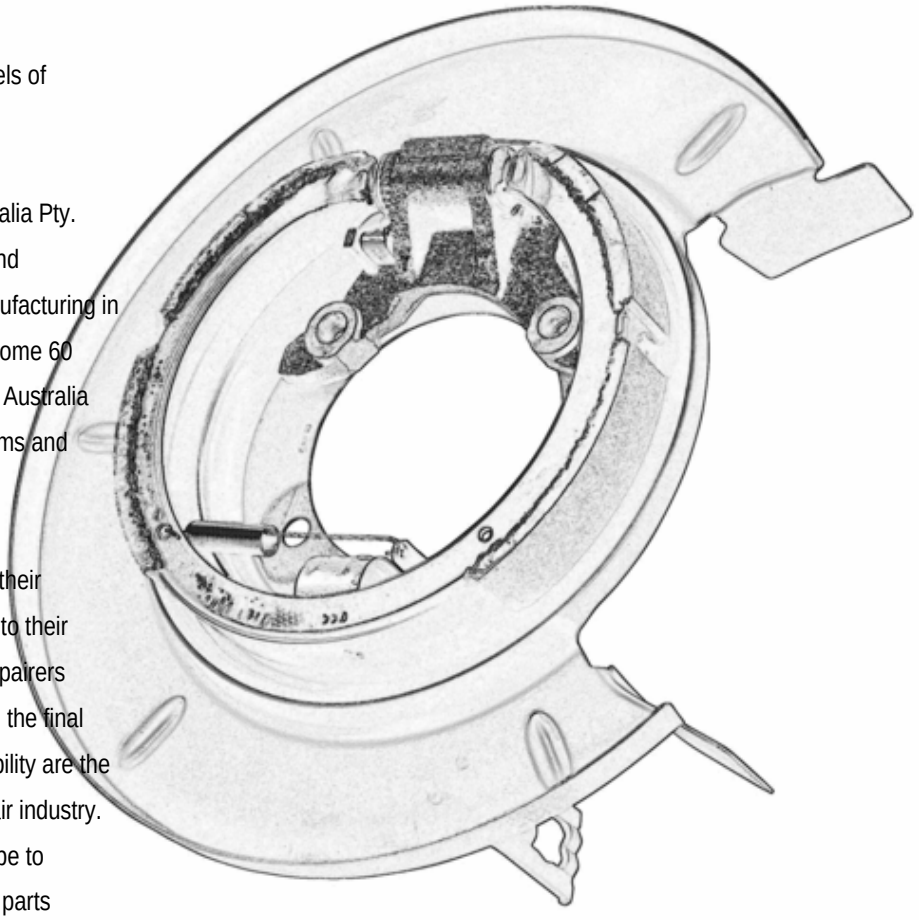
DON'T STOP WITHOUT US

HYDRAULIC BRAKE SYSTEMS GUIDE

INTRODUCTION

The purpose of this booklet is to help car repairers identify and remedy brake concerns. This is an expert guide for everybody in the industry who is involved in brake sales, repairs and maintenance. By following this guide, correct brake fault diagnosis becomes easier, and repairs will be achieved more efficiently and effectively.
That means better productivity and greater levels of customer satisfaction.



This booklet has been published by PBR Australia Pty. Ltd., a recognised world leader in the design and production of brake systems. PBR started manufacturing in 1927 and the company's products are sold in some 60 countries around the world. There is nobody in Australia who has a better understanding of brake systems and components than PBR.

PBR has built their reputation on the quality of their products and the back-up service they provide to their customers. They recognise the need to help repairers service their customers - the motorists who are the final consumers of these products. Safety and reliability are the most important qualities in the automotive repair industry. Without these qualities, the industry cannot hope to Survive. PBR recognises that repairers rely on parts manufacturers for more than just high quality products. Making sure that repairers have technical support, advice and assistance is equally important. This booklet is evidence of the commitment that PBR has to providing their customers with that support.

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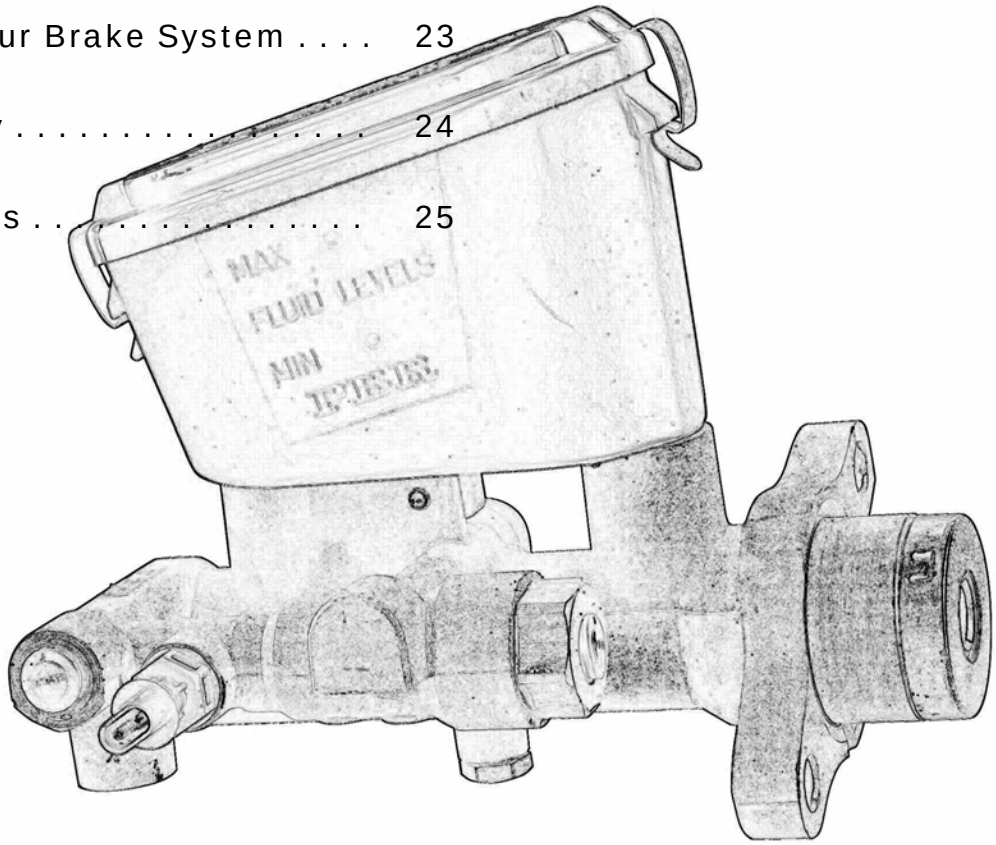


Experience The Difference

PBR Australia started life as Paton's Brake Service Station in 1927.That's almost 80 years of commitment to brake service and manufacturing.

When brothers George and Jack Paton opened their small brake service business in the inner Melbourne suburb of Carlton (in the state of Victoria) their aim was to service the developing Australian car market. Paton's Brake Service Station became part of the growing aftermarket industry. Before long, the business became known as Patons Brake Replacements (PBR), and increased its ongoing commitment to the Australian automotive industry when, in the 1930's during the Great Depression it moved into manufacturing.

But PBR's history is only the beginning of the story. Today PBR is a world leader in lightweight, high performance braking systems. From its small beginnings as a Melbourne workshop, PBR has become an international company known throughout world automotive markets as an original equipment supplier to some of the biggest names in the industry, and as a reliable, high quality supplier to the international aftermarket. It's the years of commitment and specialised experience that makes the difference.

Pursuit of Excellence

PBR's innovative designs for original equipment brake systems and components have earned them the right to deal with the largest and most influential automotive markets in the world. PBR is the only brake system manufacturer in Australia suppling to Holden, Ford, Toyota and Mitsubishi along with the performance specialists Holden Special Vehicles and Ford Performance Vehicles.

In the U.S. PBR brake systems are used in a range of General Motors, Ford and Daimler Chrysler passenger and light truck vehicles. Throughout Asia they are used by companies such as Mazda, Proton, Daewoo and SsangYong. In Europe PBR brake systems are found on Fiat, Renault, Nissan and Toyota models amongst others.

The lightweight braking componentry of PBR's original equipment brake systems includes leading edge patented designs such as the Banksia single shoe park brake, aluminium pad guided calipers, aluminium lock actuator calipers and plastic brake boosters.

The ongoing advancement of brake system technology is the cornerstone of PBR's success. This can be seen in the development of PBR brake modules to improve NVH and with the leading edge development of PBR's brake-by-wire systems which will shape the brake performance improvements of the future.

No Fault Warranty

This is PBR's quality assurance that comes with every aftermarket component we manufacture.

Widest Range

From a single component to an entire brake system, PBR has set the standard in both range and availability. And, PBR's wide range of aftermarket products is manufactured to suit Australian, Asian, American and European vehicles. The comprehensive brake range includes; master cylinders, boosters, disc brake calipers, disc rotors, drum brake assemblies, brake hoses, load sensing valves, wheel cylinders, repair kits, truck ABS and a full range of commercial vehicle air brake components.

National Call Centre

This fully computerised call centre handles all customer service, technical and catalogue enquiries. To access, phone 1300 369 727, email pbr_enquiries@pbr.com.au or refer to the website www.pbr.com.au.

Australian Owned

PBR Australia Pty Ltd is a wholly-owned subsidiary of Pacifica Group Limited, which is a publicly listed company on the Australian Stock Exchange.

Customers Know Symptoms - You Need To Identify Problems

Modern braking systems are complicated and understanding the operation of a braking system requires specialised skills and training. This means that for the average vehicle owner, even if they understand the basics of braking system operation, they are unlikely to know the cause of their braking problem.

It is your job as a professional, to gather the necessary information about the symptoms that the customer is experiencing so that you can successfully identify the cause of the problem. Collect background information such as: when the vehicle was last serviced and did the service include a brake inspection; has the owner had the brakes worked on previously and if so what was the nature of the repair; what is the driving style of the vehicle owner - do they drive and brake aggressively; what sort of driving does the vehicle do and what sort of conditions does it operate in. Naturally you should gather as much information as possible about the specific complaint that the owner has: what are the symptoms; when does the problem occur, etc.

Brake Problems Aren't Always Visible

The complicated nature of braking systems is such that a customer's vehicle may have problems for which there are no symptoms. As a professional, it is up to you to thoroughly check the entire braking system to ensure that there are no other problems that the owner is unaware of. Always be sure to inspect brake hoses for signs of swelling, cracking and leaking; check disc rotors for wear and damage; and check brake fluid for contamination and discolouration.

If components are showing signs of wear, even if they do not yet require replacement, by bringing it to the attention of the owner now you are helping to ensure the future braking safety of the vehicle, as well as keeping your customer satisfied.

Replace Components In Sets

For braking safety, components such as wheel cylinders, disc calipers, disc rotors and brake hoses should always be replaced in sets (eg. left and right or upper and lower). Once a component has deteriorated to the point where it needs to be replaced, then it is most likely that the matching component will also have deteriorated to the same point.

There are also risks associated with replacing only one component. For example, replacing only one wheel cylinder or disc caliper increases the risk of impurities from the old component contaminating the brake fluid and causing damage to the new component. With disc rotors, replacing only one rotor will probably result in the brakes pulling to one side, or in unsafe braking performance. Brake hoses, because they are made of rubber and are subject to constant flexing, have a limited life. If one hose needs to be replaced, then even if there are no visible signs of damage to the opposite hose, there is a risk that it could soon develop the same problems.

In addition, replacing only one component from a set creates a performance differential between the two parts. That is, the new part will perform better than the old part which ultimately puts additional strain on the remaining older part.

Consider Assemblies Over Kits

Servicing brakes using factory manufactured replacement assemblies rather than repair kits eliminates the potential for brake system contamination and possible brake failure.

PBR offers a range of replacement product solutions including hydraulic cylinders and brake calipers including loaded calipers, unloaded calipers and piston housings.

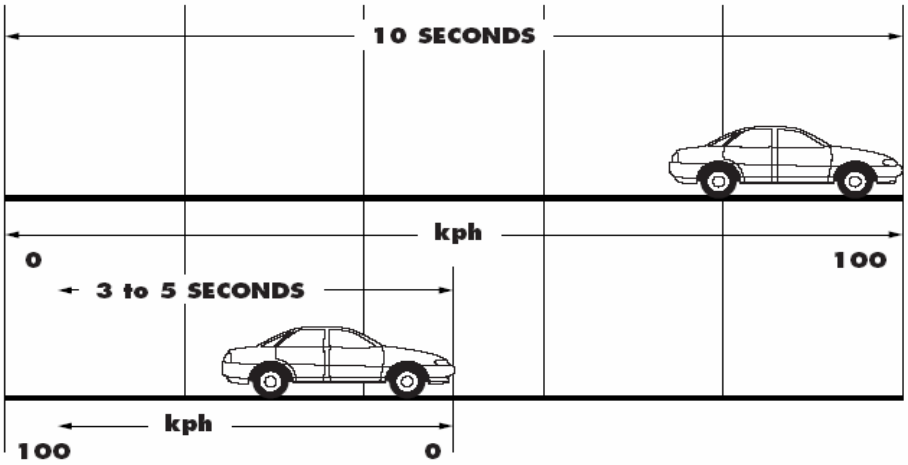
Brakes are arguably the most important feature of any modern vehicle. This leaflet is designed to give you an insight into the types of braking systems and their basic operation. We hope it helps you satisfy your customers.

A typical modern vehicle weighs around 1.4 tonnes, has a 3.5 litre engine, and accelerates from 0 to 100kph in approximately 10 seconds.

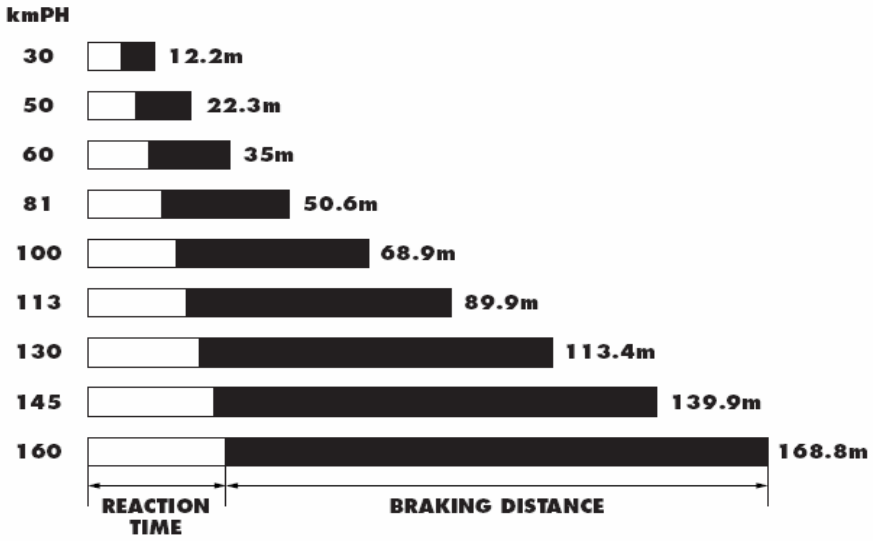
To do this, it has a sophisticated engine, transmission, and driveline system. This system consists of thousands of mechanical and electronic parts, and makes up nearly half the vehicle's weight.

By contrast, the braking system usually comprises about 200 parts weighing less than 40 kilos, and this system has to be able to stop the vehicle from 100kph in only 3 - 5 seconds.

Acceleration and Braking energies



Average stopping distance



The braking system is a means of converting the vehicles momentum (called kinetic energy) into heat by creating friction in the wheel brakes. The heat is then dissipated into the air, and it is this ability to absorb and dissipate heat that prevents brake fade under severe conditions (downhill braking, for instance).

Of course, final contact between the vehicle and the road is made through the tyres -hence their importance in braking performance. Bald or defective tyres will make even the best brakes ineffective.

The modern braking system consists of a pedal and booster assembly to which a master cylinder and proportioning valve are attached.

(Brake pedal and booster assembly)

(Brake master cylinder assembly)

At the wheels there are either disc calipers and rotors, drums and brake shoes, or a combination of both.

(Brake caliper and disc rotor)

(Drum brake assembly)

The system also has a park brake. Park brakes can either be part of, or separate from, the main brake system. Park brakes are usually applied with a hand lever operated by the driver.

(Disc caliper with park brake)

(Banksia park brake)

Many modern cars use PBR's patented 'Banksia' single shoe park brake. Banksia has far fewer parts than conventional park brakes, for longer life and greater reliability.

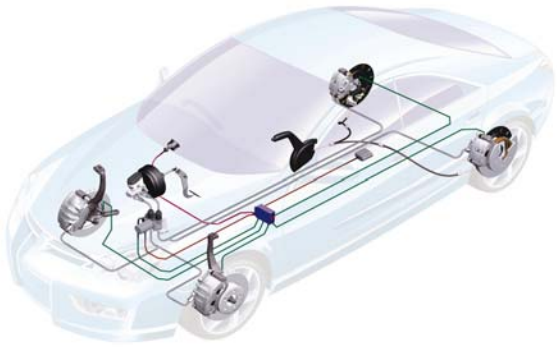
Many vehicles are now fitted with anti-lock brakes (ABS) that prevent wheel lock-up under adverse road and braking conditions. These add weight and complexity to the braking system but give the driver far better control in an emergency.

(ABS units)

Most larger vehicles have disc brakes all round. Smaller vehicles sometimes have drum brakes on the rear wheels.

Disc brakes dissipate heat quicker than drums so they are usually fitted to the front where most of the braking happens.

Wheel brakes are applied by hydraulic pressure. The pressure is produced in a master cylinder and delivered to the disc calipers or drum wheel cylinders by tubes and flexible hoses.



(The basic hydraulic brake system)

Master cylinder pistons are operated by a push-rod connected to the brake pedal, which is usually assisted by power brake booster that helps the driver by increasing the force on the piston, and reduces the driver's pedal effort.

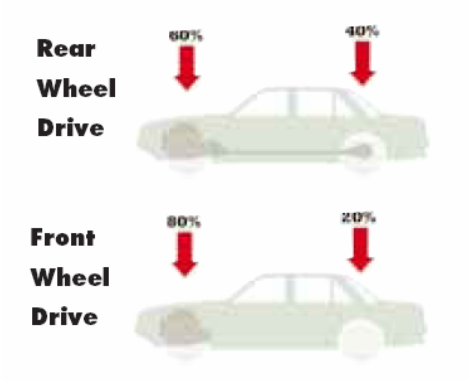
The individual brake disc calipers or wheel cylinders generate braking force by bringing friction material into contact with the discs or drums. The amount of force generated on each set of brakes is determined by the area of the hydraulic piston its size and its type.

Tandem Master Cylinder

A tandem or dual master cylinder is one of the most important safety devices in any vehicle. It operates a divided or split hydraulic system so that if one circuit fails, the other will still operate. Systems can be split so that one circuit is connected to the front brakes and the other to the rear, or diagonally between front left and rear right and vice versa.

(Tandem master cylinder)

If there is a failure in one circuit, the amount of available braking force corresponds to the amount of weight on the axle. Front engine rear wheel drive vehicles usually have 60% of their weight acting on the front wheels and 40% on the rear. By contrast, on front engine front wheel drive vehicles, the weight distribution is significantly different, with about 80% of the weight being on the front wheels and only 20% on the rear.



(Braking force distribution)

To allow for the possibility of a single circuit failure, a diagonal or cross-split layout is used. This has one front wheel and the diagonally opposite rear wheel connected to each circuit. Should either circuit fail, an equal amount of braking will still be available. It would still, of course, be only half the normal braking force of a fully operational braking system. Most tandem master cylinders have a warning switch to alert the driver to a circuit failure.

Modern disc brakes have more space between the disc and the pad than in the past. This reduces drag and improves fuel economy. However, to avoid increased pedal travel, some master cylinders are fitted with a "fast fill" valve, often called a quick take-up.

Proportioning Valves

Many proportioning valves are integral to the master cylinder housing. This reduces weight and complexity of the hydraulic piping. Alternatively they can be mounted separately.

(Integral proportioning valve)

They also have a proportioning valve (or valves) that provide balanced braking by reducing the hydraulic pressure to the rear wheels. This helps prevent rear wheel lock-up.

There are various types of remote proportioning valves:

(Single proportioning valve)

(Dual pressure sensitive proportioning valve)

(Deceleration proportioning valve)

(Load sensitive proportioning valve)

When a vehicle brakes, its weight is transferred to the front. The nose will dip as it gets heavier, and the rear will rise as it gets lighter. The rear wheels need less hydraulic pressure, hence the purpose of proportioning valves.

Where a large variation in axle loading at the rear takes place, such as in station wagons, utes, and trucks, load or height sensitive proportioning valves regulate more hydraulic pressure to the rear axle in the amount needed.

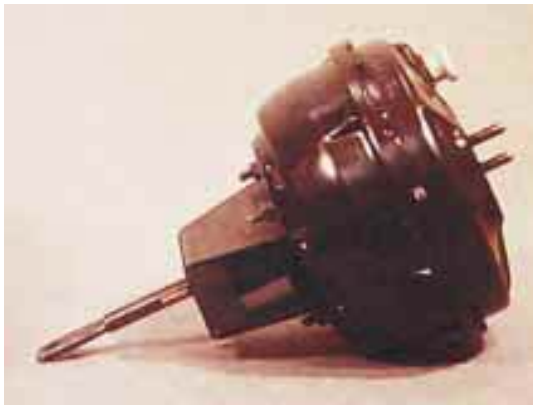
Some vehicles with front/rear split braking systems have a proportioning valve by-pass which allows full pressure to the rear if the front brakes fail.

Brake Booster or Servo Unit

The brake booster reduces the effort involved in braking which is, after all, one of driving's most repetitive functions.

Mounted on the firewall between the brake pedal and the master cylinder, brake boosters vary in size, and can be either single or double diaphragm.

(Single diaphragm booster)

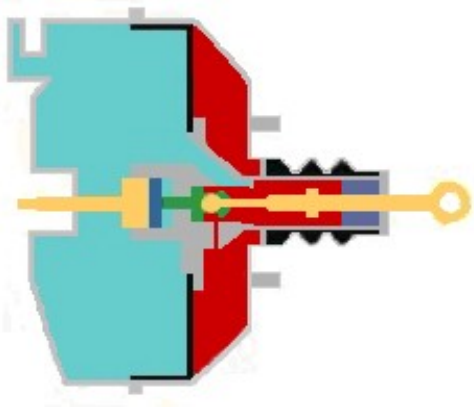


(Double diaphragm booster)

There is a vacuum in the manifold of all four stroke petrol motors. Brake boosters use this to increase the force applied to the master cylinder by three to five times without losing brake sensitivity or response and with reduced pedal effort. On diesel engines, an auxiliary vacuum pump is utilised to supply vacuum.

(Auxiliary vacuum pump)

Brake boosters have two chambers: one at the front which is always at a constant pressure, and one at the rear where the pressure varies. These are separated by a pressure plate and valve body, and are sealed from one another be a rubber diaphragm.

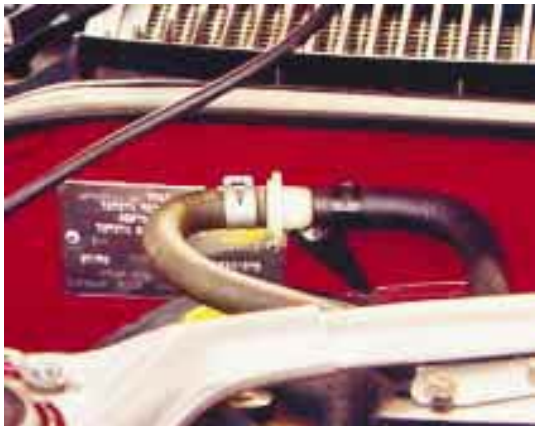


A control valve regulates the amount of atmospheric pressure let into the rear chamber. Operated by the pedal pushrod, the valve is directly connected to the output pushrod, and includes a vacuum valve.

A vacuum non-return or check valve is fitted either to the booster or in the hose from the engine manifold.

(Non-return valve on booster)

If the engine stops, this will retain enough vacuum in the booster for up to three brake applications.



(Non-return valve in hose)

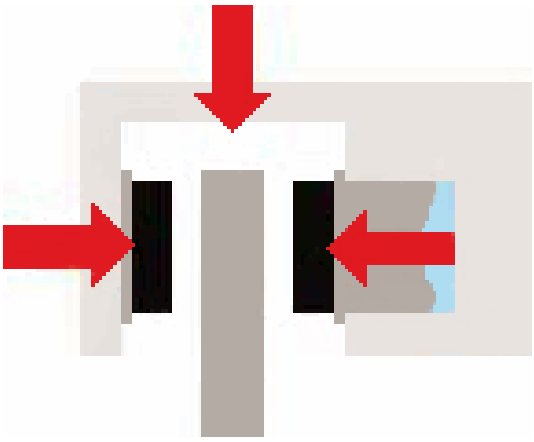
If the vacuum supply is totally lost, the control valve rod assembly and output rod act as a single pushrod. The brakes can still be operated, but the driver will have to push a lot harder to stop the vehicle.

Disc Brakes

Disc brakes are fitted to just about all of today's passenger vehicles.

In its simplest form, a disc brake consists of a cast iron rotor that turns with the wheel, and two fixed pads which consist of friction material bonded to a metal backing plate.

When the driver puts the brakes on, pressure from the master cylinder forces the pads against the rotor. The resulting friction develops the braking force needed to slow or stop the vehicle. The force with which the pads clamp the rotor governs the amount of brake force generated.

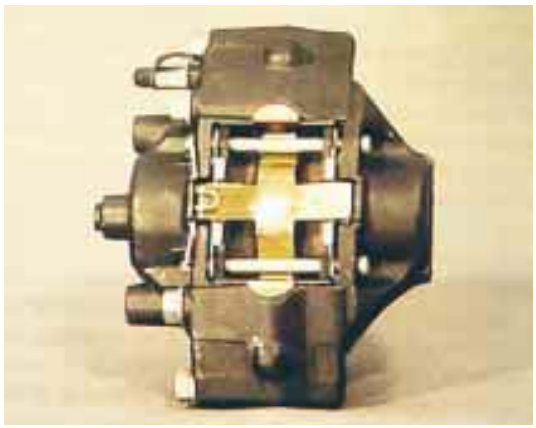


Most of the rotor is exposed to the air so friction heat is easily radiated away. This minimises brake fade and helps keep the braking stable at all speeds.

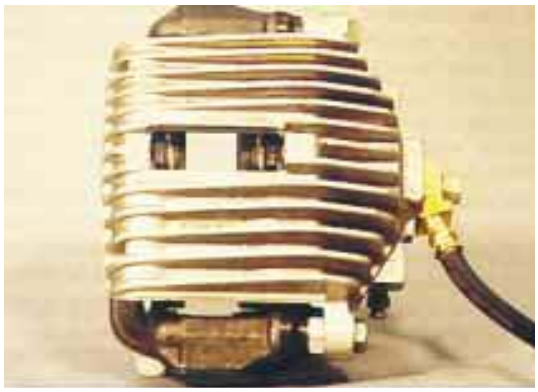
Since the rotors spin with the wheels, they will literally spin themselves dry if they get wet.

The disc caliper holds one or more pistons which force the pads against the disc rotor. Calipers may be either:

Fixed head opposed piston, or



Floating head single piston.



While fixed head calipers may have four opposed pistons, some floating head calipers have two. Multiple pistons are used when more force is needed, like heavy or high performance vehicles.

The rotors themselves can be either solid or ventilated design, depending on the application. Since the ventilated type has more surface area, it radiates heat faster so it suits heavy duty use.

(Solid disc rotor)

(Vented disc rotor)

Disc brakes don't need periodic brake adjustments (to keep the distance between the pad and the rotor constant) because they adjust automatically in use. This is so for all disc brake calipers, even those including integral parking brakes.

Where four wheel disc brakes are installed, the parking brake in some instances has been incorporated into the rear caliper. Most vehicles have a separate park brake assembly fitted inside the rear disc.

(Parking brake installation)

(Banksia park brake)

The latest development in park brake technology is PBR's patented "Banksia" design which uses a single shoe inside the rear disc.

Drum Brakes

Brake shoes are anchored to a backing plate and lined with friction material. They are mounted inside a brake drum which turns with the wheel. Pressure from the master cylinder forces the shoes against the spinning drum to prevent it from rotating.

The pressure with which the shoes are forced against the drum controls the amount of friction heat and hence the braking force. The most common type of drum brake assembly in today's vehicles is the leading and trailing shoe design. This has gained favour over the earlier duo-servo design, though both feature automatic adjusting systems.

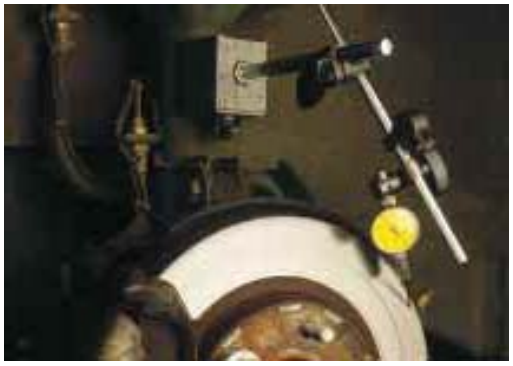
(Drum brake assembly)

Both types provide a parking brake operated by a driver's lever connected via cables to a lever-and-strut mechanism that expands the brake shoes against the drum.

(Parking brake mechanism)

The force applied by the driver is usually multiplied by an intermediate lever, and an equaliser ensures the same force is applied to each brake.

POSSIBLE CAUSES	CORRECTIVE ACTION
1. Low fluid in master cylinder reservoir	
1.1 Normal friction pad/brake lining wear.	Refill the reservoir. Apply the brakes a few times and see if the fluid level falls again. If the level does fall, follow the procedure for “Hydraulic fluid leak”.
1.2 Hydraulic fluid leak. 	Check all the hydraulic connections for leaks. Check the master cylinder, calipers, hoses, wheel cylinders, and pressure reducing valve (where fitted). Peel back the rubber boots if necessary. Note, though, there might be a little fluid under the boot left over from manufacturing. If you find any loose connections, tighten them.
1.3 Remote and direct type brake booster unit (where fitted), internal fluid leak. 	Take the vacuum hose off the booster, take out the on-return valve, and check the operation. If there is any fluid inside the booster shell, either repair or replace the cylinder.
2. Excessive travel in the brake pedal and/or handbrake lever.	
2.1 Failure of one circuit in a dual circuit braking system.	Check for fluid leaks in the brake system as per 1.2. If there are no leaks, dismantle the master cylinder, and if the bore is undamaged repair the cylinder with the appropriate repair kit. It is often preferable to simply replace the entire master cylinder.

POSSIBLE CAUSES	CORRECTIVE ACTION
2.2 Worn or unadjusted wheel bearings causing runout of the hub and disc and "knock back" of pistons in calipers or wheel cylinders. 	Renew or adjust the wheel bearings according to the manufacturer's specifications. Disc runout is often improved by refitting the disc in a different position on the hub. Use a dial indicator to ensure that disc runout is not more than 0.1mm.
2.3 Manual adjusted drum brakes out of adjustment.	Turn the adjuster until the shoe touches the drum and the drum won't turn. Then loosen the shoes so they are just clear of the drum and the drum turns freely. Apply the brake pedal to centre the shoes in the drum. Try the brakes again to check the adjustment. Use a high temperature silicon based lubricant on the adjuster and shoe abutments.
2.4 Wrongly adjusted handbrake cable or inoperative rear brake auto adjusting mechanism (if fitted).	Adjust the handbrake cable according to the manufacturer's specifications. If this doesn't help, take the brake drums off and see if the automatic rear adjusters are working correctly. Use a high temperature silicon based lubricant on the adjuster and shoe abutments.
2.5 Excessive booster to master cylinder clearance.	Adjust the booster output rod according to the manufacturer's specifications.
2.6 Worn pedal linkage and/or free play.	Replace pedal pivot bushes and pins. Adjust according to the manufacturer's specifications and reset stoplight switch.

POSSIBLE CAUSES	CORRECTIVE ACTION
2.7 Fast fill valve not operational.	Remove the reservoir cap and observe if the fluid level rises on initial pedal application. If so the fast fill valve is faulty and the master cylinder should be replaced. Note however that the fluid level will rise on further brake pedal application. This is normal.
3. Spongy brake pedal.	
3.1 Air in the brake fluid. 	Bleed the system, refill the reservoir, and check the system for hydraulic fluid leaks (see 1.2 above). Start bleeding with nipple furthest from master cylinder and work towards it, finishing with the nearest bleed screw.
3.2 Faulty brake hose.	Check all hoses for leaks and ballooning under pressure. Also flex the hoses to check for cracks. Replace where necessary.
3.3 Oversize brake drums.	Oversize brake drums may flex or distort on brake application. Check that they are within the manufacturer's specified limits.
3.4 Tapered Pads.	Inspect brake pads for taper in both longitudinal and radial directions. Also check inner pads for flatness as they sometimes wear concave during heavy braking. Replace if necessary.

POSSIBLE CAUSES	CORRECTIVE ACTION
3.5 Moisture in brake fluid - vaporisation.	Check brake fluid appearance and colour. If discoloured or cloudy, replace. Brake fluid must be replaced at least at manufacturer's recommended intervals, as its natural tendency is to absorb moisture.
4. Brake drag on wheels	
4.1 Mechanical: Binding or obstructed brake pedal.	Check that the brake pedal comes back to the off position without obstruction, for instance by a wrongly adjusted stop light switch.
4.2 Hydraulic: Pressure build-up in master cylinder.	Contaminated brake fluid may have caused the rubber components in the system to swell and block the by-pass ports retaining hydraulic pressure. Check for this by loosening the tube nuts at the master cylinder and see if this releases the brakes. Replace any faulty items as per 4.3 below.
4.3 Rubber cups or seals swelling due to brake fluid contamination by petrol, kerosene, or mineral oil. 	These types of contaminants can often be identified by their smell in the master cylinder reservoir or by corrosion. Flush the system, then replace all rubber parts including cups, seals, and hoses.

POSSIBLE CAUSES	CORRECTIVE ACTION
5. Brake drag on one wheel or axle.	
5.1 Disc pads seized or pistons sticking in a caliper recess.	Remove the split pins and retaining springs. Take out the pads and shims. Clean the caliper recess with brake cleaner and a cloth. (Avoid inhaling the dust, it may be harmful). Clean the pads and where appropriate thinly coat the steel backing plates and shims with a high temperature silicon-based lubricant. (Don't contaminate the friction surfaces). Put back the pads and springs. Secure them with new split pins, and check the disc spins freely.
5.2 Seized piston in disc brake caliper or wheel cylinder.	Remove the pads or brake drums as applicable. Carefully apply the brake pedal and check the movement of the piston(s) in the suspect assembly. Replace the entire caliper or wheel cylinder assembly if a piston is seized.
5.3 Obstruction in a brake hose.	Find the fault. Check the hose is faulty by disconnecting it. Replace the hose.
5.4 Handbrake assembly is wrongly adjusted or seized.	Check the handbrake cable, clevis pins and yokes as applicable. Also check the handbrake mechanism at the backplate. It may be necessary to remove the brake drum to check for correct actuation. Lubricate with a high temperature silicon-based lubricant being careful not to contaminate the linings, then adjust the handbrake.
5.5 Weak or broken brake shoe pull-off springs.	Take the brake drum off and examine the assembly. Replace the faulty spring(s) as necessary.

POSSIBLE CAUSES	CORRECTIVE ACTION
6. Pull or judder under braking.	
6.1 Pads or linings are contaminated with oil, grease, or brake fluid. 	Check the pads or shoes to find the source of the contamination. Replace the contaminated parts. Small amounts of friction material contamination can be moistened and rubbed off with a fine emery cloth. (Avoid inhaling the dust.) Severely contaminated pads or shoes must be replaced in axle sets regardless of their condition.
6.2 Different grades of friction material used on pads/linings in an axle set.	Check that the front and rear friction materials are the same grades by taking off the pads or drums. Replace with complete axle sets where necessary.
6.3 Seized piston in disc brake caliper or wheel cylinder.	Remove the pads or brake drums as applicable. Carefully apply the brake pedal and check the movement of the piston(s) in the suspect assembly. Replace the entire caliper or wheel cylinder assembly if a piston is seized.
6.4 If associated with judder: a) Disc • below minimum thickness discs • surface condition • run out • thickness variation b) Drum • excessive run-out • distortion	Use a fine emery cloth to rub off minor disc friction surface faults. If there is any doubt, replace both in pairs. Check that disc run-out does not exceed 0.1mm. Check the wheel bearings and replace or readjust as applicable. Check that the disc is the same thickness all around. Replace both the discs if there's more than 0.02mm difference. Check for rear drum judder by carefully pulling on the handbrake at low speed.
6.5 Loose caliper mounting bolts, loose backplate, steering and suspension components, tyre pressures.	Check the security of the brake assembly. Check the steering and suspension parts for wear. Check tyres are OK and inflated to correct pressures.

POSSIBLE CAUSES	CORRECTIVE ACTION
7. Hard pedal.	
7.1 Inoperative brake booster unit.	Exhaust all the servo unit's vacuum by turning off the engine and pressing the brake pedal repeatedly. You should hear the servo hiss each time you press the pedal. When the vacuum is gone, lightly press the brake pedal and restart the motor. If the servo is working, the pedal will sink as the servo operates. The air inlet should not hiss while the brakes are held on. Further checks can be made of the vacuum hose, check valve and fittings. If there is any doubt, it is advisable to replace the unit.
7.2 Glazed or worn-out pads or brake shoes. 	Carefully rub off any glazed surfaces on pads or shoes with a rough abrasive paper. Moisten first with a damp rag. (Avoid breathing the dust.) It is often safer to simply replace the pads or shoes.
7.3 Damaged or rusty friction surface of brake disc.	Check the discs for cracks, scoring, or burned-on rust (a black appearance). Minor surface imperfections can be rubbed off with a fine emery cloth but if any doubt exists, replace the disc. Replace both discs at once to ensure balanced braking.
7.4 Pads or linings are contaminated with oil, grease, or brake fluid.	Check the pads or shoes to find the source of the contamination. Replace the contaminated parts. Small amounts of friction material contamination can be moistened and rubbed off with a fine emery cloth. (Avoid inhaling the dust.) Severely contaminated pads or shoes must be replaced in axle sets regardless of their condition.

POSSIBLE CAUSES	CORRECTIVE ACTION
7.5 Seized piston in disc brake caliper or wheel cylinder.	Remove the pads or brake drums as applicable. Carefully apply the brake pedal and check the movement of the piston(s) in the suspect assembly. Replace the entire caliper or wheel cylinder assembly if a piston is seized.
8. Disc brake squeal.	
8.1 High frequency pad vibration.	
	Remove the disc pads and shims. Lightly lubricate the shims, metal backplate, and pad edges with PBR Disc Brake Anti-Squeal Adhesive. (Do not contaminate the friction material.) Replace the pads and shims. If applicable, check the cutaway part of the piston is correctly positioned and not clogged with dust.
8.2 Loose caliper mounting bolts.	Check to see if the bolts are loose. If so, tighten to the manufacturer's recommended torque setting.
9. Drum brake squeal.	
9.1 Lack of lubrication and/or excessive lining dust in brake assembly.	Take off the drum, shoes, and other parts. Clean the assembly (avoid breathing the dust) with a vacuum cleaner or damp rag. Lubricate the shoes, cylinder, and abutment slots with a high temperature silicon based grease. Also lubricate the backplate where the brake shoe platform touches. Clean the friction surface of the drum. Check that there is no grease on the shoe linings, rubber parts, or the drums friction surface.

BLEEDING YOUR BRAKE SYSTEM

Purpose

The purpose of bleeding is extremely important to the overall effectiveness of the brake system. Bleeding removes any air that may get trapped in the hydraulic system which could otherwise result in a “spongy” brake pedal and reduce brake effectiveness.

Preparation

This process requires two people. Make sure you have read the instructions through and have an assistant ready before you start.

Check that you have the following tools available.

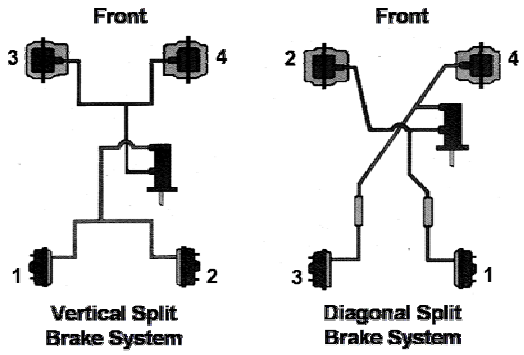
- Spanner to fit the brake caliper bleed screw
- Length of clear plastic tube which will press fit over the bleed screw nipple
- Clear container to catch the old fluid

You will also need to ensure that you have sufficient new brake fluid on hand and that it is compatible with the existing fluid.

Jack up the vehicle so that you can safely remove all four wheels and gain access to the brake caliper bleeder screws. Ensure that the workspace is clean and that you have the tools necessary to do the job.

Process

The order in which the brake calipers are bled is important and will depend on how the brake system has been connected. The following diagrams indicate the correct bleed sequence options. Front wheel drive vehicles use a diagonal split brake system whereas most rear wheel drive vehicles use a vertical split system.



Vertical Split Brake System

Diagonal Split Brake System

Note: During the bleed procedure it is extremely important to ensure that at no time does the master cylinder reservoir become drained of brake fluid. Failure to do so could result in air becoming trapped in the master cylinder.

Before commencing the bleed ensure that all calipers have been fitted so that the bleed screws are located at the topmost position of the installation.

Steps

1. Place one end of a piece of clear silicon hose with an inside diameter of 6mm over the bleed screw of the caliper.

2. Place the other end into an empty bottle suitable for catching the excess brake fluid.

3. Person 1 undoes the bleed screw half a turn to allow the free flow of brake fluid.

4. Person 2 applies the brake pedal and holds it in the down position.

5. Person 1 shuts off the bleed screw.

6. Person 2 allows the brake pedal to return to the rest position.

7. Repeat steps 3 through 6 watching the flow of brake fluid through the tube each time. When the flow of fluid contains no air bubbles, close off the bleed screw, remove the clear tube and move to the next caliper.

8. After completing each caliper check the fluid level in the brake master cylinder reservoir and top up as required to the level mark. If at any stage the reservoir runs out of fluid, fill the reservoir with fluid to the level mark and then return to the last caliper bled and re-bleed until the fluid is free of air. Then continue bleeding each caliper in sequence until all calipers are done.

Brake Pedal
A lever pivoted at one end with the power brake valve rod attached near the pivot end. A foot pad is attached to the lower end of the pedal. The force applied to the master cylinder at the foot pad is multiplied several times by the lever ratio and the brake booster.

Master Cylinder
Is a type of hydraulic pump operated by the output push rod of the brake booster. It converts mechanical force into hydraulic pressure, which is displaced into the brake lines to operate the wheel brakes.

Brake Booster
Often referred to as “Power Brake”, Servo Unit” or “Master Vac”. It is used to reduce the effort required to be applied to the brake pedal by the driver. Intake manifold vacuum and atmospheric pressure provide the power to operate the brake booster on most passenger cars and light trucks.

Brake Line
Metal tubing used for the transmission of pressurised brake fluid from the master cylinder to the wheel brakes. Often referred to as “bundy” tubing.

Brake Hose
A flexible reinforced rubber tube connecting brake lines to the wheel brakes or to other brake lines.

Drum Brake
A brake in which the frictional forces of the brake shoe linings, act on the cylindrical surface of the drum.

Brake Drum
The cylindrical rotational member of a drum brake assembly acted upon by the friction material.

Wheel Cylinder
A unit with a piston or pistons which converts hydraulic pressure supplied by the master cylinder, into mechanical force for actuation of the wheel brakes.

Disc Brake
A brake in which the frictional forces of the disc pads act on the faces of a disc.

Caliper Assembly
The non rotational components of a disc brake, including its actuating mechanism for development of frictional forces at the disc.

Disc Rotor
The parallel-faced, circular rotational member of a disc brake assembly acted upon by the friction material (disc brake pads).

Disc Brake Pad
The friction assembly consisting of friction material moulded, bonded or riveted to a steel backing plate. This is the item which is applied by the disc caliper mechanism to contact the rotating disc to produce friction (heat), hence retarding the rotation of the disc and wheel, and thereby the motion of the vehicle.
NB: Often referred to as “pads” or “disc pads”.

Brake Shoe Assembly
The friction assembly of a drum brake consisting of friction material (“brake linings”) bonded or riveted to a steel brake shoe.
NB: Terms - “shoe” usually refers to a brake shoe assembly; and “linings” usually refers to the friction material attached to the brake shoe.

Excessive Pedal Travel
That which is more than normal when compared with other vehicles of the same make and model.

Spongy Pedal
The brake pedal may touch the floor, has a “spongy” feel, can not be pumped up appreciably, and the brakes may not provide sufficient stopping power.

Hard Pedal
Applying the brake pedal will require more force than normal, stopping distances may be excessive or the brakes may not be responsive.

Brake Drag
Brake drag occurs when the friction material of a drum or disc brake is held in contact with the rotating frictional surface without the brake pedal being applied.

Brake Pull
Brake pull occurs when the brakes are applied - the vehicle veers or pulls to one side, or the rear of the vehicle “fishtails”.

Brake Judder
Brake judder is a low frequency vibration that is often felt through the car brake pedal, steering wheel, and/or body.

Brake Squeal
A noise caused by high frequency vibrations when two or more components in the braking system reach the same natural frequency.

Minimum Rotor Thickness
The minimum thickness specified on the edge of the disc rotor, below which it is unsafe to use the rotor.

Master Cylinders

PBR's master cylinder program covers an extensive range of brake and clutch master cylinders. Both aluminium and cast iron cylinders are available based on the original vehicle specifications. These are matched with OE quality rubber seals and hydraulic components to ensure a consistently high level of brake performance.

Wheel Cylinders

PBR's wheel cylinder range covers a vast array of passenger and commercial applications. Standard wheel cylinders are manufactured to OE quality levels whilst the PBR Gold wheel cylinders also include a zinc plate chromate finish to maximise corrosion protection. Gold wheel cylinders are packed as matched pairs to ensure optimum brake performance after fitment.

Jetstream Rotor System

The Jetstream Rotor System is all about maintaining OE quality levels and eliminating confusion. Each Jetstream rotor pack consists of a high accuracy disc rotor, a matched caliper set of OE quality brake pads (including noise suppression systems where required) and, where applicable, bearings and seals.

Service Kits

PBR's hydraulics service kits are available for an extensive range of master, wheel and slave cylinder applications. Each kit contains the highest quality rubber components, specially formulated to PBR's demanding specifications.

Loaded Calipers

PBR Loaded Calipers deliver the fastest brake service of them all. These calipers come as complete changeover units, including OE quality disc pads and are well suited to businesses where high quality and fast turnaround is the order of the day. Each unit is factory assembled and 100% leak tested to ensure trouble free braking.

Padless Calipers

PBR Padless Calipers deliver faster brake services because they come as a complete changeover unit but without the disc pads. These products are ideal where either you or your customer is very specific about the disc pad material to be used. Each unit is factory assembled and 100% leak tested to ensure trouble free braking.

Piston Housings

PBR Piston Housings provide exceptional value where only the caliper hydraulics needs servicing. PBR Piston Housings are a complete unit consisting of a new caliper housing, new pistons and piston seals, along with a set of replacement guide pin boots. Each unit is factory assembled and 100% leak tested to ensure trouble free braking.

Brake Hoses

PBR brake hoses are manufactured to ensure maximum brake performance and life by combining high quality, low-expansion rubber hose with purpose built precision fittings. Hoses are assembled to Original Equipment specifications and incorporate double-crimping of the hose ends to ensure consistent brake performance over time.

Brake Fluid

PBR brake fluid comes in four specially formulated grades:

Yellow Dot

Super DOT 3 fluid suitable for early model and Toyota vehicles

Red Dot

DOT 4 fluid suitable for current model vehicles

Gold Dot

Super DOT4 fluid suitable for heavy duty road use

Racing

Suitable for club and track racing