Common Brake Disc Information

Brake Disc Run Out

"Discs do not warp or run out of their own volition. When run out occurs, it is invariably caused by incorrect fitting of the disc, or inconsistencies in the calliper/piston."

When fitting or refitting discs at any time it is vital that the mating surfaces of disc and hub are scrupulously clean. The tiniest speck of rust, swarf, or dirt will cause run out after 3 - 4,000k's.
Similarly securing bolts/nuts should be torqued correctly and equally. Calliper pistons should always be checked for equal performance/movement. Sticking pistons are sure to cause distortion and poor brake performance.
All the discs we sell are carefully boxed and each box carries detailed fitting instructions and checking procedures – PLEASE READ

"Justifiable warranty claims on our discs are very rare indeed!"

Brake Disc Problems and Cures

After many years experience in selling and fitting automotive brakes, we have accumulated some interesting statistics and information about why brakes shudder. First of all, eliminate the reasons
not connected with the pad and disc combination, that cause shudder.
These are imbalanced tyres and wheels, loose steering linkages, sticking caliper sliders or hydraulics, sticking master cylinder will give rise to brake shudder.
The remaining reasons for brake judder will be down to two disc related problems, which are DISC DISTORTION or LACK OF PARALLEL.

"Disc Rotor Distortion [Run out when mounted on stub axle]"

First of all we have to assume that when the disc is mounted to the hub that it is measured with a dial gauge and runs out perfectly true for the first day of installation. This is a critical element to how long the disc will last before problems arise, far more critical that most mechanics realise. The maximum run out acceptable on a disc is 0.15MM.
If run out above this figure is detected, remove the disc clean the hub again of any rust scale or grit and rotate the disc one bolt hole and re-inspect. This procedure of checking for run out has a critical effect on other disc problems, which will be described later.

"Even torqueing of the nuts is absolutely essential. Uneven torque can twist or distort a rotor by a considerable amount and can result in disc run out and eventual thickness variation."

In today's commercial world very few manufacturers sell heat-treated discs. These discs, even if mounted and checked for run out within the above limits can

distort during use over a period of kilometres and give rise to vibration. This has an incident rate of about 1 in 140 discs sold.
It is sufficient for just one disc of the pair to become distorted before vibration is noticed.

"It is interesting to note that rear wheel brake vibrations are normally felt through the brake pedal on application of the brakes and front disc distortion is shown up as steering wheel flutter."

With certain vehicles, using "wide bank" brake pads, which have a tall profile, this design of taller pads promotes a condition of "dynamic distortions". Brake shudder is detected under heavy braking but at low speeds the shudder goes away. This is because of differential heating of the disc between the outer and inner due to the differential rubbing speeds.

The only way to avoid or minimise this problem is to use a pad with a higher thermal conductivity, i.e. a semi metallic (EBC Red grade) or EBC latest V4 (Green) brake pad with high copper content. The effect of the higher metallic content stabilises temperatures by drawing heat away from the disc, which gives rise to the fact that many German manufacturers which use these wider band pads use semi metallic pads (in spite of their huge dust problems) for original equipment.

Lack Of Parallel [Disc thickness variation]

Lack of parallelism of the brake disc occurs, when the discs are fitted with excessive run out or that generate run out, during their lifetime. Because the pad is always touching (or first touches), the disc at the highest point maximum deviation of the run out, it gradually wears the disc thinner at the point where the pad is most often contacting. This has the effect of causing a lack of parallelism (thickness variation) of the brake disc of very small dimensions, which are sufficient to show up as violent brake shudder. Again either front or rear, depending on whether the vibration is detected on the steering wheel or the brake pedal respectively. More abrasive pads will accelerate this phenomenon, such that the lack of parallel and shudder, are detected at around 1000-15000 kilometres. Less abrasive pads may prevent the shudder being detectable for up to 6000 kilometres

Lack of parallel or thickness variation will also cause one set of pads on the axle to wear faster than others and promote dust generation. The constant rubbing of the pad on the disc even at the lightest or zero pressure will cause on set of pads to be constantly heated, surface carbonisation occurs and dust is generated.

"Our findings re that there are no way of avoiding disc thickness variation and brake shudder unless rotors are mounted perfectly true to begin with."

It is sad to say, that in all the instances that we have inspected and monitored mechanics fitting brake discs, that hardly a single one bothers to clean the abutment face of the brake hub free from rust, scale and dirt adequately and that

is quite common for mechanics to allow 0.1-0.25 mm of run out to be present, when the vehicle leaves the workshop.

This is a recipe for disaster and will almost guarantee that violent brake shudder will be the outcome within a short number of miles even if, from the workshop, the shudder was not noticed (as can often be the case) due to the run out.

Conclusions

Discs must be mounted perfectly true within 0.04mm
All ancillary parts must be checked, calliper, piston, slider, wheel balance etc
Lack of disc parallel due to poor set up run out is not covered by warranty
Disc thickness variation is the major cause of brake judder
Bad initial fitting is the cause of disc thickness variation
4 & 5 cause uneven pad wear and dusting
Disc thickness variation of the smallest values has a critical effect on judder

The Importance of Correct Wheel Nut Torque

TORQUING WHEELS AND WHY IT IS SO IMPORTANT.

"Brake pedal pulsation may be caused by improper machining of disc rotors, normal wear, rust on the mounting surface or by improper torqueing of wheel nuts."

In reality, most brake pedal pulsation problems can be traced to improper torquing of wheel nuts, which distorts the disc rotor, and causes runout. Runout of .07 mm or .003 inch may cause DTV ('Disc Thickness Variation') after 5,000 to 6,000 kms on later model motor vehicles.

DTV is caused by the disc pads scalloping out the high spots on a rotor with runout, as they continue to rub along the swept surface area of the rotor, while the brakes are in the off position. Once DVT develops brake pedal pulsation will become a problem. To check for runout use a dial indicator. Also check that the rotor does not have a runout problem because of scale build up between the 'hat' section of a hubless rotor and the hub area.

"Remember it's the original torquing of the wheel nuts that caused the rotor runout that then caused the DTV that finally caused the pedal pulsation problem!"

To prevent this always, and we repeat ALWAYS, tighten the wheel nuts in a star pattern, to the correct torque specification. There are a variety of tools available to assure proper torquing of wheel nuts (always refer to the vehicle manufacturer's manual for torque specifications).

A quick and easy method of assuring that the wheel nuts are torqued correctly is by using a torque wrench that is rated for the correct amount of torque specified in the manufacturer's manual. However, it is possible to get an incorrect torque when using these torque wrenches, which is usually over torquing rather than under torquing of the wheel nuts.

This over torquing is possible if you hold your hand on the shaft of the torque wrench while applying pressure through an impact gun. By holding onto the shaft you may dampen the vibrations, changing the built-in torque limiting properties of the torque wrench.
Finally, after you have torqued the wheels correctly, be sure to explain to the vehicle owner the importance of torquing wheel nuts correctly. In most cases when the vehicle comes back to your workshop with brake pedal pulsation and you are satisfied that you have not distorted the disc rotor, you'll find the wheels have been removed since you worked on it, possibly to have tyres fitted and they have incorrectly used an impact gun and created the problem.
In cases such as this, the customer returns the vehicle to your workshop, not understanding how having the tyres fitted can create the brake pedal pulsation. It is also good customer relations to let them know how much trouble you went to so as to do the job correctly.

Brake Squeal and Other Noises

BRAKE PAD SQUEAL AND OTHER NOISE PROBLEMS

Basically the noises heard from the brake systems (assuming that the pads are not simply worn out) are dividable into two types of noise.

GRINDING SOUND and BREAK SQUEAL.

Brake squeal is a common problem and is the nightmare of all pad manufacturers. It is caused when the pad "bounces" in a calliper and the squeal noise is resonance between the back plate and the piston. The grinding noise that is sometimes heard (more frequently with semi metallic not Asbestos pads) is somewhat unnerving and sometimes tends to sound as though the pads are completely worn out. The third noise, which can come from the brake system, is after the fitting of grooved or drilled brake rotors, which can be a whirring or aeroplane type sound.

"We have found that the fixes for all of these problems are as follows;"

Applying plastic shims to the rear of the pad can dampen this, but these are expensive and to fit them on every pad where the incidence of brake squeal can be only 1 in 10 is false economy. These are however, available, as a low cost accessory item. We definitely do not recommend the use of general workshop greases, especially Copaslip on the back of brake pads as these are a friction reducing agent being applied in the area of the only part of your vehicle which is designed to produce friction – the brakes. There are however, some "paint on" anti squeal silicone/rubber based materials, which are viscous enough to stay where they are placed and are useful in reducing brake squeal.
On certain BMW and Audi calliper fitments, we have found that applying a 5mm or 1/4 inch chamfer at the front and back leading edges of the pad has the effect of completely reducing the squeal. (Many OE pads ARE chamfered in this way). This is a fix, which needs to be done by a knowledgeable workshop mechanic if the problem arises, but the measurements above should not be exceeded. As our

pads are TOTALLY ASBESTOS FREE, there is no health hazard with the dust generated bearing in mind our dimensions mentioned above are maximums and a normal dust mask is advisable.

One of the MOST PROMINENT REASONS causing brake squeal on used cars is poor disc condition. Pads will often make a noise due to vibration whilst bedding in. The worse the condition of the disc obviously the longer it takes to bed in and the longer the noise continues. Pads that have not achieved a 90% SURFACE AREA CONTACT with the disc will ALWAYS squeal.

"We have seen plenty of examples where pads just sit on a small lip on the outer and inneredge where the used disc was badly "troughed" and was not replaced or re-skimmed."

Turning or skimming of rotors is also recommended if not replacing discs as this removes the glaze and polish from the surface of the discs, which can also promote brake squeal.(Always observe the disc minimum thickness, which is in our published catalogues for safety reasons and to avoid disc overheat).

GRAUNCHING or GRINDING SOUNDS

Can be down to the material itself, happily we have had very few complaints of this on our pads. We have found that by putting a centre line groove in the pad, this can contribute to reducing this noise. We have therefore adopted a programme of centre line grooving on a large number of pads to reduce the incidence of this problem. The addition of the centre line groove also totally eliminates any pad cracking in the centre surface area of the pad where maximum heat is generated and "bulging" can occur.

BRAKE ROTOR NOISE

Created by rotors with holes or grooves, this sound is usually at its loudest when the discs are first installed and does drastically reduce after a few hundred kilometres, when the pad becomes flat and seated on the disc. This is not a warrantable situation and is normally "part of the programme" as we say and has to be accepted by customers ordering grooved and slotted discs.

SOLUTIONS WHEN NOISE OCCURS

1) Check rotor condition and "turn" or replace.
2) Allow pads to bed in properly.
3) Apply 5mm chamfer at left and right edges.
4) Use anti squeal backing if available.
5) NEVER "sand" friction material faces to eliminate noise.

Brake Fluid Information

BRAKE FLUID - What is it and why is it so important?

Brake fluid is the means by which foot pressure on the brake pedal is transferred to the brake pads and discs to slow or stop a vehicle. The brake fluid lives in a pressurized world within the master cylinder, brake hoses and brake caliper. The pressure placed on the brake pedal is transferred by the master cylinder compressing or forcing the brake fluid along the brake lines to force the brake

caliper to close the disc pads onto the disc rotor. Brake fluid is an easily neglected critical safety area of any motor vehicle. We check tyre pressure, oil levels and other fluids at regular intervals and so we should do the same with the brake fluid. Because our brake fluid operates in this pressurized world it is imperative that the fluid level should not alter. If it does, our pressurized brake system becomes unsealed and therefore its performance is reduced. Brake hoses being made of rubber; deteriorate over time, as can the rubber seals and fittings, leading to a softer brake pedal, more aggressive foot force to stop or even brake failure.

"Not only should we monitor the level of brake fluid, we should regularly replace it. "

How often? For optimum performance – annually.
Why? Brake fluid breaks down over time and absorbs water even though the system is sealed. Fresh brake fluid when new has maximum compression characteristics, but over time and uses it loses compression though changes in its composition and make up.

How is this possible in a sealed environment you ask?

One of brake fluids most important characteristics is in fact its ability to absorb water! It is designed to absorb water! Diffusion allows moisture in the air to permeate microscopic pores in the rubber brake hoses and the various seals in the hydraulic brake system. This moisture would then rot out the internals of our brake system if it wasn't absorbed by the brake fluid. In extremely cold weather it also stops this water/moisture from freezing in the brake system. This feature comes at a cost, which is, that water contaminated brake fluid reduces its performance. But brake fluid composition and therefore its effectiveness can also be altered by its working environment, because the brake system generates extreme temperatures, some of this is transferred off the disc pad and rotor into the brake caliper holding the disc pad and this heats up the brake fluid that flows within the brake caliper. To give you some idea of this in action, should your brake system have 3.7% of water trapped within its brake fluid, the boiling point level of your standard brake fluid is reduced from 205 degrees Celsius to 140 degrees Celsius a thirty percent reduction! So we now know that moisture will reduce the effective boiling point by almost 1/3. There are many different types of brake fluids with many differing effective temperature ratings to handle this event.

So apart from changing my brake fluid regularly should we look to upgrade the fluid to one of these with a higher/greater temperature tolerance?

The rating of the fluid your car was delivered with should be maintained unless you upgrade the internal components to handle this upgrade. All seals, brake hoses and fittings are designed and tested relevant to the chemical composition of the brake fluid to be used. Simply replacing with a higher grade brake fluid (replacing Dot3 with dot 4 for instance) gives rise to the impact the slightly different composition (the borate ester) might have on your braking system. The viscosity difference (thickness) can effect the wear rates on seals etc and cause squeaks to develop. So it's best to stay with the same brake fluid type, but maybe

go for a higher operating range within the same dot fluid, rather than jump up to a higher dot rated fluid.

What do the various ratings of brake fluid mean?

There are three main classifications of brake fluids which are known as “Dot 3, Dot 4 and Dot 5” The Dot stands for Department Of Transport and is an American based standard and runs to 14 different requirements, both physical composition and operating, under which each must be made. The most important is the measurement of its boiling point characteristics and these are measured within two ranges, being its dry boiling point and its wet boiling point. Dry boiling point is the point at which the fluid boils when first used out of the bottle and wet boiling Point is a measurement based on 3.7% water absorption in the brake fluid and at what point it starts to boil. As we know from above, water is absorbed into the brake fluid by design and it traps a lot of heat from the brake operation. These two events alter the effectiveness of the brake fluid and the minimum operating temperatures as described by the Department Of Transport regulations ensure the fluid is still capable of functioning safely.

DOT 3 - Usually glycol ether based with a minimum dry boiling point of 205 degrees Celsius and a minimum wet boiling point of 140 degrees Celsius (with 3.7% water content as discussed above).

DOT 4 - Also glycol ether based with a touch of borate esters to increase it’s immunity to water absorption. Dot4 must have a minimum of 230 degrees Celsius dry and 197 degrees Celsius wet.

DOT 5 - Silicone based and must have a minimum boiling point of 265 degrees Celsius dry and 180 degrees wet. Being silicone based this type of fluid flows more easily through the pressurized braking system Giving greater braking performance and thereby reducing heat build up. The disadvantage is that by it’s nature being more compressible it allows more room for air to be present within the fluid (air becomes trapped within its molecular structure).

There is a fourth classification of brake fluid being DOT 5.1. Recent innovations has lead to the development of a Glycol ether based fluid that now meets the characteristics as required under the industry standard DOT 5. It has the same dry and wet minimum boiling points and is basically DOT 4 fluids with higher boiling points. Also being Glycol ether based it doesn’t share the negative feature of silicone based fluids or dot 5, as air is not trapped within the silicone. These are also known within the industry, sometimes, as dot 4 plus.

DOT 5.1 is therefore the best of the best but it comes at a cost differential to DOT 3, 4 & 5 fluids.

Why should I buy brake fluid in small containers and not in bulk like engine oil?

Buying brake fluid in small containers and not using leftovers is paramount to having a safe and Effective braking system as once opened, the contents are drawing moisture and air and losing its compression and therefore its optimum performance characteristics, the same as if sealed within your hydraulic braking system as described above.

Bleeding your brake system.

This is the method by which fluid is replaced within the pressurized brake system and air is eliminated. Replacing all the brake fluid throughout the lines, cylinders and calipers must be undertaken with extreme care as any trapped air

will decrease significantly the operating performance. The objective here is to obtain an air-free brake system.

Performance and racing / summary.

There is not a brake fluid available that will allow you to run indefinitely without periodic changing or bleeding. When racing or doing laps the brake fluid should be replaced both before and after the days racing (each event would be better) and using a cool down lap before stopping, will assist greatly in preventing boiling, as it will avoid the heat soak when the airflow stops. The brake fluids job is to provide you with a consistent stable performance and regular bleeding and replacement, will ensure optimum operating performance and eliminate the possibility of brake failure, when you need your brakes the most- that all important emergency or hard braking situation.

Bedding in of Pads and Rotors

BEDDING IN OF PADS AND ROTORS

When a vehicle has had both new rotors and/or just new pads fitted, there are two processes or objectives, to getting the brake system to operate at optimal performance. The first step is to make sure the disc face is clean of all oils/anti rust or any foreign matter like previous brake pad material. If the rotors are not being replaced then it is imperative that the disc is machined prior to the fitment of new pads- without exception.

The second step is heating (not cooking) the brake rotor and pads, to transfer the pad material evenly, onto the rotor face. This step involves performing a series of stops, so that the brake rotor and pad are heated steadily, to allow the transfer of pad material onto the brake rotor friction surface. The friction surface should be clear of all oils which are used to stop the rotor from rusting before being fitted to the motor vehicle.

Whilst these will be burnt off, they risk transferring and possibly polluting the brake pad material and will definitely lead to a longer bedding in process.

Whilst performing a series of brake applications to transfer the pad material, care should be taken to not come to a complete stop, as this can lead to the transfer of pad material unevenly on the disc at the point where the pad comes to rest on the friction surface.

Standard road going vehicles; - from zero degrees to 450 degrees Celsius.

A typical program of 8-9 brake applications, from 60km down to 10km p/hour, without any cool down in between would be sufficient.

Performance pads on road going vehicles; - from zero degrees to 700 degrees Celsius.

For performance pad materials, a further two sequences of ten stops will be required after a cooling down period between each cycle, to ensure that the pads have reached the required higher operating temperature to allow for the pad material to transfer effectively.

"Please also note that due to the increased brake force generated by performance pads, it is essential that all slides and sides of pads that may come into contact with the caliper body, be greased with graphite paste like "Permatex nickel anti-seize" and we also recommend the fitment of brake shims. Performance pads on track and club use vehicles; - from 150 degrees to 900 degrees Celsius."

For race type material pads, we recommend the same 2 cycles of ten brake applications from 60km down to 10km as for performance pads, followed by 4 sharp brake applications from 140km down to 80km, to ensure the pad material has reached optimal operating temperature and therefore material has transferred onto the brake disc - proper bedding in, will reveal a discoloration on the pad edge where it comes into contact with the disc rotor face, as if it has been overheated (appx 2mm band).

Applicable to all applications and uses.

At all times during the bedding in process, care should be taken to not apply the brakes in a harsh manner or decelerate from high speeds, as this will corrupt the transfer of materials and lead to uneven material build up on the rotor surface, which in most instances will require machining to regain a flat rotor surface for optimal operation. (Disc thickness vibration-DTV-which leads to brake judder or vibration).

How will I know if they are bedded in?

The two major visual indicators are disc rotor discoloration and machining marks on the friction surface of the disc rotor.

1) Disc rotor should have a slight bluish tint with a grey tint that indicates where the brake pads have come into contact with the rotor. Too much heat will cause the rotor face to be extremely blue and has been overcooked in the bedding in process.

2) If there is still a shine on the rotor surface, then not enough pad material, has been transferred.

Once brakes have been bedded in, it is also important, to keep them that way. If any brake pad is used below its adherent operating temperature over a period of time it will slowly remove the transfer layer on the rotor surface. Standard and especially performance pads, like to be driven a little more aggressively every now and then to maintain this pad material, on the rotor friction surface. Similar in effect to taking a city based car on a country run every now and then and noticing the change in the exhaust tail pipe color, go from black to grey as it operates at a different temperature, to what it has become accustomed.

Passive use of brakes over an extended period of time will in effect lead to "unbedded brakes".

Common Problems in Ford Fitting

ProServ® AUTO PARTS RDA EBC BRAKES

COMMON PROBLEMS FOUND IN FITTING NEW DISC ROTORS OR BRAKE PADS TO FORD

FALCONS, FAIRLANES AND LTD'S WITH ABS BRAKING SYSTEMS.

When fitting to Ford Falcons, Fairlanes and LTD's with an ABS braking system, at all times a measurement should be made of the abs sensor ring positioning, as it can move during shipping and transport. Whilst extreme care is taken in the manufacturing process, the sensor ring is subject to movement through jarring and transport and if the sensor ring has moved from its correct positioning, the abs light will remain on and brake sensation will be reduced.
The correct depths for confirming measurement are as follows;-

Ford EA-ED model FALCON/DA-DC LTD'S/NC FAIRLANE with ABS (RDA 130 PART NUMBER), the top of the abs sensor ring (outer part of the sensor ring where the slots are is the correct measuring face) should be located at a depth of 5.80mm EXACTLY from the top of the inner bearing cup.

Ford EF-EL model FALCON/NF-NL FAIRLANE/DF-DL LTD'S with ABS (RDA 132 PART NUMBER), the depth of the sensor ring should be 9.64mm EXACTLY from the top of the inner bearing cup..

IMPORTANT WARNING!

Due to the minimal tolerance & precise measurement required for fitting it is company policy that we do not provide any guarantee or warranty unless these particular part number applications are fitted by qualified mechanics or engineers and all fitting instructions have been dutifully followed at all times.

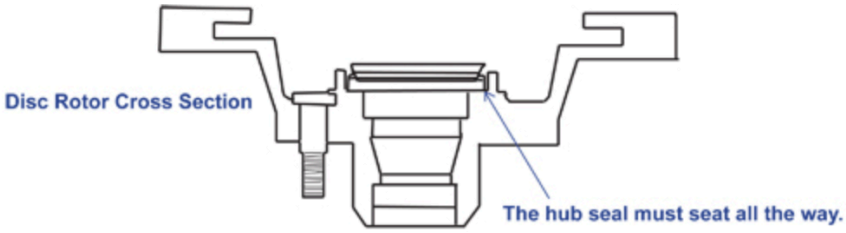
Preventing Disc Thickness Variation (DTV) on FORD EB to EL Falcons

One of the most common problems encountered today is brake pedal pulsation and/or brake shudder in EB to EL model Ford Falcons. This is due to Disc Thickness Variation (DTV). As little as 15 microns of DTV will cause this problem, which may not be apparent until the vehicle has travelled between 6000 and 8000 kilometres, after new pads have been fitted. During this time, while the brakes are in the off position, the pads continue to rub along the face of the rotor scalloping out high spots. The more aggressive the pad material the worse the problem becomes.
Consider that there are 27 microns to one thousandth of an inch and you can realise that this becomes very difficult to measure. Running a dial indicator over the face of the disc will not read DTV but by measuring with a micrometer over eight different places along the face of the disc this will indicate if DTV is present. To rectify the problem you may machine the rotor, if it remains within the scrap tolerance, or replace the rotor, but to prevent DTV returning, there are several important service procedures that must be adhered to:

FRONT HUB SEAL POSITION PLEASE TAKE IN LINE DRAWING

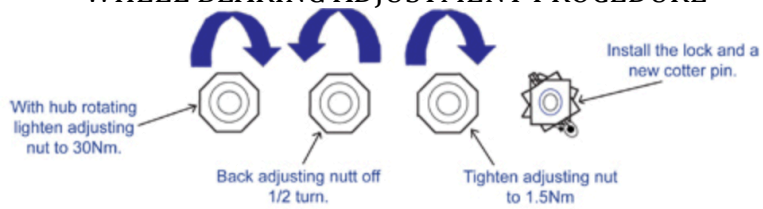
For long term performance of disc rotors to suit Ford models:

EA - EL, DA - DL, NA - NL it is recommended to follow these fitment procedures.
BEARING SEAL ASSEMBLY



Ensure the bearing seal is pressed completely into the recess.
This allows for true torque adjustment.
The seal must be inserted all the way to the bottom of the bore (refer to diagram). (DTV Pic 1) If it does not go all the way in, when attempting to adjust the bearings, the seal presses against the end of the stub axle and therefore you cannot adjust the bearing correctly. Because of the design of the rotor, it tends to lean over towards the hub and if the bearings are not adjusted correctly and built-in run-out will occur.

WHEEL BEARING ADJUSTMENT PROCEDURE



PLEASE TAKE IN LINE DRAWING
It is important to follow the correct bearing adjustment procedure as specified in the Ford Repair Manual

1. Remove the wheel where necessary.
2. Pry off the hub dust cap.
3. Remove the split pin and nut retainer.
4. Loosen the bearing-adjusting nut three turns. Then, rock the wheel/hub and disc in and out several times to push the brake pads away from the disc.
5. While rotating the wheel/hub torque the adjusting nut to 30 Nm to seat the bearings (step 1. in diagram).
6. Loosen the adjusting nut on-half turn then re-tighten the nut to 1.5 Nm (steps 2 & 3. in diagram).
7. Selectively position the nut retainer on the adjusting nut so that a set of slots lines up with the hole in the spindle (step 4 in diagram).
8. Lock the adjusting nut and nut retainer with a new split pin (step 4. In diagram).
9. Check the wheel/hub rotation. If the bearings rotate properly, install the hub dust cap. Install the wheel if necessary. If the bearings are rough or noisy in operation, clean or replace the bearing assemblies as required.
10. Lower the vehicle.
11. Before driving the vehicle, pump the brake pedal several times to obtain normal brake lining to disc clearance to restore normal brake pedal travel.

Common Problems in Holden VT fitting

VT COMMODORE BRAKE SHUDDER

There has been some concern regarding brake shudder on VT Commodores. Some of the problems could be associated with the front hubs. The front hubs need to be checked for end float.

The following procedure should be practiced, as stated in the manual.

1. After removing wheel, temporarily reinstall three, reversed wheel nuts with a flat washer under each to prevent damage to the nut thread.
2. Mount a dial indicator to a suitable magnetic stand and attach to the front strut tube. Position the dial indicator pointer at the outer diameter of the disc, as shown in drawing.
3. Apply an outward, 10kg (22lb) force to the outer brake disc diameter, in an opposite direction to the dial indicator. To maintain consistency a spring balance capable of measuring this force, must be used. With this force applied zero the dial indicator.
4. Apply an inward, 10kg (22lb) force to the outer brake disc diameter and note the dial indicator reading.
5. The reading obtained is the angular movement, (not end float); to determine the bearing's serviceability, compare the measured result with the following specifications.

WHEEL BEARING ANGULAR FLOAT SPECIFICATION

NEW BEARING 0.106mm (0.0042") MAXIMUM

USED BEARING 0.213 mm (0.0085") MAXIMUM

6. Should the inspection show that the wheel bearing assembly is outside the specified, angular float dimension, and then the hub must be replaced.

WORN HUBS, CAUSE ROTOR RUN OUT, RESULTING IN DTV

Special care should be taken when machining these discs. Minimum run out should be achieved. After machining discs, index the rotors to the hub, to achieve minimum run out.

MAXIMUM LATERAL RUN OUT (front discs) .040mm

When tightening wheel nuts the torque specification is 100 – 125 Nm Avoid over tightening with rattle guns.

UPDATE Bedding In

BEDDING IN OF PADS UPDATE

Whilst we covered most items in Bulletin 5 regarding the bedding in of brake pads and rotors, we are still seeing a reluctance of fitters to change their old methods of brake pad bedding in methods. Customer complaints of brake squeal

are subsiding due to improved brake pad materials with sophisticated formulations, built-in shims, chamfering of the pad face and brake in coatings. Fitters have adjusted to these changes as well and have followed good practice of cleaning the disc face in most instances.

"One area we are still seeing some reluctance, to change from the old ways, is in the bedding in procedure."

Some fitters believe the best way to bed in brake linings is to apply the brakes heavily a few times to the point of an emergency stop. This is a left over from the past, whereby pads where made in a "green state" and needed the gases burnt out of the pad material, thereby curing the compound. Nearly all modern manufacturers have cured pads in the box, whereby the gases have been burnt off already and the old method of bedding-in, only causes the pad material to glaze up, leading to customer complaints of brake noise and hard pedal feel.

An exhaustive review of recent warranty claims, has shown that this, is the single main cause of product problems and the education of all is a long term plan, that needs to be accelerated to the improvement of all involved in the friction industry.

Over the past 5 years there have been more product development and changes in brake pad material than in the previous 50 years of motoring and common sense tells us all that fitters need to take on board these technology changes and embrace new methods.

The removal of asbestos as an ingredient in brake material, has been the main driver of all the recent material changes and development and the importance of changing the bedding-in procedure to allow for this, cannot be understated.

Our recommended bedding in method as shown on our boxes and fitting sheets is as follows again;-

When a vehicle has had both new rotors and/or just new pads fitted, there are two processes or objectives, to getting the brake system to operate at optimal performance.

The first step is to make sure the disc face is clean of all oils/anti rust or any foreign matter like previous brake pad material. If the rotors are not being replaced, then it is imperative that the disc is machined, prior to the fitment of new pads- without exception.

The second step is heating (not cooking) the brake rotor and pads, to transfer the pad material evenly, onto the rotor face.

This step involves performing a series of stops, so that the brake rotor and pad are heated steadily, to allow the transfer of pad material onto the brake rotor friction surface. The friction surface should be clear of all oils, which are used to stop the rotor from rusting, before being fitted to the motor vehicle. Whilst these will be burnt off, they risk transferring and possibly polluting the brake pad material and will definitely lead to a longer bedding-in process. Whilst performing a series of brake applications to transfer the pad material, care should be taken to not come to a complete stop, as this can lead to the transfer of pad material unevenly on the disc at the point where the pad comes to rest on the friction surface.

A typical program of 8-9 brake applications, from 60km down to 10km p/hour, without any cool down in between would be sufficient.

For performance pad materials, a further two sequences of ten stops will be required after a cooling down period between each cycle, to ensure that the pads have reached the required higher operating temperature to allow for the pad material to transfer effectively.

At all times during the bedding in process, care should be taken to not apply the brakes in a harsh manner or decelerate from high speeds, as this will corrupt the transfer of materials and lead to uneven material build up on the rotor surface, which in most instances will require machining to regain a flat rotor surface for optimal operation

Brake Pad Squeal and other noises update

Why does brake squeal happen on different cars at different times, with different brake pad material, but not consistently across the range of make/model or brake pad brand?

Over the years we have all been well drilled that brake noise is directly linked to pad movement in the caliper. There are many possible causes for this including;- brake rotor surface roughness (regardless new or machined rotors), flexing of the caliper, caliper requiring overhaul, shock absorbers and bushes worn in front end, alloy mounting brackets expanding/contracting in heating and cooling cycles and the development of more rigid materials in the manufacture of pads.

Disc brake quiet, copper paste, various other sprays and shims have been produced to try and rectify this problem. In the past 20 years caliper designers, not pad manufacturers, have been changing the designs and material callipers and their brackets are made off, how pads are located in calipers. The only reason these changes are being continually advanced is to stop brake pad movement within the caliper body.

A bit of history-

Thirty (30) years ago calipers were designed, so the pad manufacturers had wire spring or clip set-ups on the pad, to absorb vibration or movement.

Twenty (20) years ago designs were changed so the bracket located around weird shaped “ears” or “lugs” of the pad, rather than just square lugs that slide, as the pad wore down.

In the last 10 years, caliper designers have taken this one step further by adding spring steel locating shims or clips to their bracket design, these for the most part aren’t manufactured by or sold with the replacement pad (regardless of the brand).

The spring tension that these locating shims or clips originally had, has been reduced or even eliminated over time thru use, heat cycles and general wear and tear.

In fitting replacement pads regardless of whether brake discs have been removed and machined, replaced with new brake rotors or even left as they are, the locating shims /clips need to be re-tensioned to enable them to do their job of stopping the brake pad from moving in the caliper.

There are two ways of doing this, removing the caliper body or removing the caliper body and bracket. Just as important as pushing the piston back, regreasing slides or cleaning muck away from where the pad slides, servicing the spring steel locating shims/clips by re-tensioning same is a must.
In the life of the worn out pads being replaced (well bedded in and cured over time) these spring steel locating shims/clips have been heated up and cooled down thousands of times over as many as 2-4 years, so when removing the old pads these clips usually stay in the bracket stuck in place (bedded or bent in the shape of the bracket) offering no tension.
These spring steel locating shims/clips were designed to take up the gap between the locating ears or lugs and the bracket guides thru the use of tension, to limit pad movement.

The three main scenarios of brake noise being;-

Light pedal application over the longer distance.
Short abrupt braking, causing the transfer of weight, to the front wheels.
"Graunch" or metal on metal sound, over the last 2-5 metres of braking.
In all three cases it has become more common in recent years, due to brake pad material moving away from carbon or organic fibre content (which absorbed a lot of friction and therefore noise) to more metallic based products (due to legislation & technology to handle faster cars and higher temperatures being reached) that brake noise is on the increase.
In the first two symptoms of brake noise above, by bending/replacing the spring/clip tension you will reduce pad movement hence eliminating friction noise.
There are many different types of these spring steel locating shims/clips, but if you take the time to understand how each of these are designed to work and fiddle around with correcting them (re-tensioning) back to how they would have been originally, then your professionalism and thoroughness will show dividends.
In the third symptom, it is the pad which hasn't reached it's optimum working temperature to work efficiently, or indeed if the drivers driving style, type of car and pad compound chosen is not a suitable match (If one or two of these were different, the outcome would also be quite different).
Because pad manufacturers are moving to more and more semi metal, full metal and ceramic based materials to deal with faster cars and customer safety expectations, caliper maintenance (slides, clips, shims, piston overhaul) is an area that is requiring greater importance. Most of the focus has been on the bedding in of brake pad material to the brake discs (which is still very important) but as explained above, re-tensioning of the spring steel shims/clips, will also ensure a professional job is achieved and customer satisfaction is assured.

When Changing Brake Pads

Although it is possibly the most important (safety wise) and most frequently used application in getting from A to B, a driver will and should notice the slightest change to their driving comfort and vehicle performance with their brakes.

Unfortunately as any reduction in performance is often gradual, the change becomes more noticeable often only in an emergency situation, or when a component gives out it's own warning signs of pending failure.

Unfortunately in Australia anybody can work on a braking system. As brake repair specialists, we need to understand and spend a lot more time, in giving a professional and safe service to our customers.
The most misunderstood complaint from the person behind the wheel when operating under brakes is "steering wheel shimmy or shudder" through the car.
The two most common reasons/causes of this are:
1.Brake Rotors Warping
2.Brake Pad Material Build Up.

BRAKE ROTORS WARPING

If on the first couple of brake applications during road test, shudder or shimmy is experienced, then there can only be a few reasons/causes:
A) Something is lodged between hub and rotor, ie dislodged surface rust or foreign substance is stopping the rotor and hub sitting "true" to each other.
B) The Brake Rotor has been machined during manufacture incorrectly or damaged during transport prior to fitment, (highly unlikely it will be both).
lf the road test is good with no shudder or shimmy and that appears at a later date, then there is only one way this issue can be caused = heat.
The misconception here is we are not referring to just excessive heat, but too greater change in heat, from moderate/high down to cold, (river crossings and car washing etc).
Braking involves friction between the brake pads and rotors. When the friction is excessive, so is the heat. Average around town driving will not create excessive heat, even in the early days of bedding in, but braking for sustained periods will. A small or average hill will not cause issue, but coming down a mountain or lesser hill with a trailer certainly will. Riding the brakes for long periods of time will cause considerable heat build up. Sustained braking in these circumstances will cause the rotor material and pad material to get very hot and with that, softer, than at a lower operating temperature. If at the end of this braking, you are at a complete stop with brakes applied, the majority of the rotor is cooling at a quicker rate than that section of the brake rotor that is squeezed between the hot brake pads under hydraulic pressure.

BRAKE PAD MATERIAL BUILD-UP

The least understood, but most common cause for experiencing brake shudder or shimmy, is due to the build-up of brake material on the brake rotor face. Transferring pad material onto the rotor face is an important part of bedding in

the pad and rotor faces, to ensure optimum performance, over the life of the brake components. Poor bedding in, or not bedding the material surfaces to each other at all, will lead to greater driver dissatisfaction. We are all well aware of the importance of not having finger prints or grease on the rotor surface, as it creates high spots, which is a build-up of material due to one area reaching higher temperatures than the material around it.

Many drivers overheat their brakes without even knowing it.

In fact you can overheat standard pads and rotors without ever feeling brake fade. Long gradual stopping, hill descents, and general bad driving habits are all causes of overheating.

When brake pads reach temperatures outside of their designed operating temperature range (this is the same for performance & standard pads) the compounds they are comprised of, act unpredictably by depositing themselves onto brake rotor surfaces, unevenly.

Example;- good driver (person who doesn't abuse their brakes) but due to brakes recently being changed is; driving on a multiple lane road 80 kms limit in moderate traffic, braking lightly well before traffic comes to a stop, (reading the lights well ahead). Once the pads contact the rotors with initial braking pressure, temperatures begin to rise. The gradual even braking is applying heat to the system causing the heat to keep increasing. By the time you get to a full stop, odds are that there has been no lift from the brake pedal or, at least not for long and heat has been maintained in the rotors over the entire time. The brakes are now very hot and border-line overheating.

Now at a stop, your foot is holding the hot pads in one place with pressure and most drivers use more pressure when stationary, than is required. Now with everything high in temperature and in constant contact, brake pad material is transferring to one spot on the rotor surface. If this continues, that area is heating up quicker and quicker, as the uneven pad material is increasing and eventually a shudder will develop. If stationary for an extended time or parked, explained earlier warping will occur and shudder (shimmy) will appear on the next braking application, in the front end of the vehicle.

A correct bedding in procedure is under valued by many repairers (some think it is a waste of time), but if done correctly, it will eliminate these issues and complete a professional brake and rotor service .All brake pads must be bedded-in with the rotor they will be used against to maximize brake performance. The bedding-in process involves a gradual build up of heat in the rotors and pad compound. This process will lay down a thin layer of transfer film onto the brake rotor surface. See technical bulletins 5 & 8 on our website for the correct and recommended bedding in procedure. When bedding in a car try and do it without stopping completely or braking longer than a 3-5 seconds, allow a non braking period between applications for cooling, and before parking at conclusion drive for a longer time without braking, to maximise cooling before brake components become stationary.

In summary when installing new brake rotors and brake pads:

When installing new pads, the rotors should be new or at least resurfaced to remove any transfer film from the previous set of brake pads.

If not, incompatible brake materials will cause an uneven build up of material and can cause glazing of pad and rotor, leading to poor stopping performance and brake shudder (shimmy).

It is critical that the installer clean any rust, scale, or debris from the hub mounting surface thoroughly and clean all preservatives from the rotor itself.

Brake Pad Selection Guide

		Vehicle Type				
Vehicle Use	**Brake Pad Options**	**Small**	**Medium**	**Large**	**SUV**	**Vans / Utilities / 4WD & Commercial**
Light Duty (avg. to moderate braking / light to moderate loads)	RDA Branded	GP MAX	GP MAX	GP MAX	GP MAX EXTREME	EXTREME
	Premium Upgrade	ULTIMAX	ULTIMAX	ULTIMAX	ULTIMAX	ULTIMAX
Medium Duty (More frequent braking & hills / light towing)	RDA Branded	GP MAX	GP MAX	GP MAX	EXTREME	EXTREME
	Premium Upgrade	ULTIMAX	ULTIMAX	ULTIMAX	ULTIMAX	ULTIMAX
Heavy Duty (frequent braking & hills / regular load carrying & towing)	RDA Branded	EXTREME	EXTREME	EXTREME	EXTREME	EXTREME
	Premium Upgrade	ULTIMAX	ULTIMAX	ULTIMAX	ULTIMAX	ULTIMAX ULTIMAX carbon

THIS IS A GUIDE ONLY and some situations may fall outside the scope of this guide, including:

. Road/Track Performance users may need to consider the EBC Performance Range.

. Larger Van & Commercial applications that consistently operate heavily laden and in demanding braking situations may need to consider EBC Carbon (Look for the DPC prefix).