

4.

WHEELS AND TYRES

the hub of
successful off-roading

The pressure a tyre exerts on the ground and the effect the tread pattern has on the surface over which the vehicle is passing will determine the ease and efficiency with which the vehicle will travel. Although motor manufacturers go to a great deal of trouble to research what type of tyre will work best with a particular vehicle, they are normally shod with general purpose tyres or just road tyres with aggressive treads.

For best results when selecting tyres ask these questions:

- *Tyres, like vehicles, are a compromise between on-road performance and off-road ability. How much time will the tyres spend off-road?*
- *What kind of off-road terrain is most likely to be encountered? Sand, mud, snow, rocks, etc.*
- *What kind of load will be carried? Exceeding the tyre's load ratings will cause premature failure, blowouts and accidents.*
- *What is the maximum speed that will be attained by the vehicle? Tyres have maximum speed ratings that must not be exceeded.*
- *What kind of ambient temperatures will be encountered? Some East Bloc manufactured tyres will not withstand the heat of an African desert.*

TYRE SELECTION

Mud tyres

A tyre suited to sand or normal road use clogs rapidly and loses traction in mud. The large gaps and chunky look in the tread of mud tyres facilitates 'self-cleaning'. As the wheels rotate the mud embedded in the tread is released and is thrown out. Heavy treads tend to make more noise than fine treads and this is most noticeable on tar at speed. Purpose built mud tyres do not have good wet road performance, so extra care is needed in these conditions.

Sand tyres

The main feature of a tyre designed for sand is not, as is commonly thought, broad width, but a tread pattern that compresses the sand beneath the tyre instead of penetrating through it – which is what happens when a mud tyre is used on sand. The gaps in the sand tyre tread are narrow and the tread pattern runs longitudinally around the tyre. Good sand tyres flex well when used at low pressures.

Sand tyres must also be tough enough to withstand rough tracks and sharp stones of semi-desert regions, since rarely do pure sand conditions last for long before being interrupted by sections of sharp stones and gravel.

Broad tyres

Not all vehicles are designed for very broad tyres. On some vehicles the tyres may rub the steering arms, brake hoses or chassis when the steering is on full lock. If your vehicle is blessed with good axle articulation, oversized tyres may rub against the body when the axles are extended in off-road travel. They also put undue stress on transmissions not designed for the use of big tyres.

Broad tyres in sand

It's a mistake to think that very wide tyres will automatically be suitable for sand operations. That's due to the belief that it is the tyre's width that affects its penetration. Although this is to a small degree true, almost all of the advantage gained by a tyre's width is counteracted by the fact that a broad tyre needs to push more sand in front of it than does a narrow tyre, ie. it has a higher rolling resistance. A tyre moving over thick sand builds up a wall of sand in front of it. The greater the penetration, the deeper the tyre sinks into the sand, and the higher the wall becomes. Eventually the vehicle's progress will be halted as the wall becomes higher and higher and the drag overcomes the engine power or traction. Narrow tyres create narrow sand walls, and so have lower rolling resistance.



General SAG general-purpose rough-country tyre works well in just about every environment. High resistance to punctures is also a quality of this tyre - important for a tyre to be effective in the wilderness.

Broad tyres in mud

I have witnessed occasions when broad tyres have had a distinct disadvantage in mud; and other times (albeit less frequently) when they have been an advantage.

One dry winter on Vaal Dam I was asked to assist a Ford F250 fitted with Yokohama Super Diggers, a common broad tyre well suited to sand. The craft which the Ford was attempting to pull out was a lightweight skiboat with a 30hp motor on the back. Once the tyre treads had clogged the vehicle became useless. My vehicle was fitted with 205X16 radial mud and snow tyres at 2,3-bar. Not only did I extricate his vehicle and boat in tandem, but then proceeded to pull a five-ton yacht up the same slipway.



Narrow or general-purpose tyres can be made more effective in sand by lowering the pressure, but a purpose-built sand tyre cannot be improved for mud conditions.



In comparison, consider the case of three Land Rover Defenders fitted with 750X16 Michelin XL mud tyres inflated to 2.5-bar trying to mount a steep muddy slope during a hill-climb. While the Defenders struggled to get up the hill, the Isuzu KB diesel I was driving walked up without so much as the slightest wheel-spin. The Isuzu was fitted with Continental RVT280s, 265/70R15, a broad general-purpose off-road tyre, also inflated to 2.5-bar.

There seems to be no definite conclusion when it comes to mud tyres, pressures and tyre width. What is conclusive though, is that a self-cleaning tyre does make a significant difference to performance in mud, and tyres suited to sand will not have this feature. In conditions when the mud gets deep so that penetration needs to be avoided, broad self-cleaning tyres and very low pressures are desirable.

Broad tyres in rough country

In rough country, broad tyres are more easily damaged by rocks than narrow tyres. This is the most significant and undisputed disadvantage of broad tyres.

Snow tyres

A mud tyre will perform well in virgin snow conditions. On compacted snow, as found on well-used roads, a less knobby tyre will be more effective. Typical effective road/mud and snow tyres are indicated M&S (mud & snow) and have squared shoulder and block tread.

Rough country tyres

Don't mistake a heavy knobby tread for toughness. The thickness of the sidewalls is of as much importance as the thickness of the tread. Tyres of this type have restrictive speed ratings when they become specialised very-heavy-duty types. If your vehicle is operating under constant off-road conditions where resistance to damage is more important than traction, cross-ply tyres may be worth considering.

Damage to a sidewall is a common occurrence in rocky terrain. The thickness of the sidewall is a good indication of a tyre's resistance to damage. Three-ply sidewalls are recommended for off-road conditions



All purpose 4x4 tyres

The vast majority of leisure off-roaders will require a tyre to handle all theatres of operation – sand on the beach or on a safari into Botswana, mud for the occasional rainy spell that turns the tracks into a slippery mess, and rocks on the family weekend 4x4 outing or over the spectacular hills of the Richtersveld.

No single tyre stands out as being the best for all conditions. The best way to choose a tyre suitable for your needs is to talk to experienced enthusiasts who have been there before.

Summary:

- *Heavy tread far apart: good for mud, mediocre in sand.*
- *Medium tread close together: good in sand, mediocre in mud.*
- *Thick tread: good for sharp rocks, often combined with hard compound rubber which will wear well on rough tracks. Will not flex well – a disadvantage in sand.*
- *Thick sidewall: good for sharp rocks. Good load rating. Less ability to flex in sand. More resistant to damage when at lower pressures due to the strength of sidewall.*

OTHER FEATURES

Speed ratings

The maximum permissible speed is printed on the tyre sidewall. Tyre damage will result if this is exceeded. When a tyre is deflated for reduced penetration, the permissible speed rating no longer applies.

Load ratings

The maximum permissible load is printed on the tyre sidewall. Tyre damage will result if this is exceeded, particularly if high speeds are attained.

High ambient temperatures

Tyre damage due to heat occurs when an under-inflated tyre is run at high speeds. Heat blowouts can occur to inner tubes before the tyre is affected. The result is an inner tube that shreds itself and after such a blow-out it is irreparable. Cheap imported tyres are often totally unsuited to the extreme road temperatures.

Imported or local tyres?

Imported tyres generally have softer rubber compound and many do not cope well with local high speed gravel road conditions. Whenever I am consulted as to the best tyre I more often than not recommend a locally manufactured tyre.

RADIALS VERSUS CROSS-PLIES

Cross-plies

These are constructed by laying strips of fabric over each other at 90° angles, forming a wafer effect. These strips are called plies and the more plies a tyre has the higher its load carrying ability will be, while its flexibility is reduced. They were first used in the 1860s and apart from improvements in the materials used they have changed little in design. When the side wall of a cross-ply expands with deflation, the ground pressure in the middle of the tread decreases. At the same time the ground pressure on the outside of the tyre increases. The lower the inflation pressure the more marked the effect.

When the tread bar of a cross-ply meets the ground it bends. This causes the weaker area of casing behind to distort, allowing the tread bar to move backwards. As the tyre rotates and the tread leaves the ground, it flicks back to its original position. This movement, combined with the distortion of the tread described above, causes trauma to the surface over which the tyre is passing. In sandy conditions, this trauma, exaggerated if the cross-ply is under-inflated, will cause the tyre to dig in. Cross-plies are therefore unsuited to heavy sand conditions.

Cross-plies also have a higher rolling resistance than radials and this will affect fuel consumption. Perhaps the only time that cross-ply tyres could be advantageous is when the vehicle spends most of its time carrying heavy loads at low speeds over hard rocky ground that could cause damage to more expensive radials.



Radials

Radials are superior to cross-plies in almost every respect except price. They offer superior traction, safety and comfort, both on a paved surface and off-road.

Radial tyres are made by laying strips from bead to bead (the bead is the point where the tyre meets the rim). The advantage of this design is that flexing of the sidewall does not affect the tread. They flex independently of each other. So, decreasing pressures will flex the sidewall and tread area, while keeping the tread pressure evenly spread and increasing the tyre's contact area with the ground, thereby decreasing the ground pressure and the tyre's penetration.

TUBES VERSUS TUBELESS

The question of tubed or tubeless is much debated in four-wheel driving circles.

These are the facts:

- *If a tubeless tyre is deflated for use in heavy sand and conditions that require excessive throttle, the tyre may move on the rim. The result is total deflation.*

- *A tubed tyre running at reduced pressures generates more heat and is more prone to damage.*
- *A tubed tyre is often easier to repair in the bush than a tubeless one, because they are easier to remove from the rim and are much easier to re-inflate (tubeless tyres often require a bead expander to do this).*
- *A spike type puncture is easier to repair on a tubeless tyre. If the puncture site can be found, the wheel need not even be removed from the rim. With a more serious puncture or tyre damage they are more difficult to repair than tubed tyres.*
- *Tubes do not strengthen the tyre or help prevent punctures.*
- *Blowouts occur less often to tubeless tyres. In tubed tyres, sudden deflation can be caused by excessive heat that is aggravated by friction between the tyre casing and the tube. This is especially serious if the tyre is under-inflated or overloaded where tyre distortion increases this friction tenfold.*
- *Damage to tyres is common in outback travel. If you use tubeless tyres, carry a suitable tube to enable you to effect a repair should the damage be sufficient to render the tyre useless for tubeless operation. It is very unlikely that you will find the tube of the correct size when you need it and even if you do not intend to go into very remote areas, carry a spare tube. You have been warned!*
- *Blowouts can tear a tube to pieces rendering it useless, so if you use tubed tyres, carry a spare tube.*

TYRE SELECTION – SUMMARY

There is no ideal, all-conditions off-road tyre, so all are a compromise in one way or another. When driving in Southern Africa count on encountering heavy sand. If you travel during the rainy season (November to May) you may also be faced with mud. You are only likely to encounter snow if driving in very mountainous areas in winter.

If you have no specific task for your 4WD and it is going to be used as a general leisure vehicle and will be covering all types of terrain, my recommendation is a steel belted, medium width, high profile radial with a fairly chunky tread pattern. Make sure that the tyre's load carrying capacity is sufficient for your purposes.

THE FITTING OF TYRES, TUBES AND VALVES

Tyres and tubes

When fitting tyres with inner tubes it is imperative that once the tyre is inflated it should immediately be deflated and then re-inflated. This will remove twists in the tube. If a twist remains, the tube may split. Evidence of tube failure of this nature can be detected as the tear begins at the point of highest stress, namely the valve. Many tyre fitting workshops do not know this, so you should keep an eye on the fitting operation and make sure that this operation is carried out correctly. I learnt the hard way and suffered one such blow-out on a front wheel on a brand new tyre while doing 110 kph.

Valve stems

The length of valve stem fitted to tubed heavy duty tyres fitted to a 4x4 must be the short type. Long stems are vulnerable to damage by rocks, grass and undergrowth and are subject to failure, often when the tyre is working hard in a remote location. Tyre fitment centres may assure you that it makes no difference – but it does, so insist on short valve stems. If you use tubeless tyres, carry a few spare valves with you.

TYRE BUYER'S GUIDE

On the sidewall of all tyres is a series of numbers and letters. This gives information about the tyre's construction and size. The example below is for a Continental Conti Trac AT. From this, and the tables which follow, much is learned about this product.

NEW LOAD/SPEED INDICES

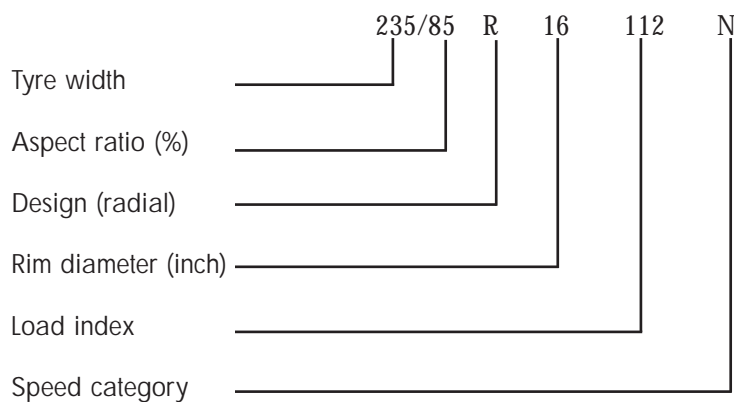
Some tyres may display this information in the following way:

235R16C

108Q
375kPa



At a speed of 160kph (Q)
this tyre can carry a load of 1000kgs (108)
at an inflation pressure of 375 kPa.



SPECIFIC TYRE BRANDS

This summary is based on the opinions of thousands of 4x4 enthusiasts. It has been difficult to compile it because during the research, opinions were at time so diverse that it became difficult to arrive at a conclusion. For example, the Yokohama Super Digger

LOAD INDEX TABLE

LI	kg	LI	kg	LI	kg
96	710	107	975	118	1320
97	730	108	1000	119	1360
98	750	109	1030	120	1400
99	775	110	1060	121	1450
100	800	111	1090	122	1500
101	825	112	1120	123	1550
102	850	113	1150	124	1600
103	875	114	1180	125	1650
104	900	115	1215	126	1700
105	925	116	1250	127	1750
106	950	117	1285	128	1800

SPEED CATEGORY TABLE

Index	max kph	LI	kg	LI	kg
G	90	N	140	T	190
J	100	P	150	U	200
K	110	Q	160	H	210
L	120	R	170	V	240
M	130	S	180	W	270

has a well documented reputation for outstanding tread life and suddenly someone who, when asked about the Super Digger reported only 35000 kms out of a set. I know of a number 4x4s that have covered over 100 000 kms on a single set.

This summary is meant as a guide to the reputation of each tyre and not what the manufacturers claim. Please do not regard it as absolute as differing conditions, vehicle types, load variations and tyre pressures over the life of a tyre can all have a significant effect on a tyre's performance. It also only covers the most popular tyre models found on Southern African 4x4s.

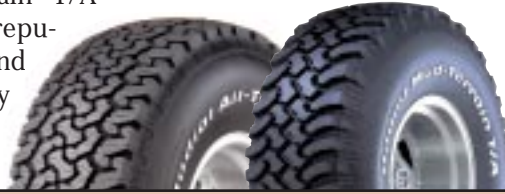
Key to Charts:

- *Mileage: reputation for distance covered before replacement.*
- *S/Wall: number of sidewall plies and resistance to penetration.*
- *Tread: strength of tread and resistance to penetration.*
- *Punct: resistance to punctures. A heavy tread does not necessarily mean high resistance. For example, some tyres are like magnets to nails. Nobody seems to know why.*
- *Mud: performance in mud.*
- *Sand: performance in sand at below normal pressures.*
- *Wet tar: compromises that make a tyre good off-road are often felt on wet tar.*
- *Dry tar: grip and noise levels.*
- *Rocks: performance and resistance to punctures.*
- *Sizes available have been omitted because of the rapid changes made to tyre designs and it would probably take about ten pages to list all of the manufacturers and their products.*
- *Ratings: P=Poor, F=Fair, G=Good, E-Excellent.*

BF Goodrich

This US manufacturer makes a number of off/on-road products and all appear to have a good reputation. Their tyres fit 14, 15 and 16-inch rims. The All-Terrain T/A has a particularly good reputation for robustness and good mud traction. They are more expensive than most.

*Left: Mud Terrain T/A
Right: All-Terrain T/A*



BF GOODRICH									
Model	mileage	s/wall	tread	punct	mud	sand	wet tar	dry tar	rocks
Long Trail T/A	G	G	F	G	F	F	G	G	G
All-Terrain T/A	F	G	E	E	E	F	G	G	G
Mud Terrain T/A	F	G	G	G	E	F	F	F	F

Continental (Gentyre)

Gentyre and the Continental brand are home-grown products all of which were developed for local needs. The General listed here is the Super All-Grip radial, once supplied as OE (original equipment) on Land Rover Defenders and is an excellent tyre for a working 4x4. The Conti Trac AT is Continental's flagship model and is ideally suited to luxury 4x4s that are also required to tackle off-road conditions and long stretches of unpaved roads. It is currently OE on the Defender.

The second generation Conti Trac AT was available from early 1999. It can be told from the first generation by a serrated seam on the sidewall. This tyre has improved tread life and a tougher sidewall. Conti Trac is available in a range of 15 and 16-inch sizes.



*Left: Conti Trac AT
Right: RVT280*

CONTINENTAL									
Model	mileage	s/wall	tread	punct	mud	sand	wet tar	dry tar	rocks
Conti 180N	G	F	F	G	P	E	G	G	F
Conti 280	G	G	E	E	G	G	F	G	E
Conti Trac AT (new)	F	G	G	F	G	G	E	E	F
Gen SAG radial	G	G	E	E	G	G	F	F	G

Firestone

The two products that Firestone have built from local needs is the R4S and the ATX. Both are available in 14 and 15-inches, the ATX being the most widely used for off-road work. Its reputation is one of ruggedness and excellent puncture resistance. Their road manners are not as good and they can be a little noisy. They do not work well in mud. The Town and Country is a very old design and

is Firestone's only 16-inch 4x4 tyre. It is a polyester-treaded tyre with poor overall performance, unsuitable for today's high-speed station wagons.

Firestone ATX



FIRESTONE									
Model	mileages/wall		tread	punct	mud	sand	wet tar	dry tar	rocks
ATX	G	G	E	E	P	G	F	G	E
Town & Country	P	P	F	F	P	F	F	F	P

Goodyear

The Wrangler is one of the best known multi-purpose tyres and has an excellent all-round reputation. OE on the Hilux for some time, the Wrangler is a light duty off-road tyre with a good balance of toughness and road grip. Its only short-coming is its narrow tread pattern which clogs with mud quickly. Its unaggressive tread belies that fact that it is robust and able to cope with fairly tough off-road work although sharp stones can and do penetrate the tread with heavily loaded vehicles.



GOODYEAR									
Model	mileage s/wall		tread	punct	mud	sand	wet tar	dry tar	rocks
Wrangler	G	F	F	G	P	G	F	G	G

Michelin

Undoubtedly due to its fine reputation for making excellent road tyres, Michelin is, in my opinion, overated as a maker of off-road tyres. I drove on Michelin for well over a decade and the day I changed, my problems with tyres came to an abrupt and pleasing end. Michelin's offer traction as good as their competitors but some reason every Michelin I drove suffered repeated punctures. And, to back up my opinion, I still receive as steady flow of stories about the lack of strength or resistance to punctures of many Michelin products.

Michelin was the first manufacturer to tackle the leisure 4x4 market in a big way with the 205/16 M+S radial fitted OE to the Range Rover. In South Africa many suffered sidewall failures at high speed, some with fatal consequences. Michelin's conclusion was that the cause of the problem was that local Range Rovers were overloaded with air-conditioners, winches, power steering, bull bars etc. combined with under-inflation. The fact that it was always rear tyres that blew and my own imported vehicle, which suffered three such blowouts, had none of these fittings did not influence their conclusions.



Michelin LTX A/T

If you are operating a Range Rover on these now discontinued tyres change them before 40 000kms. Their replacement, the M+S200, is better but blow-outs are still happening. Interestingly, 95% of all recorded blow-outs occurred on the left rear wheel. The LTX M/S fitted OE to the Discovery is an excellent road tyre but its tread is too weak for a laden vehicle on gravel. The M/S is made in 14, 15 and 16-inches and the A/T in 15 and 16-inches only. The A/T appears to be considerably tougher than the M+S. The M+S 200 is one of the best snow tyres available.



Michelin
LTX M/S

MICHELIN									
Model	mileage s/wall		tread	punct	mud	sand	wet tar	dry tar	rocks
XC M/S 200	F	F	P	P	G	F	G	G	F
LTX A/T	F	F	F	F	G	F	G	G	F
LTX M/S	F	F	F	P	F	G	E	G	F

Yokohama

One of the best Japanese off-road tyres is the Super Digger, a well known brand with a reputation of extremely long life and atrocious manners on wet tar. This has been changed with new models and it appears that the softer compound has improved the tyres performance in all but longevity. The Y815 is OE on the SWB Pajero and suits the vehicle well. The Y826 is the choice for those who like the 'fat takkies' look.



Left: Super Digger 815
Right: Super Digger 826

YOKOHAMA SUPER DIGGER									
Model	mileage s/wall		tread	punct	mud	sand	wet tar	dry tar	rocks
Y815	G	F	G	F	F	G	G	G	F
Y826/828	E	G	G	G	F	G	F	G	G

TYRE PRESSURES

The pressure a tyre exerts on the ground is something that can be adjusted – the lower the air pressure in the tyre, the less the ground pressure will be and therefore the less the tyre will penetrate the sand or mud over which it passes. In sand, penetration will halt progress, while in mud and snow this can sometimes be an advantage. Reducing or increasing tyre pressure is therefore a way in which the driver can change the effect his tyre will have on the ground before difficult terrain is negotiated.

The key element in deflating tyres for off-road driving is that low pressure increases the length of the tyre footprint (not the width), thus exerting less weight per-square-inch and thereby reducing

penetration. At the same time it subjects the sidewall to damage and if the vehicle is driven too fast or over unsuitable terrain the tyre is easily damaged. Tyre pressures and their effect is covered in detail in chapter 5 'Driving'.



A good pressure gauge is essential equipment for the off-roader.

Recommended inflation pressures for imported vehicles

Road conditions in the First World differ greatly from those in Southern Africa. Tyre pressures recommended for vehicles most often sold in other parts of the world, most commonly Europe, USA and Japan, are often inappropriate for local road conditions, loads, ambient and road surface temperatures. If you own an imported vehicle fitted with imported tyres, you may need to modify the suggested tyre inflation pressures to prevent poor wear patterns and inferior handling on rough roads.

SPARE WHEEL LOCATION

The location of spare wheels carried by 4WD vehicles varies and each position has its advantages and disadvantages.

Under the rear overhang

In almost all under the rear overhang fittings the spare wheel reduces ground clearance. This is particularly serious with vehicles such as the Toyota Land cruiser station wagon. Also, if the vehicle bogs down, a spare wheel makes an excellent base for a jack and a good anchor if it is buried. If the vehicle is bogged it may be impossible to get at the spare if it is located in this position. Most significantly, if it is stolen or falls off, it is unlikely that anyone will notice.

On the bonnet

When the release knob is pulled from inside the vehicle to open the bonnet, the catch often does not release due to its added weight. It is therefore difficult for a single person to open the bonnet if a spare wheel is stowed there. Forward vision is also restricted and safety in a head-on collision is compromised. An advantage of this position is that it offers excellent weight distribution. Removing the wheel and replacing it requires some physical strength and will scratch the bonnet's paintwork.

Inside the vehicle

A spare wheel carried inside the vehicle means that you may have to unpack your luggage to get to it. It takes up valuable load space that could be used for more delicate articles. Because it is heavy, it is important that it is well secured.

On a roof-rack

A spare wheel carried on a roof-rack is ideal because it is easily accessible, can be secured well forward to aid weight distribution, and the bowl of the wheel rim can be sat in when game viewing.



Swing-away wheel carriers are the most convenient way of carrying a spare. If you tow a trailer make sure that additions to the trailer draw-bar allow the wheel carrier to be swung clear of the tailgate. A single and twin-wheel carrier is made by Outback Extreme (011 397 8883)

Spare wheels are usually heavy and it may take two people to lift it onto the roof rack.

On the rear door

With current trends the rear door appears to be the place to carry a spare in terms of looking cool. A spare wheel carried on the rear door is without doubt convenient but negatively affects weight distribution and on some vehicles not originally designed to have it there has odd effects on handling.

If a special rack is fitted that is separate from the rear door it can be a useful place to carry other equipment such as a spade. Some door mountings are not strong enough to take the constant vibrations in rough country and eventually break. The Land Rover Defender's rear door is notorious for cracking and so a purpose-built spare wheel carrier must be fitted. If the wheel is attached directly to the door, the hinges and clamps should be periodically tightened and the door jam set so that there is no free play.

WHEEL RIMS

Magnesium alloy rims

Mag rims are unsuitable for heavy off-road work. The bead, the part of the rim most frequently damaged off-road, is the mag rim's weakness and when damaged they cannot be hammered back into shape as with a steel rim.

Steel rims

This type of rim should be selected for serious off-road use. Steel rims are constructed in two parts: a pressed steel centre boss and a rolled circular bed for the tyre. These parts are either rivetted or welded together, rivetted types being the strongest and most reliable. Steel rims are sometimes of inferior quality and in some cases severely warped rims are supplied with new vehicles, making perfect balancing impossible.

Damage and repair of steel wheel rims

Common causes of damage are overloading, running with less than the total amount of wheel nuts or driving over rocks, etc. Make

sure that wheel studs are clean and lightly oiled otherwise stud nuts can tighten against dirt and rust. Running with loose wheel nuts can cause severe rim distortion which is irreparable.

Slight damage can be easy to repair, eg. bending of the outer bead. This can be straightened using a shifting spanner and light use of a hammer. Make sure the bead is returned to its original shape and the distortion has not been transferred along the bead. Because wheel rims are made from high grade steel, welding should not be undertaken owing to the possibility of the temper being altered by the heat and resultant weakening of the rim.

Maintenance of wheel rims

Rust is a bit of a maintenance headache when it comes to wheel rims. Because of the habits of male dogs and the fitting of tyres when the rim bead is unclean, tyres can weld themselves to the rim making them very difficult to remove. It is a good idea to remove each tyre from its rim and then to refit them before going on an extended safari to avoid having to repair a puncture in the bush and spending three hours simply trying to remove the tyre from a rusted rim.

A solution to this problem is hot-dip galvanising although this is not entirely suitable as excess zinc deposits can create small spikes that can cause punctures and zinc deposits on the tyre bead requiring smoothing with fine glass-paper. Sand blasting and then coating with epoxy paint is the most ideal rust preventative method.

Split rims

Some older vehicles were fitted with split rims of a two part design. This facilitates the removal of the tyre from the rim. These rims are unsafe and should not be handled by the uninformed. It is imperative that the tyre be totally deflated prior to splitting the rim as air pressure remaining in the tyre will cause the rim to split with explosive force which could cause serious injury. Also, when a tube is fitted onto a split rim, a gater consisting of a ring of shaped rubber must be inserted between the rim and the tube. Not fitting a gater with a tube will result in the tube wearing and eventually rupturing at the joint between the rim halves.



Right: A carrier attached to the rear of the vehicle is a very handy place to carry recovery gear. Above: Cosmetic rims covers should be removed and left at home during long trips.



TYRE MAINTENANCE IN THE BUSH

In my recent travels I have been lucky enough to have been loaned vehicles from various manufacturers to drive and photograph for my many books. All these vehicles were new and therefore very few were unreliable. These vehicles were also rarely fitted with the extras I would have liked, such as a roof rack, suitable jacking points or a second spare wheel. Rarely too were the vehicles fitted with tyres adequate for the trip in mind. The off-roading I do is no more strenuous than the average enthusiast and I drive with care and consideration for the vehicle, but I am frequently faced with multiple punctures or damaged tyres during the trip. I am therefore forced to carry a comprehensive set of tyre repair equipment.

The list is as follows:

- *Electric tyre pump*
- *Foot tyre pump*
- *Tubeless repair kit/Tube repair kit combination*
- *2x tyre levers*
- *2nd spare wheel*
- *Spare inner-tubes*
- *Jacks and tools to remove and replace wheels*

12-volt electric tyre pumps

Electric pumps available vary greatly – some are quick, efficient and costly and others are simple devices more efficient at converting noise into heat than inflating a tyre, but even these are less effort than using a hand or foot pump, and they take about the same time.

Electric pumps are fairly reliable, but if they break down they are not easy to repair. It is therefore advisable to carry a foot or hand pump as a backup. More expensive pumps that are driven directly off the engine fan-belt are well worthwhile should you intend doing a lot of beach or desert travel when constant deflating and re-inflating tyres becomes a chore. Another method is to carry compressed air tanks with tyre pump hoses attached. This is an expensive and bulky way to do it, but if you're a diver it may



Left: The Thomas air pump is one of the more expensive pumps available. Right: The Bush Buddy air pump, sometimes called Volcano, a little smaller than the Hurricane pump but much cheaper and almost as efficient. It is excellent value for money. Next page top: An example of a Hurricane pump mounted in an engine bay. Mounting a pump here saves space and is very convenient. Note the similarities with the Volcano.

prove an easy solution. One tank will be required for each vehicle.

No decent electric pumps go for less than R350. If you settle for the cheaper kind be happy to wait a while for your tyres to get pumped – 45 minutes to an hour for 4 tyres from 1-bar to 2,5-bar.



Foot and hand pumps

Foot pumps are perhaps a little less strenuous to use than hand pumps, but their use in sand can be awkward. They must be placed on a plate or tarpaulin to keep sand from entering the mechanism. Both hand and foot pumps are inexpensive and are easily maintained and repaired.

Automatic Tyre Deflators

When it comes time to deflate tyres off-road, it is a laborious process to go from tyre to tyre, deflate, check pressure, deflate some more and then check pressures again. Automatic tyre deflators solve this problem and will deflate tyres to a pressure preset on each unit, while the vehicle is driven. The kit consists of four valves that are preset (mine are set to one bar) that are screwed onto each tyre valve when its time to deflate. The valve opens until the preset pressure is reached and then shuts off. For the valves to open the tyre must be above two bar.



Automatic tyre deflators are a hassle-free way of deflating a set of tyres

REPAIRING A PUNCTURE

Tyre repair kits

A repair kit should comprise a set of a minimum of two tyre levers, a rubber repair kit with patches of varying sizes, a valve spanner and a pump. A tyre repair kit designed specifically by the author for the African off-roader is stocked by most 4x4 gear shops, AA stores and Makro. Ask for the 4xForum tyre repair kit or call 021 785 5752.



Carry a second spare wheel and tube

By carrying a second spare, a puncture need not be repaired immediately. If the second spare is required, this is the time to make a repair. Do not wait until your vehicle is immobile before you make a repair or you may find your vehicle immobilised in

A combination tubed/tubeless repair kit with tyre gaters and spare valves is essential equipment, regardless of which type of tyre is fitted to your vehicle. Most off-road repair kits are for tubeless only, and will not go further than repairing a simple thorn type puncture. This simple but versatile kit is designed by the author.

a position which makes it difficult for you to work. Change to the spare, drive to a shady place or set up camp and then repair the puncture in a relaxed, unhurried fashion. It may even prove enjoyable and will feel like part of the bushwhacking experience.

Repairing a puncture (tubed)

For punctures that cannot be repaired with the tyre on the rim, follow the instructions under the heading 'Repairing a Puncture (tubeless)' making allowances for the fact that the tyre patch (tube patches do not work on tyres) will be cemented (Solution for tubes may not work on tyres and tyre patches) onto the inside of the tyre. Read the literature that comes with the repair kit and follow the tyre removal procedure below.

For punctures that can be repaired without removing the tyre from the rim follow these instructions:

As these plug repair systems differ slightly, read the instructions that came with your kit. Locate the item causing the puncture and draw a circle around it. Do not assume that if you find what seems to be a nail/thorn in your tyre that this is the only cause of the puncture. Look carefully at the entire tyre including the inner and outer sidewalls marking all irregularities. Remove the nail/thorn. Insert the plug into the spiker and apply cement (some systems do not require cement) to the plug. Insert the plug and withdraw the spiker according to kit instructions. Inflate the tyre and splash water over the repair and over any other suspect areas checking for bubbles.

Repairing a puncture (tubeless)

Inspect the tyre and mark any objects which could have caused the puncture. Do not remove the object at this stage. Place the flat under your vehicle and use the jack and the vehicle's weight to break the seal between the tyre bead and the rim. Breaking the bead (separating the tyre from the rim) is the first and often most frustrating task when repairing a puncture in the bush. The problem is that when the tyre is driven over, or crushed using a high-lift jack, the opposite side kicks up. To prevent this, two high-lift jacks placed opposite each other and worked together works well. If you only have a single high-lift, use a bottle jack or similar to prevent the wheel from lifting.

Once the seal is broken, place the wheel on a ground sheet (it is important to avoid dust) and remove the valve. With a basin of slightly soapy water at hand, wet the tyre levers. Stand on the edge of the tyre and insert the levers between the tyre and the rim. Work your way around the tyre until the bead is over the rim. NOTE: Not all wheel rims are symmetrical. Start with the outside (the side with the valve). If you have difficulty removing the bead, try the other side of the rim. Then with the wheel standing upright, remove the tube where you think the puncture has occurred and mark it. Then remove the rest of the tube, replace the valve and inflate it. The puncture should then become easy to find. Immersing the tube and watching for bubbles is another way of locating the puncture, and may also reveal other defects such as a leaking valve. Mark the puncture and deflate the tube completely.



A puncture can occur in the most unexpected places. On this occasion we holed a sidewall on the banks of the Chobe River.

Repair kits come with a scraper which is then used to roughen around the puncture site after the tube has been dried. Clean away any rubber particles and apply the rubber solution. When it is touch-dry, remove the backing and apply the patch. Rub over the patch with the round end of a screwdriver handle or similar object until you are sure that a good bond has been made. Clean out the inside of the tyre and remove the object that caused the puncture. This is a good time to inspect the outside too, and remove any thorns, stones or nails that may be working their way through the tyre. Dust the tube with talc and fit it inside the tyre with the valve intact. Soap the tyre bead and, with the tyre levers, work your way towards the valve, pushing the tyre over the rim. Be careful not to pinch the tube with the tyre levers.

The final stage is to inflate the tyre. Roll the wheel looking at both sides checking that the tyre is seated uniformly on the rim. Then deflate the tyre and re-inflate it. If the tube is not correctly aligned it may split when it is run.

Getting a puncture on a steep slope

I have on two occasions needed to replace a wheel while my vehicle was pointing skyward at about 20°. This is no easy task. Preventing the vehicle from rolling off the jack is the first priority.

These are the steps:

- *Wedge all wheels with rocks or chocks.*
- *Anchor the vehicle using its winch cable or a chain to another vehicle. Do not use stretchable rope or a tuggum strap.*
- *The winch cable must be fully stretched before jacking can begin.*
- *Engage low-range first gear and lock all differentials that you can.*
- *Firmly apply the hand-brake.*
- *Remove the spare wheel from the vehicle before jacking.*
- *Have all occupants leave the vehicle before jacking and have them stand to the side. Keep bystanders from walking behind the vehicle.*
- *Make sure the vehicle remains stable as jacking begins and jack slowly. Only remove the rim once you are confident that the vehicle cannot roll further and fall off the jack.*

CARE OF WHEELS AND TYRES

Make sure that all of your tyres (including the spare) are fitted with valve caps. They form a positive seal and keep out mud and dust.

If you have a 4WD vehicle that is only used occasionally you have an added maintenance chore when it comes to tyres. When a tyre stands for long periods in the same position, the sidewall sections closest to the ground are subjected to sustained flex, causing minute cracks to develop in the rubber. These cracks admit dust, water and light all of which cause a slow deterioration process and ultimately damage the tyre. The solution is either to drive the vehicle once a week (which is not a bad idea anyway, considering the care required to keep the rest of the vehicle in good order) or to jack up the vehicle taking the load off tyres. Cover the tyres when the vehicle is parked in the sun – many makes of tyre are easily damaged by sunlight.

Balancing and rotating

To get optimum mileage out of a set of tyres, the tyres must be periodically rotated. Most radial tyre manufacturers do not advise reversing the direction of rotation, ie. swapping from side to side. However this is not the case with vehicles equipped with permanent four-wheel drive transmissions, where tyres should be rotated; left front to right back and left back to right front. This should be done every 10 000 – 15 000 kilometres.

Balancing should be done every 35000 kilometres or thereabouts. 4x4s are generally on the heavy side and on some vehicles only when balancing is radically out is the vibration serious enough to be transferred to the driver. If this is left unchecked, premature failure of shock-absorbers and suspension bushes will result.

Maintenance of tyre pressures

Vehicles with the spare wheel stowed under the load bay means that the driver has to climb under the vehicle to check pressures and inflate it. Because off-roaders cannot afford to allow the spare to go flat or drop off without being noticed, a valve extender pipe is a good idea.

It works like this: the extender L-bend fits onto the spare and is hand tightened. The valve end is then permanently fixed to a convenient place. Ideal locations are under the tailgate (pickups) or next to the fuel cap hidden behind the lockable flap. Mounting is straightforward and is easy to do as long as there is easy access behind the location. Valve-Tyre-Extenders are available from good 4x4 equipment outlets and the 4xForum, 021 785 5752.

