# LOW PEDAL DIAGNOSIS

**Wingate would like to welcome you to this brake diagnostic training. In this training we shall explore the problem of low brake pedal and discuss probable causes and rectification procedures.**

A low brake pedal may be defined as one which can be depressed more than half its total travel and may, in some cases be accompanied with a loss in braking performance.

Irrespective of whether a loss of performance occurs, customer perceptions are usually that the two are linked, and the concerns that they express will tend to reflect this.

In a previous training we examined spongy pedals which also suffered form excessive travel.

A low pedal however can be easily distinguished because it exhibits one or two additional characteristics that the spongy pedal does not.

The first is that whilst the pedal is low, it is still firm, with none of the sponginess of the previous complaint.

The second characteristic is that on some systems rapid pumping of the brake pedal may decrease some of the excessive travel, temporarily bringing the height back to somewhere near normal.

The cause of a low brake pedal may be either mechanical, hydraulic, or a combination of the two.

Mechanical problems are due to excessive clearance in the brakes or the pedal and booster assembly.

Hydraulic problems on the other hand are usually restricted to a circuit failure due to fluid leakage or some internal fault in the master cylinder.

No matter what the problem, diagnosis time can be greatly reduced if a logical sequence such as the one shown on the flow chart is followed.

The first step in any diagnosis procedure is to check that the problem actually exists and is not in fact normal for the type of vehicle being examined.

If doubt exists it is often helpful to perform a comparison with another vehicle of the same type and specification.

A comparison can also be of assistance in demonstrating to a concerned customer that the condition is normal for that type of vehicle.

Once it has been confirmed that the pedal is indeed low the next step is to check the fluid level in the master cylinder reservoir.

A low fluid level is an indication that a leak may exist in the system, the cause of which must be investigated before proceding any further.

A total loss of fluid in one section of the reservoir would indicate

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a circuit failure, and should have been accompanied by the brake warning light being illuminated.

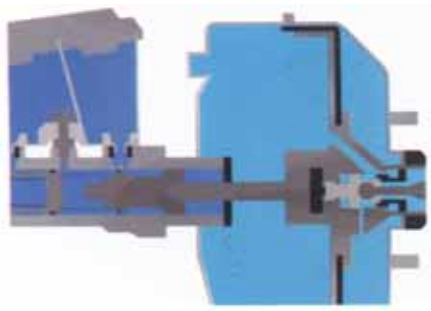
It will however still be necessary to visually inspect the master cylinder, service brakes, brake pipes, valves and hoses for signs of fluid leakage.

This will allow for the possibility of the master cylinder having been topped up just prior to the vehicle being brought into the workshop.

Firstly, check the front of the booster where the master cylinder is attached.

A stain accompanied with peeling paint down the front of the booster is an indication that the secondary seal in the master cylinder is leaking, or that the front seal of the booster is defective.

This allows manifold vacuum to act on the rear of the master cylinder, drawing fluid past the secondary seal and in some designs into the booster.



Following that, an inspection of the service brakes should be carried out for signs of fluid staining around discs and calipers or drum brake backing plates.

Finally, a visual inspection of the brake lines, valves and hoses should be performed paying particular attention to the flexible hoses and where they should be swaged into their steel and fittings.

If any of the abovementioned faults are encountered they should be repaired before proceeding any further with the diagnosis procedure.

If the sytem passes these initial inspections the next step is to clamp off all flexible brake lines on the vehicle.

This can be done safely and without causing damage to the hose by using any of the propriety brake clamps sold by most tool and equipment retailers.

The pedal should now be checked for height and if normal, the fault will lie in the service brakes, if not, the master cylinder assembly should be checked.

Having reached this point a decision as to which path in the flow chart to take will have been made.

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Because service brake problems are more common with low pedal concerns, we shall follow this path first.

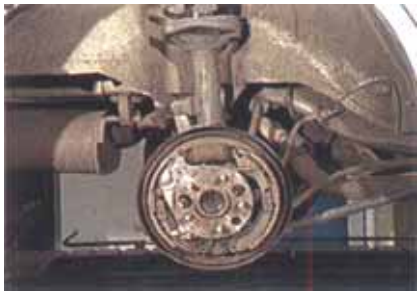
The procedure is to now release one clamp at a time and check the amount the pedal drops.

It is normal for the pedal to drop a small distance due to the designed clearance between shoes and drums, or pads and disc rotors.

Again, a comparison can be useful in helping confirm a diagnosis and this can be achieved by re-clamping each wheel after it has been tested.

In this way a brake or brakes which have excessive travel, will be easily identified.

In a high percentage of cases it is the rear brakes, particularly those systems which have drum brakes on the rear, which cause problems.



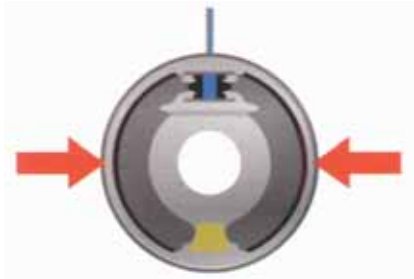
Because of this it is normal practice to release the rear clamp or clamps first. In this way comparisons between wheel or axles can easily be performed.

Lets now spend some time looking at the various problems encountered in service brakes which lead to excessive pedal travel.

We shall start by looking at drum brakes.

These are still relatively common on the rear of modern small and medium sized vehicles and many of the earlier larger sized ones.

Low pedal problems with these types of brakes are caused by excessive clearance between the shoes and drums.



This in turn causes the wheel cylinder to move further than it normally would, requiring more fluid from the master cylinder and resulting in longer pedal travel.

All modern drum brakes have some form of self adjusting mechanism and in many cases no provision, in the form of apertures in the backing plates, is made for manual adjustment. Even if an aperture is provided, manual adjustment is often difficult to perform hence the importance of these mechanisms working correctly.

Automatic adjusters work in a variety of ways. Some only work when the brakes are firmly applied with the vehicle travelling in reverse, whilst others work when the handbrake is applied.

The most common type in use today, adjusts whenever the brakes are applied and clearance between the drums and shoes exceeds the design limit.

With the type that only work in reverse, or when the handbrake is applied, the problem may be as simple as the customer not operating the vehicle in

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a manner which would cause the adjusters to work.

In this case a simple explanation of how the adjusters work should be all that is necessary to solve the problem.

However, self adjusters can also bind in the threads, or the handbrake cable can be adjusted to a point where the adjusting lever is held away from the adjuster teeth.

In some extreme cases the self adjusting mechanisms may be prevented from working or have been removed completely by misguided service personnel.

Should this be the case the only long term solution to the problem is to refit the self adjusting mechanisms.

On vehicles fitted with disc brakes on all four wheels, excessive pedal travel can be caused by a number of mechanical problems.

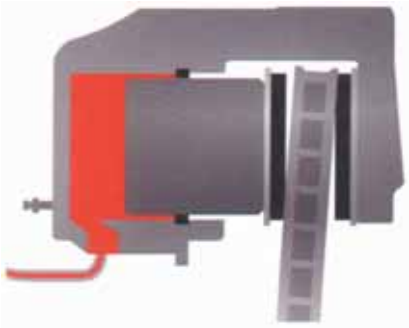
Some of the most common are seized caliper slides or pistons, or excessive wheel bearing free play.

The first problem occurs when the pins or slides of a floating caliper, or one piston in a fixed head, opposed piston caliper, become seized.

Initially this has little effect on the pedal height, but as the distance the vehicle travels goes up, and consequently the number of brake applications increases, so does the pedal travel.

In the case of the floating caliper the piston applies the inner pad first and then, because the caliper body can no longer slide, deflects disc until it contacts the outer pad.

Over time, the outer pad is worn down causing the disc to be deflected further each time before it comes in contact with the outer pad.



This naturally results in increased piston movement, making the master cylinder displace more fluid and leading to an increase in pedal travel.

With the fixed head, opposed piston caliper the problem is basically the same, except that in this case it is one of the pistons that does not move instead of the caliper body.

The result will however be the same and pedal travel will increase as the pads are worn down.

Loose wheel bearings, the second problem associated with disc brakes, causes pad knock-back and occurs when either front or rear wheel bearings have too much free play.

This allows the disc to move an excessive amount internally,

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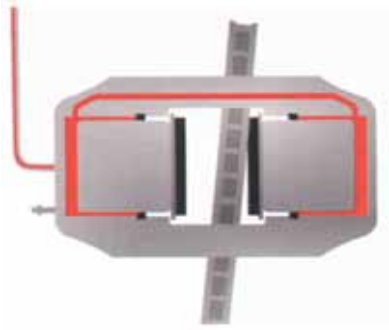
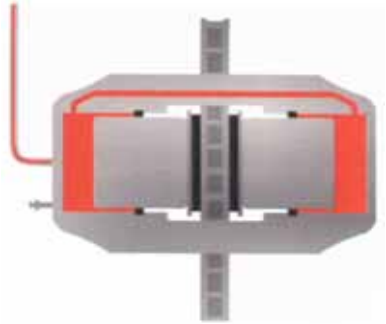
pushing the pads and pistons away from the disc.



Again we are faced with increased travel to bring the pads into full contact with the disc and again the master cylinder must displace more fluid.



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That now completes this path in the flow chart and we shall now turn our attention to the second path of the chart.

This is the path that would have been taken if, after clamping off all the flexible hoses, the brake pedal was still abnormally low.

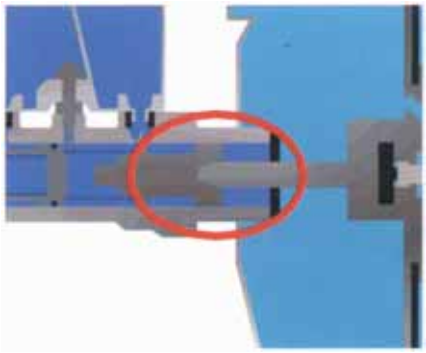
In this section we shall examine the pedal assembly, booster input rod adjustment, booster output rod adjustment, booster and master cylinder condition.

Pedals and linkage assemblies contain moving parts and like all others, are subject to wear.

Whilst new vehicles should not suffer form this problem, older vehicles which have been in service for some time should have their pedal pivot points and linkages examined for excessive movement.

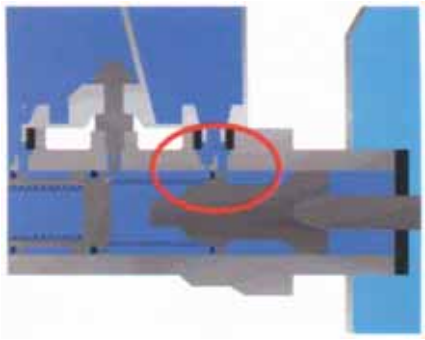
Equally as important is the adjustment of the brake pedal itself. Any additional free play in this area can lead to excessive pedal travel. When checking free play manufacturers specifications and adjustment procedures should always be followed.

Next the clearance between the booster output rod and the master cylinder primary piston should be checked.



Some boosters have adjustable output rods, while others the rod is fixed length.

All are designed to place the primary cup on the primary piston in a position that leaves the compensating port just uncovered.



Most manufacturers provide some type of gauge to measure this distance.

However, in the absence of one of these gauges, it may be possible on non fast-fill master cylinders to drain the primary reservoir, shine a light down the primary compensating port, and have an assistant note the distance the pedal is depressed,

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before the primary cup is seen crossing the compensating port.

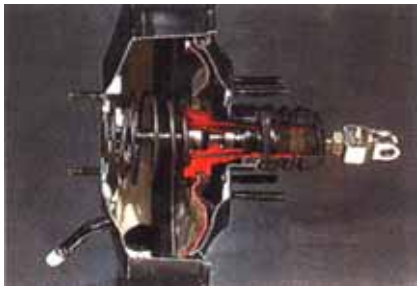
On systems where adjustment is available, manufacturers specifications should be followed.

On non adjustable systems a component mismatch, or the use of non genuine replacement parts will most likely be the cause.

Another potential problem area for adjustable and non adjustable systems is the reaction disc.

This is a small rubber disc which sit between the valve assembly and the output push rod, inside the booster.

Its job is to allow the driver to control the amount of assistance the booster provides.



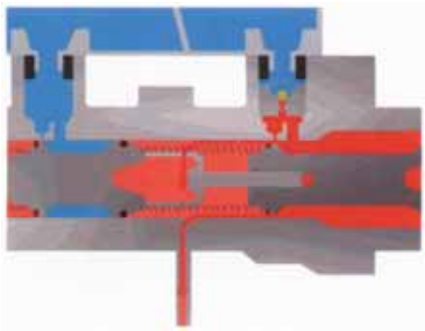
Should this disc have become dislodged and fallen into the bottom of the booster, which could happen if the master cylinder has ever been removed, the output pushrod would then move backwards, greatly increasing the distance it would have to move, and causing a corresponding increase in pedal travel. Fortunately, this problem is easy to diagnose. All that needs to happen is for the vehicle to be driven at 5 to 10kph and the brakes applied gently. If the reaction disc has fallen out, not only will the pedal be low, but the vehicle will nose dive, similar to the brakes being violently applied.

The final test in this path is the master cylinder itself.

In the interests of fuel economy, modern braking systems run greater clearances between the pads and the disc rotors, giving far less drag than earlier systems.

This has resulted in the master cylinder having to displace more fluid. To maintain correct pedal height and effort, the fast-fill master cylinder has been introduced on many current vehicles.

This master cylinder features a stepped bore on the primary circuit to initially displace a large amount of fluid and therefore maintain pedal height.



This extra displacement is controlled by the fast fill valve.

The valve opens at a pre-determined pressure and re-directs the remaining fluid from the large bore into the reservoir.

Should this valve fail in the open position all fluid from the large bore will enter the

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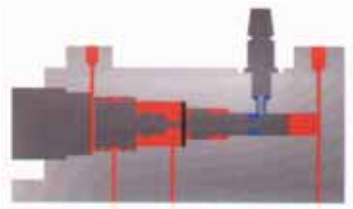
reservoir causing the brake pedal to be low.



This will be easily detectable due to the increased eruption, or turbulence, visible in the reservoir as the pedal is first depressed.

On either conventional straight bore, or fast fill master cylinders fluid may leak internally between circuits or over primary cups.

In most cases the pressure differential warning switch should sense the difference in pressures between the circuits and illuminate the brake warning light.

Both of the problems mentioned will require overhaul or replacement of the defective cylinder.

Of course no brake repair is complete without a thorough road test to check braking performance before returning the vehicle to the customer.

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