URETHANE CATALOGUE

INDEX

2013 - VERSION 1 URETHANE BUSHINGS, XTREME ALIGNMENT COMPONENTS & MOUNT KITS

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Glossary

Part Number and Bush Location

The part numbers that appear in this catalogue are structured so that you can identify the location on the vehicle and individual bushes by their tooling number.

Example:

Part Number:	**N71041 (or X……)**	
Explanation:	**N**	Lovells Designation– Performance Replacement Bushing/Component
	(X)	Lovells Xtreme– Performance Alignment Component. (Usually Adjustable).
	7	Location on vehicle - see below
	1041	Tooling/bush number
Location guide:	**N1**	Steering Idler arm, steering rack, column coupling
	N2	Sway bar Mount, link, link-rod, mount bracket
	N3	Shock absorber Stud and ferrule bushes
	N4	McPherson strut Bearing plate, upper and lower mounts, insulators
	N5	Front control arm Inner wishbone and control arm
	N6	Rear control arm Control arm and wishbone
	N7	Spring Eye/shackle, pad, spring saddle, sandwich pad
	N8	Location rod Radius rod, trailing arm, panhard, watts linkage
	N9	Sundry Body /radiator mounts, differential, alternator, engine steady and bump stops

Kit Contents Explanation

As you source information contained in this catalogue you will notice that the quantity of kits needed for each vehicle application is shown in the right hand column. You will also note that the quantity of bushes contained in each kit is shown in the column to the left of the part number. It is important that you understand how Lovells classify a bush and the resulting kit contents:

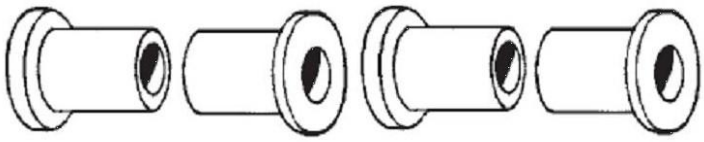
TYPE 1

Bushes which are totally Urethane without shells or crush tubes (ie. spring shackle, idler arm, sway bar mount) are counted individually.

Example:

Make & Application Spring - front & rear eye shackle

Bushes/Kit	**4**
Part Number	**N71041**
Kits/Application	**1**
Notes	No Crush Tubes



N71041

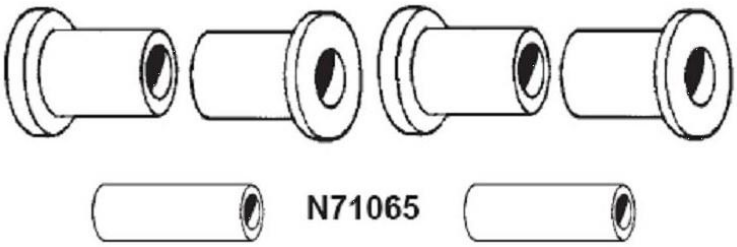
TYPE 2

In some applications, 1. O.E. rubber bush is replaced by Lovells half bushes and 1 crush tube (ie. some spring eye
and shackle applications comprise 2 half bushes and 1 crush tube as an assembly therefore a kit comprising 4 half
bushes and 2 crush tubes would read as 2 bushes per kit.

Example:

Make & Application Spring - front eye

Bushes/Kit	**2**
Part Number	**N71065**
Kits/Application	**1**
Notes	Including Crush Tubes



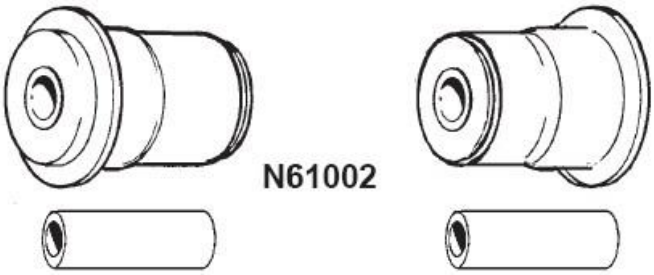
N71065

TYPE 3

Bushes that have both a shell and crush tube are counted individually.

Example:

Make & Application Lower trailing arm



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LOVELLS SUSPENSION

For years Australia has witnessed the culmination of urethane as a replacement for rubber suspension components. However, unlike other fast moving industries, technological advances were a non occurrence, as urethane characteristics and qualities went unchanged for 15 years. This fear of change, presented a lucrative opportunity to enter the market with an advanced product for the future, 'raising the bar' in terms of industry standards and regaining confidence in those who believed urethane was an insignificant replacement to rubber.

The key was to develop a product that combined the comfort of rubber with the durability of Urethane. Lovells Urethane ensures the perfect mix of product qualities, by offering a Urethane complex that over comes harsh vehicle travel, produces crisp handling, maintains geometry control, prolonged life span with the soft, comfortable ride of rubber. The range covers all your front and rear suspension requirements from control arm to shackle bushes backed by a 2 year/ 40,000km warranty.

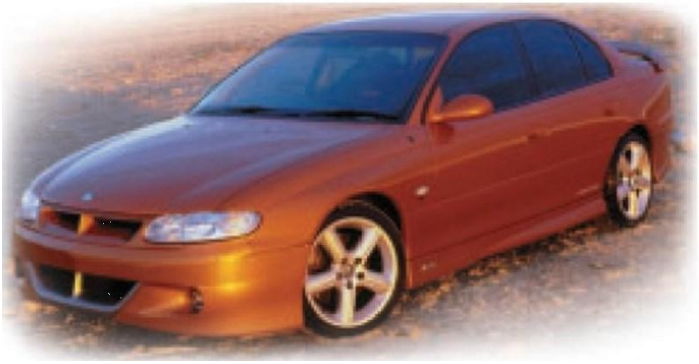
'For the Ride of your Life'

LOVELLS XTREME

Urethane suspension was originally developed for motorsport applications as polyester characteristics did not permit suitable road use. Urethane was hard, stiff and created unwanted vehicle vibration for regular day to day driving but provided track cars with strength and vehicle stability. As the decades rolled over and Urethane technology developed, the motorsport market became a small, insignificant sector of a rapidly growing alternate rubber replacement in passenger vehicles.

Lovells now offer performance suspension products branded **'Xtreme',** ranging from offset caster bushes and engine mounts to performance coil over race spring kits. Extensive R+D and the exclusive use of 'Lovells Urethane' bush material has produced components that offer the ultimate in mechanical stability without sacrificing ride comfort.

Optimise camber & caster settings with Lovells Xtreme adjustable strut mounts and dictate your vehicles ride height with coil over struts, both covering a massive range of performance four cylinders and popular V8's. Achieve greater alignment capabilities from 'Xtreme' products resulting in the ultimate suspension settings improving tyre wear, tyre performance, crisp handling, steering response and cornering ability.



The Urethane Concept Rubber vs Urethane

Installation and Pivoting Concept

Although rubber and polyester suspension bushes may have the same purpose, the technology behind their design and outright performance is blatantly different.

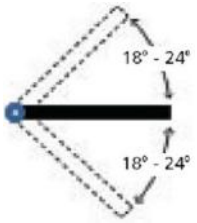
'Rubber suspension bushes' are developed to be compressed and / or chemically bonded to the suspension components in its application. For example, a shackle bush's outer diameter is greater than the eye it is applied to, whilst the centre of the bush - the inner diameter (bore) is a firm fit on the pin or sleeve.

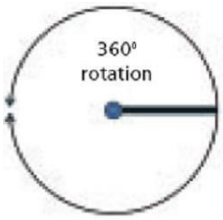
Due to this tight fit between the pin/shackle and bush it is necessary to lubricate the bush internally and externally with soapy water solution (e.g water based hand cleaner) to permit the internal and external access of the bush into the eye. Once the shackle plates are tightened or the component is installed with the chassis clevis, the bush enters a state of static compression.

A metallastic rubber bush (outer steel shell) is under compression from the time of manufacture and is chemically bonded to the outer of the metal centre sleeve and the inner of the steel shell. As a result suspension movement is restricted when the metallastic bush is press fitted, and clamped by the bolt through to the chassis (subframe).

Lovells have complied the following table to explain in brief the difference between *"Rubber and Lovells Polyester Suspension Bushes."*

Rubber	***Lovells Urethane***
• Static compression fit	• Mechanical fit
• Restricted rotational movement	• Unrestricted rotational movement - free pivoting bush
• Shell bushes - centre sleeve bonded	• Shell bushes - centre sleeve not bonded

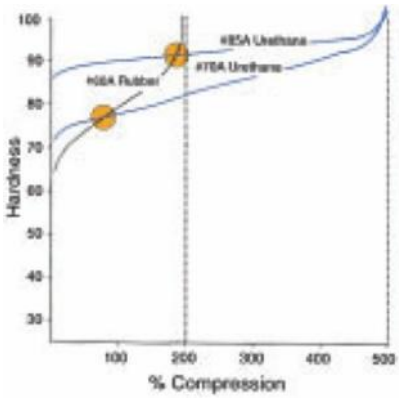




Compression

Lovells Urethane's greatest attribute over rubber is the way it performs whilst under compression - Urethane is a "mechanical grade solid elastomer" which exhibits a property called Linear Flow (ie. a solid which exhibits the physical properties of a liquid).

As a result of these linear flow properties Urethane will compress up to 500% before it reaches it's elastic limit and goes into tear or shear - rubber reaches it's elastic limit at 200% compression.



From this graph, we can see that although the Urethane grades are harder than rubber before installation, the fitted and resulting hardness under compression tell a different story.

At 200% compression the rubber has reached its elastic limit and starts to go into tear or shear.

The #85 & #70 durometer 'Lovells Urethane' all reach their elastic limit at 500% compression and exhibit a radically slower hardness take-up than rubber, hence we can draw the conclusion that Urthanes are harder than rubber statically but become softer than rubber dynamically.

Comparative Testing

Two grades of "Lovells Urethanes' (#85 & #70 Durometer Shore A) were cast into samples suitable for various tests by standard casting methods.

Rubber samples were obtained from available sources in sheet form - for the tensile and tear tests this was a 3mm sheet of natural rubber made by Dupont and for the compression, compression set and chemical resistance tests it was a 12mm sheet of natural rubber by Dupont. Included also are some tensile and tear tests on a 1.4mm sheet of butyl rubber.

Hardness

The hardness of each sample was determined according to ASTM D2240-8G "Rubber Property - Durometer Hardness'' using a Type A durometer.

Premium 85 Lovells #85A
Premium 70 Lovells #74A
Natural Rubber 3mm sheet #60A
Natural Rubber 12mm sheet #64A
Butyl Rubber #54A

Tensile

Tensile tests were done according to ASTM D412-83 "Rubber Properties in Tension" Method A using DieC

	Elong	Modulus	Tensile
	%	100%	300% Strength
85 Lovells	650	6.6 mpa	9.1mpa 28.8mpa
70 Lovells	610	4.4mpa	7.0mpa 33.0mpa
Natural (N.R) Rubber	340	2.4mpa	6.4mpa 6.9mpa
Butyl Rubber	580	1.5mpa	6.0mpa 14.6mpa

Basic Definitions for Polyurethane Properties

Hardness:	The resistance of a material to deformation by an indentor under a load.
100% Modulus:	The force required to stretch a sample to double its original length.
300% Modulus:	The force required to stretch a sample to three times its original length.
Tensile Strength:	The force required to break a material. The higher the number the stronger the material.
Elongation %:	The amount of stretch a material undergoes from its original size before it breaks.
Tear (D470):	Measures the force to continue a tear in a material once it has started. High numbers represent better resistance to tear.
Rebound:	A test for the rebound characteristics of the elastomer. High resilience implies low heat build up.
Compression Set:	The characteristic of the elas tomer to remain deformed after load forces are removed. Low numbers are best.
Texus Flex:@ 95%	Flex cycles before urethane failure with 95% stoemetric amount of curative.
Texus Flex:@ 105%	Flex cycles before urethane failure with 105% stoemetric amount of curative

Types of Urethane's

Although there are many types of Urethanes readily available there are only three families of Urethanes which are commonly used in automotive applications.

These are:
- Thermoplastics
- Exothermic Urethane (cold cast)
- Endothermic Urethane (hot cast)

Thermoplastics

Thermoplastic Urethanes are chemically stable materials which are very sensitive to heat input.
To mould a thermoplastic bush the plastic is granulated and fed through an injection moulding machine - at temperatures of 1120 - 1200 C the plastic melts and is forced into a die as a liquid. The moment the mould is quenched below the melt temperature the bush becomes solid and is ejected from the mould.
Injection moulding results in very high volume production and low piece price.
Since the thermoplastic bush is liquid in a solid state it exhibits poor pin set co-efficient and little or no memory - it is also very prone to temperature increases whilst in service. Arduous 4WD testing has resulted in shackle temperatures of 1800 C - at temperatures above 800 C the bush becomes more plastic and by the time it reaches above 1200 C it is most likely to commence losing it's physical shape and begin to melt.
Thermoplastics are not recommended for any automotive applications.

Exothermic Urethanes (ie. Lovells Urethane)

These are commonly called cold cast urethanes.
By blending a prepolymer and a curative at a fixed ratio we create a chemical reaction which exotherms (gives off heat) while the reaction is taking place - heat is used to accelerate this process but is not instrumental to the chemical reaction occurring.

Cold cast urethanes are normally processed at 800 C and post cured at 80-1000 C for 17 hours.
Once the chemical reaction has taken place and the bushes have been post cured the material is both physically and chemically stable. These bushes will withstand heat spikes of up to 2000 C.

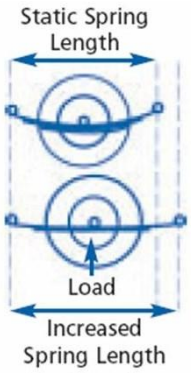
Endothermic Urethanes

These are commonly called hot cast urethanes. When the prepolymer and curative are blended the chemical reaction needs a trigger - heat. As a result these urethanes need to be processed and postcured at 110-1200 C. Once in service these bushes are heat sensitive - if the operating temperature rises above 110-1200 C the increased heat retriggers the chemical reaction and the bush initially swells. This is the reason all hot cast bushes have rifle grooves around the shank to give some freedom for the bush OD to grow. If the temperature still increases the chemical composition of the bush will restructure and cause degradation of the bush, seizing on the pin or crush tube, and in the worst case failure of the metal suspension components.

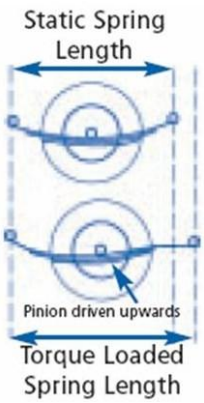
Suspension Bush Types and Design Concepts

Spring Eye and Shackle

Rubber spring eye and shackle bushes are one of the most commonly replaced suspension components for light commercial and 4WD leaf sprung vehicles. There use has been somewhat short of the mark, requiring constant replacement, meaning costs and stress on linked suspension components.
Rubber spring eye bushes are a compression fit design, with the general size of the bush slightly larger than its application and slighty firmer over the shackle pin.
When fitted the rubber bush undergoes compression and bonds to the interior of the spring eye and shackle pin. The bush is put under Load further compression as the shackle Increased pin and nuts are torqued. This



compression transforms a soft, oversized bush into a compressed and dramatically harder equivalent.



Due to compression the bush radically bonds to the eye and pin and hence reduces rotational/pivotal movement. As a result the bushes resist or work against the spring underload, specifically the changes in spring length and its freedom during radical bump and droop movement.

Lovells Urethane spring eye and shackle bushes
- Induce free pivot in spring length changes under bump and droop loading
- Enhance manoeuverability
- Eliminate pitching (rocking horse ride) in short wheel based 4WD's
- Permit camber and spring length change ultimately reducing axle tramp

Shock Absorber Bushings

Shock absorber advances and demands for improved travel and load bearing has placed extra importance and stress on shock absorber bushings. Based on design and performance , rubber bushes can fail sometime before the hydraulic components and seals fail.

Wishbones and shock absorbers respond to changes in road surface, load and cornering by going through bump (upwards movement) and rebound (downwards movement).

A vehicle undergoing bump travel, receives a compression load through the shock absorber, however properly primed, the valving resists the compression and the load is transferred though to the shock mount pin and eye bushes. Low resistance is offered by rubber shock absorber bushings, compressing before the shock begins to close resulting in low speed valving lag. The same instance occurs from static to rebound, and directional movement from bump to rebound, rebound to bump involving rubber bushes, doubles low speed valving lag.

Lovells Urethane shock absorber bushings
- Eliminate low speed valving lag, including the use of heavy duty hydraulic and gas shocks.
- Enhance the performance of both new and used shock absorbers
- Have superior density and linear flow properties, radically enhancing capacity to cope with bump and rebound travel.

Steering Rack

Power steering, aggressive wheel alignment geometry, wider wheels and lower profile tyres have all put radically increased loadings on the steering systems of modern cars.
This has resulted in more premature wear and failure of steering components and rack mount bushings. Most OEM designs employ soft rack mount bushings to minimise road harshness being transferred into the steering wheel.

Engine oil leaks also help to degrade the performance of steering rack mount bushes.

Lovells Urethane steering rack mount bushes
- Exude characteristics that are chemically resistant to oils, coolants and solvents
- Enhances the stability of the steering rack

Sway Bar

Load transfer whilst cornering, resulting in body roll is controlled by the vehicle's stabiliser or sway bars. As the suspension is loaded during cornering the sway bar links attached to the wishbones transfer movement through the swaybar to the opposite side of the vehicle's suspension.
Fitment of urethane link bushes will reduce lag in the sway bar as the suspension moves (refer to notes on shock absorber bushes)

Rubber breadloaf or D mount bushes which attach the bar to the chassis dampen the bar's rate by not permitting total load transfer across the bar. Making the swaybar free pivoting with the fitment of urethane bushings actually increases the bar rate - urethane link and D mount bushes will increase the active bar rate 20-30%.

Lovells Urethane sway bar bushes
- Increase bar rates by 20-30%
- Reduce lag in the suspension as the bar moves
- Pivot at both mounting points, utilising entire bar length

Trailing Arm, Rocker and Torque Rod

Live axles on the majority of passenger vehicles, light and heavy commercials and 4WD's are located by trailing arms or torque rods. Rubber bushings in these links permit excess pinion angle changes resulting in premature differential, universal, tailshaft and sometimes gearbox failure.
Vehicles with two piece tailshafts suffer shudder on take-off and driveline shudder when heavily loaded in open highway conditions.

Properly designed and lifted urethane bushes will immediately address the pinion angle change and associated problems.

Lovells Urethane trailing arm bushes
- Permit optimum pinion angle changes eliminating differential, tailshaft and/or gearbox failure.
- Eliminate take off and driveline shudder under heavy loads

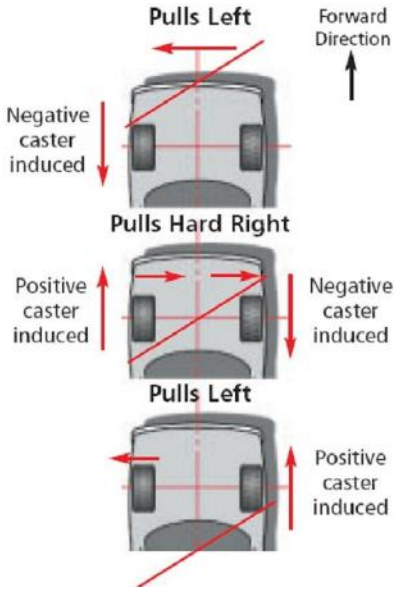
Radius Rod

Inability to control fore and aft movement of the suspension under minor braking, turning, bump and dynamic suspension loads is common to vehicles with single blade control arms held in position by radius rods, in attempting to achieve optimum ride comfort

many OEM manufacturers are designing radius rods with bushes at both ends.

Under brakes or bump the wheels move back and then recover forward as the brakes are released, the vehicle comes to rest or continues ahead. This rearward movement of the wheels induces negative castor increases in the suspension geometry.

The following problems can occur during driving along a changing road surface running diagonally across the road:



1. Left wheel impacts joint and moves back. As negative caster is induced, wheel pulls left. Right wheel steers straight ahead.

2. Left wheel moves forward into positive caster- wheel pulls right. Right wheel impacts joint and moves back. As negative caster is induced wheel pulls right.

3. Right wheel moves forward into positive caster- wheel pulls to left. Left wheel steers straight ahead.

4. The opposite will occur if the change in road surface runs in the other direction across the vehicle. The initial change in the road surface pulls the car slightly to the left, then it pulls firmly back to the right as both wheels cross and eventually slightly left as the RHF recovers.

There has been no steering change made however the car has been through three directional changes. Straight roads represent little problems however, corrugated roads or hard cornering will dramatically propel the problem.

Lovells Urethane radius rod bushes
- Enhance suspension geometry retention
- Provide ‘crisp’, responsive handling
- Optimise braking capacities

demand on engine mount performance.

To gain smooth idle and minimize engine and transmission harshness (under acceleration / deceleration), manufacturers have opted for either voided or fluid filled mounts - especially in the past 5-12 years. Excellent levels of in-car comfort have been achieved but increases in engine/ transmission movement within the chassis have resulted. The increased movement equates to torque rolling of the engine unit resulting in major loss of torque transfer to the drive wheels.

In front wheel drive vehicles excessive engine movement results in increased angularity in the drive/ CV shafts. Vehicles incorporating equal length driveshafts are not badly affected but those with unequal length driveshafts suffer badly from torque steer - the short shaft runs far greater CV joint angles than the long shaft resulting in the long shaft transferring higher torque output

Base model production vehicles suffer from these engine movements and resulting torque bias problems. Performance variants and turbo models e.g. local base models retrofitted with multi-valve and turbo engines from Asia, greatly increase these issues.

Rapid acceleration/ deceleration in front engine live axle rear wheel drive vehicles results in significant torque rolling of the inline engine and transmission. This leads to further loss of torque output to the differential and less “hook up” at the rear wheels. GMH, Ford, Nissan, Toyota & BMW all have developed fluid filled mounts which offer increased flexibility, but produce excess torque rolling.

Lovells manufactured and reconditioned engine mounts
- Stop torque rolling
- Reduce torque steer in FWD vehicles
- Increase high performance acceleration
- Minimise damage to components (ie. Exhaust) from excessive engine mount

LOVELLS XTREME

SPORTS SUSPENSION TECHNOLOGY

Lovells Xtreme Alignment Components are a range of Australian made premium quality replacement adjustable bushing assemblies specifically designed and manufactured for high performance & competition vehicles.

The advantages of the Xtreme Alignment Suspension is the ability to maintain street driveability and comfort, with the versatility of 'dial in' performance when required.

Xtreme Alignment Components are supplied in kit form for the front & rear of most passenger vehicles, and offers the advantage of incremental adjustment allowing substantial vehicle alignment variations all directions. Our kits make possible the fitment of popular large diameter wheel & tyre combinations up to 20inches when used in conjunction with Lovells Eliminator Performace Shock Absorbers.

"Xtreme "Sports Suspension Coil Springs"
Lovells Xtreme Sports Suspension Race Coil Springs are manufactured to the highest standards in accordance with ISO 9002 and appropriate Australian Standards from OneSteel micro alloy steel.

Each spring is individually cold coiled on variable speed / custom mandrel coiling machines. The springs are then end ground or taper forged if design specifies before being rate tested and scragged (compressed beyond normal working height) to achieve maximum fibre stress.
All coil springs are then shot peened to eliminate material surface defects. Coil springs are then powder coated before being assembled to the matched strut / shock absorber assembly.

Lovells Suspension Components are manufactured to very high standards utilising the very latest and most up to date urethane technology available worldwide. For the very first time we can offer softer grades than any other product offered to the market, both within Australia and overseas.

We have formulated #85 Duro, #70 Duro and #60 Duro urethanes and application engineered them to give outstanding ride and geometry control whilst maintaining overall driver and passenger comfort. In all wishbone, control arm and leaf spring applications the Lovells urethane bushes act as a flexible bearing and

must be greased at the time of assembly.

To gain optimum performance from Lovells components take the following precautions when installing:

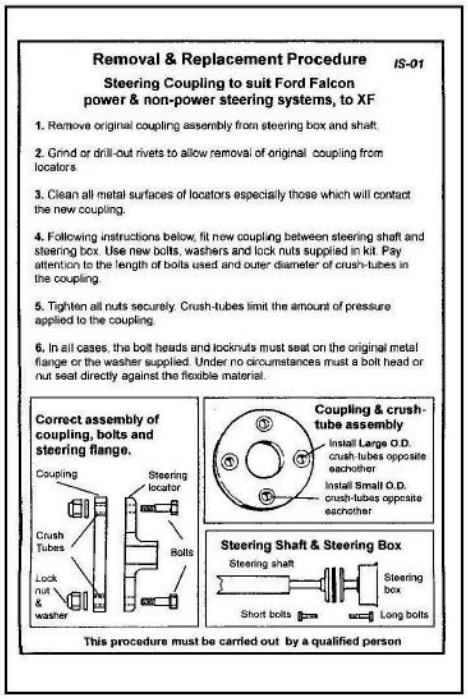
a. Ensure all suspension parts are free from rust, scale, paint and previous rubber deposits.

b. Shackle and mounting pins, control arm and spring eyes and shoulders must show no major signs of pitting or damage - any damaged components must be replaced or repaired to vehicle manufacturer's tolerances.

c. **Goop** grease has been supplied in the kits where required and must be used to optimise bush performance and durability. Goop grease has been formulated from a reinforced No. 2 lithium complex base and selected additives with molybdenum disulphide for mechanical stability, extreme pressure qualities for extended life and a high melting or drop point of 230 degrees Celsius minimum. Goop grease should only be applied to the bores and out flanges of all bushes and components - it is not recommended to grease the outside surfaces of bushes and components.

d. Tighten mounting bolts with the vehicle at normal ride height, to minimise risk of premature bush failure.

INSTRUCTION SHEETS INCLUDED WITH KITS



Removal & Replacement Procedure *IS-01*

Steering Coupling to suit Ford Falcon power & non-power steering systems, to XF

1. Remove original coupling assembly from steering box and shaft.

2. Grind or drill-out rivets to allow removal of original coupling from locators.

3. Clean all metal surfaces of locators especially those which will contact the new coupling.

4. Following instructions below, fit new coupling between steering shaft and steering box. Use new bolts, washers and lock nuts supplied in kit. Pay attention to the length of bolts used and outer diameter of crush-tubes in the coupling.

5. Tighten all nuts securely. Crush-tubes limit the amount of pressure applied to the coupling.

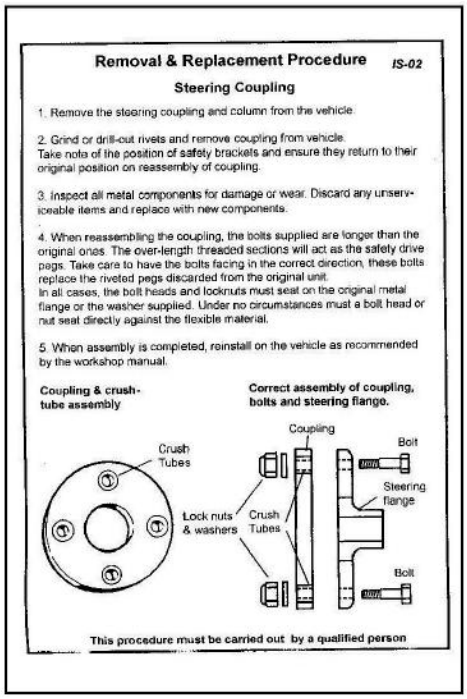
6. In all cases, the bolt heads and locknuts must seat on the original metal flange or the washer supplied. Under no circumstances must a bolt head or nut seat directly against the flexible material.

Correct assembly of coupling, bolts and steering flange.

Coupling & crush-tube assembly

Steering Shaft & Steering Box

This procedure must be carried out by a qualified person



Removal & Replacement Procedure *IS-02*

Steering Coupling

1. Remove the steering coupling and column from the vehicle.

2. Grind or drill-out rivets and remove coupling from vehicle. Take note of the position of safety brackets and ensure they return to their original position on reassembly of coupling.

3. Inspect all metal components for damage or wear. Discard any unserviceable items and replace with new components.

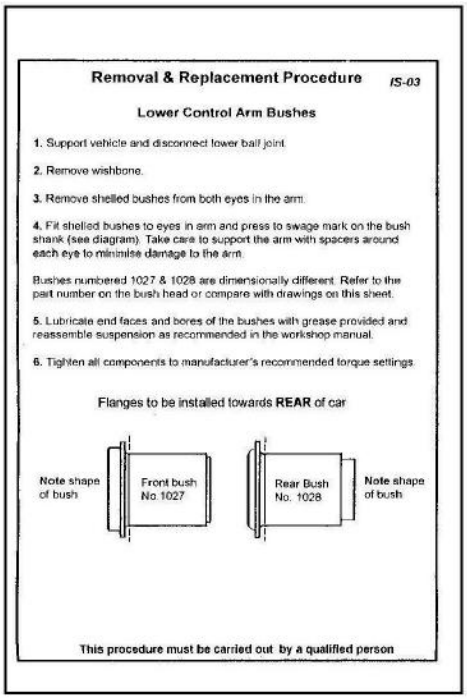
4. When reassembling the coupling, the bolts supplied are longer than the original ones. The over-length threaded sections will act as the safety drive pegs. Take care to have the bolts facing in the correct direction, these bolts replace the riveted pegs discarded from the original unit. In all cases, the bolt heads and locknuts must seat on the original metal flange or the washer supplied. Under no circumstances must a bolt head or nut seat directly against the flexible material.

5. When assembly is completed, reinstall on the vehicle as recommended by the workshop manual.

Coupling & crush-tube assembly

Correct assembly of coupling, bolts and steering flange.

This procedure must be carried out by a qualified person



Removal & Replacement Procedure *IS-03*

Lower Control Arm Bushes

1. Support vehicle and disconnect lower ball joint.

2. Remove wishbone.

3. Remove shelled bushes from both eyes in the arm.

4. Fit shelled bushes to eyes in arm and press to swage mark on the bush shank (see diagram). Take care to support the arm with spacers around each eye to minimise damage to the arm.

Bushes numbered 1027 & 1028 are dimensionally different. Refer to the part number on the bush head or compare with drawings on this sheet.

5. Lubricate end faces and bores of the bushes with grease provided and reassemble suspension as recommended in the workshop manual.

6. Tighten all components to manufacturer's recommended torque settings.

Flanges to be installed towards **REAR** of car

This procedure must be carried out by a qualified person