

## Suspension Bushes and the Effects of Maintaining Correct Wheel Alignment

The role played by suspension bushes in locating and aligning other suspension components is very important. The following information will assist you in selecting the most suitable bush to achieve the maximum effect for the car.

Bushes, in most cases are a locating device and as such, when they deteriorate they allow for the control arms and trailing arms to move. This effects the alignment of the suspension and wheels. This is why Pedders stress the importance of checking bushes properly when conducting an undercar steering and suspension check. Bushes absorb road shocks and accurately locate components, while allowing them to move in the directions they were designed to move. A bush must therefore be able to compress, to a certain degree, and then return to its original position. If a bush is too hard, too soft, or damaged in any way, the ride, handling and steering geometry will be compromised, also there may be an issue with vehicle safety.

One way to understand the importance of a bush being in good condition and having the right elasticity or compressibility, is by considering the setting of the toe angle. As you know, most vehicles are given toe in, this is a "static" setting for a "dynamic" situation. This is to allow for the change in alignment angles produced by the motion of the vehicle. When a vehicle is in motion, or 'rolling', the front-end bushes compress, allowing the wheels to become exactly parallel, i.e. the angle changes from toe in to zero.

If a bush is too soft, or is damaged, the correct rolling toe angle will not be achieved, resulting in steering mis-alignment and rapid tyre wear. The rear suspension bushes are just as important. For example, a worn bush on a trailing arm, live axle type of suspension will cause mis-alignment of the final drive housing, which in turn produces rear wheel steering, causing the car to pull or drift and as a consequence, increase the rate of tyre wear.

To correctly diagnose bush wear, we must first understand the different type of bushes:

## COMPRESSION BUSHES (RADIUS/STRUT ROD BUSHES)

Compression bushes bear load in two directions on the same axis, e.g. caster rod bushes (backward and forward load) and shock pin bushes (up and down load). While these bushes are new they have equal amounts of rubber with equal pressures which centrally locate the component.

Rubber is a very resilient material and has a 'memory', i.e. it will return to its original position when in good condition, but after repeated cycles of compression during normal operation, they become work-hardened and permanently deformed, losing the ability to return to their original shape and position.

A classic example of bushes which are over looked in servicing, are the strut/radius rod bushing. Symptoms of bad strut rod bushing are often mistaken for brake trouble. This is because, when the car is under braking, the load placed on the bush is extreme and it will compress, allowing the wheel to move rearwards and if the bush is in inferior condition, this can effect the wheel base and cause the car to "pull" under brakes.

Soft strut rod bushes can also cause steering pull during normal driving as toe and caster angles are "loose". If the bushes allow the caster angles to decrease, the vehicle will have vague steering. If the bush is distorted, the control arm can vibrate and thump against the chassis.

If the car still pulls under braking, inspect these bushes. One easy way to spot a bad strut bush is to look for a tell-tale shiny or polished area on the frame around the bush. Look also for cracks, distortion or gaps between the bush and the frame.



## TORSIONAL BUSHES

Torsional bushes are the type that allow a component to twist or move through an arc. Not only are they a pivot for the suspension, they are also an insulator which absorbs vibration, noise and shocks. When the bush is new, the 'ferrule' or centre tube is in the centre of the bush with equal pressure from the rubber in all directions. This maintains the central location of the ferrule. As the bush wears and is subjected to load, the ferrule can be forced off-centre. When this happens the rubber 'flows' around the ferrule creating unequal pressures. This allows the bush to move more easily in the direction that is carrying the most load, causing changes in 'rolling' alignment and tyre wear.

Some torsional bushes have the rubber bonded to the metal surfaces. This allows the rubber to 'torque' or twist with normal suspension movement. As the bush wears and is subjected to load, this bonding can break or the rubber itself can split open between the two cases. This causes excessive movement of the bush and prevents its natural 'torquing' action. The bush must be replaced.



## VOIDED BUSHES

Voided, or Noise-Vibration-Harshness (N.V.H.) bushes, as they are otherwise known, are usually of the torsional variety, but are designed with voids or air holes in the rubber. They are designed to absorb noise, vibration and harshness, to prevent it being transmitted to the vehicle body. The important thing to remember when fitting most voided bushes is that they need to be 'timed', i.e. to have the voids correctly aligned. Normal procedure is to fit the bush with the voids in line with the arm, to absorb N.V.H. as it travels up the arm.

There are exceptions to this and for that matter, the bush may be incorrectly timed by a previous fitter. If in doubt contact your nearest Pedders store or vehicle dealer for information.



## INSPECTING BUSHES

Whenever inspecting or repairing suspension and steering, and also when diagnosing related noises, rattles or bumps, you should always conduct a comprehensive inspection of all bushes.

Commence with a visual inspection, looking for splits, tears, cracks, off-centre ferrules, oil soaked bushes, and general decay. If a bush looks bad, it is.

Where bushes appear worn or damaged or misaligned, follow the visual with a manual inspection. Use a suitable lever to flex the bush or component to expose the bush surface for further visual inspection and feel for excessive looseness or play.

Finally, there are three basic tests which should expose any weakness in bushings.

### 1. Dry Park Check

The Dry Park Check is the most effective way to check steering components for wear. It is carried out while the vehicle is at its static ride height, simply by rocking the steering wheel from left to right. This loads the steering gear in the same way as motion of the vehicle, while keeping all components in their normal ride height position.

**WARNING :** When doing a dry park check on vehicles with power steering, it is advisable to have the ignition "on" for Electric Power Steering or the engine running for Hydraulic power steering assistance, this will guard against possible damage to the steering gear.

## 2. Roll Back Check

A roll back check is for rear wheel drive vehicles with live axle and trailing arm suspension. It is not suitable for front-wheel drive vehicles or those with independent rear suspension.

A roll back check is carried out simply by locking the tail shaft. This is done by placing the vehicle in PARK if automatic, or in first gear if manual. Leave the handbrake OFF and ensure the ignition is turned off, then use a rear wheel to rock the car back and forth while an assistant checks the suspension bushes.

The roll back check loads the rear axle in the same way as acceleration or braking, causing it to push and pull on the trailing arm bushes and expose any weakness or failure in the bushings.

## 3. Brake Reaction Bush Check (Radius Arm Bush)

This operation takes the involvement of two technicians, one undertaking the test and the other observing.

Have the first technician drive the car at walking pace in the work shop, Apply the brakes in short sharp "Dabs". While this is happening, the second technician observes for any major rearward movement of the wheel. If it's significant, then there is a good chance the bushes have deteriorated to the extent that they are no longer survivable and need to be replaced.

This test can also be replicated with the vehicle travelling backwards, applying the same procedure. It is worth noting, that observation of the rear suspension is worthwhile as well, because anywhere there are bushes, there is a possibility of movement.

## SELECTING THE CORRECT BUSH FOR THE APPLICATION

You would be forgiven for thinking that there are just two options in bush material, rubber or Polyurethane. However, in catering for the needs of virtually all vehicles on the road in Australia, Pedders has identified the clear need for no less than three different types of bushing material.

### 1. Standard Rubber

The most commonly used material in general applications where a soft, compliant bush action is required and where resistance to contaminants such as oil and grease is not a priority. Standard rubber is most effective in reducing noise and vibration, but less effective in providing component rigidity.

### 2. Heavy Duty Rubber

Heavy Duty rubber is usually a synthetic rubber material which is more resistant to contaminants than standard rubber and is chosen for applications with higher loads and requiring more durability.

### 3. Polyurethane

For precise mounting of components, where a hard and stable action is required at the expense of comfort, noise and vibration. Most suited for performance motoring, heavy duty load carrying and resistance to contaminants.

## When Fitting Bushes, Remember

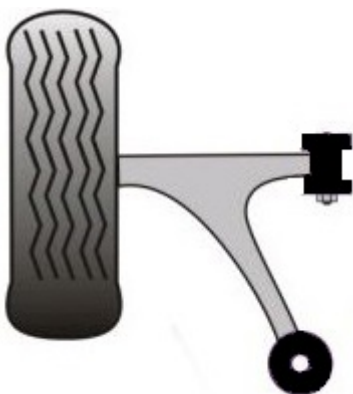
1. Correctly 'time' voided bushes.
2. Tighten mounting bolts at normal ride height.
3. Check for tapered case type bushes.
4. Ensure locating 'tits' on compression type bushes are facing the right way and are located in the hole before tightening.
5. Do not apply grease or oil to rubber bushes (Mineral based lubricants are the enemy of rubber).
6. When lubricating Polyurethane bushes, using the correct lubricant, only lubricate the rotating, such as a ferrule or sleeve.
7. Do not over tighten compression bushes.
8. Do not tack weld press fit bushes (heat will destroy the bonding).
9. Do not use spacers to increase compression on the bush, too much compression will split the bush.

## The Effect on the Wheel Alignment

When bushes experience wear, the arms they are a part of, are now allowed to move. This movement directly relates to the position of the wheels, if they are not in the same position as they were when the car had it's last wheel alignment, then it is a sure bet that the wheels are no longer set to the correct alignment.

This will allow for premature wear of the tyres. If any movement beyond what is expected of a bush and any movement is detected in a ball joint, it is recommended that the offending component be replaced A.S.A.P.

Movement in bushes can equate to massive Camber and/or Toe changes, 2mm can alter the toe setting by as much as 10mm, this is not good for steering stability or tyre wear. The same situation may occur in the rear suspension as well, when a bush wears in the arms it will allow for a change of position of the wheel, whether it be an I.R.S. or a live axle fitted with trailing arms. It is very possible the car will develop "Rear Wheel" steer. One of the symptoms, for rear wheel steering, is that the steering wheel will not be in a central position when driving.



**So remember, check all the bushes front and rear so the car maintains good steering, handling and extended tire life.**

