LOKKA Discussion Paper

(This discussion paper is for general information only)

Due to the wide range of model variations, vehicle variations, applications and fitments you should speak to a consultant prior to the purchase of this product to ensure its suitability for your application.

LOKKA is a fully automatic Differential Lock that does not require any manual operation. It does not have switches, external lines, electric or pneumatic controls of any sort.

It relies on a simple but highly innovative mechanical design which makes use of two distinct sets of forces - the "ground driven" forces acting on a wheel when cornering (that force an outside wheel to turn faster) and the forces from the engine (power) turning the diff. The combination of these two sets of opposing forces and the unique design allow the automatic engagement and disengagement of the driving gears when a vehicle turns or requires differential action.

Difference to a normal differential

1. A normal diff is designed to perform two main (traction related) operations.

A. - Transmit engine power via the drive train to the wheels

B. - Allow "differential action" - ie allow the wheels to travel at different speeds to allow cornering without drive train and tyre damage.

2. The traditional differential design allows for an infinitely variable rate of differentiation ranging from the standard 50:50 where both wheels turn at the same speed (straight line driving & the ideal for offroad) to a ratio of 100:0 where one wheel spins freely and the other is not driven at all - (the big problem)

3. The design also allows for all power to be transmitted to the "path of least resistance" which is fine on bitumen because both wheels always have some degree of traction but offroad you often require substantial power and in this case even a small difference in traction can result in wheel spin and hence total loss of traction.

4. An LSD (limited slip differential) is simply a standard differential with either a fixed bias or a dynamic biasing mechanism which serves to only partially "lock up" the two axles by way of clutch plates or special gear design. However most require that both wheels still have some traction on the ground to operate and even when new will cause a wheel in the air to spin uncontrollably so as to be completely ineffective where off road traction is required.

5. LOKKA overcomes the traction deficiency of the standard differential so as to ensure that 50:50 power split is achieved when driving irrespective of ground (or air !) conditions, yet at the same time still allowing differential action when cornering on hard ground

Simple explanation of LOKKA's operation

The LOKKA mechanism allows a wheel to turn faster than the speed the diff is driving it - (differential action), but never allows a wheel to turn slower than the speed the diff and engine is turning it - (traction). Thus a wheel cannot ever stop turning if the engine is driving it, but in a corner it can be forced to actually turn faster. Unlike a normal diff the engine can never drive one wheel faster than the other.

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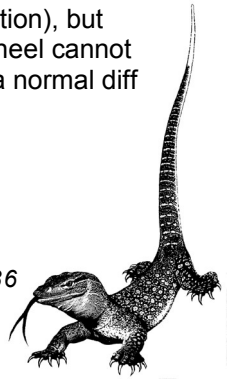

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100% Positive Locking mechanism

LOKKA is positive locking, meaning there is no slippage when locked - there is a mechanically solid engagement of all parts. In contrast an LSD is not positive locking and does allow slippage and one wheel "spin up" - the spinning of one wheel at twice the diff speed while the other wheel having traction remains motionless. This means that you get 100% of drive and traction to both wheels.

Simple

LOKKA design is by sight extremely simple - in fact so simple that most people cannot understand how it can operate so well. It uses less than half the mechanical components of others, weighs less because no new carrier is needed and for these reasons costs less.

Dynamic Locking Principal

1. Unlike other types of Lockers the LOKKA has a locking and unlocking principal that is dynamic. The more power that is applied the harder it locks so it doesn't need large bias forces constantly operating on it to keep it locked, the bias spring forces are minuscule and can be easily compressed with two fingers. This results in a locker that is able to lock and unlock extremely easily even when driving on some of the most slippery of surfaces. The locking mechanism is so sensitive that a wheel can be disengaged with one finger when a wheel is jacked up off the ground.

2. LOKKA's engineering principal is based on two sets of opposing forces but simplified . . . there are two forces acting on the internal gear sets

A. - one acting to unlock the cam and axle gears by the gear tooth design and effects of the ground driven forces acting on a wheel when cornering,

B. - the other to lock the cam and axle gears due to the camming action of the cross shaft and axle gear due to a 4 dimensional spiral cut cam groove with bearing surfaces under the effects of engine power.

3. Depending on the situation the locker can either uncouple or couple the driving gears. ie if the differential forces acting on a wheel to turn it faster than the wheel is being driven by the diff and engine, then that side can freely disengage and hence unlock and provide differential action.

The most affordable locker

LOKKA is by far the lowest cost and value for money diff lock available in the world. The cost reductions are achieved by the economy of low part numbers, reduction in materials, assembly labour, machining and an overall weight reduction in freight. In addition the unit can be fitted DIY and results in substantial savings. It is not just cheaper at the cost of performance - it out performs and has better road handling characteristics than opposition products and is more durable, reliable and stronger than other lockers.

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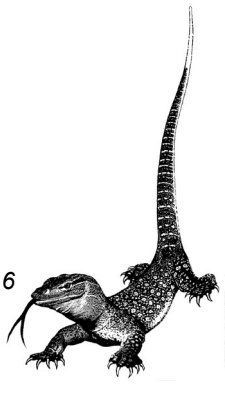

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Very Low Backlash

LOKKA has approximately half the backlash of some other automatic lockers and achieves this through its different design principal. In particular it does not suffer from a large amount of backlash in the driving teeth. LOKKA uses specialised low profile gear sets (small, wide teeth) which have no backlash (almost zero) when engaged means that operation is smoother - the backlash in the unit is restricted principally to the ramping and camming action that occurs between the cross shaft acting in the groove cut in the cam gear. Because the camming action is smooth and progressive rather than sharp and abrupt it results in well mannered driving characteristics.

Load Transfer and strength

LOKKA design uses a large number of very low profile teeth which collectively do all the ramping and the driving. Engine power is transferred through the flats of all 20 teeth at the same time rather than the original standard diff which has only 2 or 4 teeth driving at a time with all the force being transmitted between two points on the curved surfaces of the pinion and side gear teeth. LOKKA has a total linear length of approx. 12 cm and surface area of around 3cm2 and hence has 2-5 times greater surface area over which to transfer the engine power. This means that LOKKA can handle substantially more power than the original differential gears and can do so without wearing out, because when driving and locked there is no longer any of the slipping and sliding that occurs when the traditional spider and side gear turn and mesh.

Elimination of excessive tyre wear

If a wheel can differentiate easily and the locking and unlocking characteristics are smooth rather than harsh, then the 4WD owner will eliminate excessive tyre wear and drive train damage common when differential action is hampered or the locker does not allow easy unlocking.

Available for most popular models

There is a wide range of LOKKA models and the range to suit new and older 4WD's is always expanding. Because LOKKA is designed to fit into every different type of differential carrier, there are no major common parts, thus every diff has its own unique LOKKA kit designed especially and only for that differential. They are not interchangeable.

Constant 4WDs

Like all automatic lockers, LOKKA cannot be used in the front axles of (C4WD) constant four wheel drive vehicles - however some makes such as Jeep and Mitsubishi offer a part time 4WD option and LOKKA can be fitted. Otherwise free wheeling hubs need to be fitted or a part time 4WD kit.

High strength ultra resilient alloy

LOKKA is made from advanced Alloy.

Life expectancy

LOKKA due to its design and material composition has a life expectancy approximately twice as long as the differential they have replaced - this is obviously dependent on the use and application, fitment, condition of diff etc. In Models that utilise the existing side gears - normal side gear wear is arrested at the time of LOKKA fitment and should almost never wear out.

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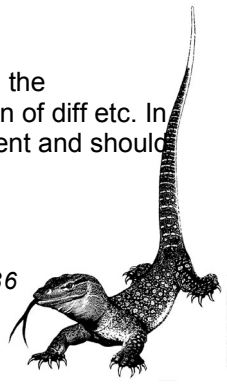

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Trademark

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Doubles your 4WD's offroad ability

1. A 4WD fitted with one LOKKA will in general terms have more than twice its original offroad ability. This is easily tested by taking a LOKKA equipped vehicle up a steep hill or across terrain that has previously been impossible to traverse and drive it with absolute ease and at a lower speed beyond that same point even to the point of stopping and restarting from that same point.

2. A vehicle with dual LOKKAs has a truly amazing ability and is capable of climbing vertical walls, crossing deep washouts and negotiating seemingly impossible terrain with slow ease and minimum skills on the part of the driver.

Uncompromised steering

1. The steering benefits of a LOKKA are that it not only operates smoothly but also sensitively. This allows the driver to steer and select the best path or line when driving off road. LOKKA's ability to unlock so easily when cornering means it is simply easy to steer with the steering wheel to negotiate a corner. This is in stark contrast to a manual locker (or an automatic locker that will not unlock easily) that will severely restrict steering in many instances and must be unlocked to safely negotiate tight corners.

2. In addition the lack of differential action in other types of lockers means that the drive train componentry is subjected to huge unnecessary stresses which result in damage to CV joints, hubs, axles, uni joints and gears.

3. The steering advantage applies to LOKKA fitted in the front, rear or both.

4. However it is there are situations where steering and handling will change the traditional handling of a vehicle including some under steer and tightening of the steering wheel.

Excellent on road handling

2WD on road handling is the best available and a front fitment has no affect, even with the hubs locked (exception : not suitable for C4WD). Off road steering with a front fitment is virtually unchanged - you may experience a slight tightening of the steering wheel in some situations but is barely noticeable except where the effects of tailshaft windup can occur on hard surfaces (as it does without). This is because you are feeling the effects of both wheels driving with 100% traction on the ground. Depending on the terrain and driving style there may be some element of under steer but it is minimal.

Eliminates the harsh noisy actions

1. A correctly installed LOKKA to a vehicle in sound condition will be a pleasure to drive and will rarely yield a noise much louder than a metallic clicking. An occasional metallic clack can occur in some circumstances and if occurs frequently should be checked.

Prevents one wheel spin up

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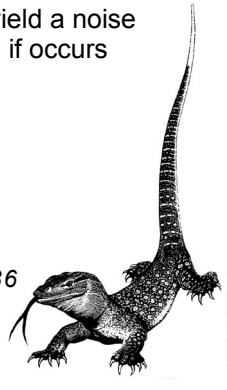

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1. The single cause of one wheel spin up and the resultant axle and drive train damage that occurs when the spinning wheel suddenly bites onto something solid is caused by an standard differential allowing all power to flow through the path of least resistance and differentiate in the ratio 100:0 ie 100% drive to one wheel on a poor traction surface and 0% on firm ground.

2. With LOKKA this can never occur - it is not physically possible to drive one wheel faster than the other - thus with two wheels constantly driving at exactly the same speed you will negotiate slippery obstacles in a controlled fashion and alleviate the sudden stress loading of drive train components. However the increased traction of a vehicle will often result in the vehicle negotiating seemingly impossibly difficult obstacles and as such common sense and due care are required for the vehicle to ensure the safety of the occupants and prevent damage to the vehicle.

Approach obstacles at lower speed

1. If a vehicle has adequate traction on the ground it does not require such large amounts of momentum, thus a LOKKA equipped vehicle will be able to negotiate difficult obstacles that were previously only possible with the use of high speed and momentum. By eliminating speed from your obstacle negotiation you will be able to drive more safely, with better planning, improve reaction times and in particular keep all 4 wheels on the ground thereby improving traction even further and saving your car, your belongings, passengers, drive train and suspension from damage. Better yet you don't have to be an expert driver to do so because with good traction you need only drive normally. (Of course there are still situations where momentum can be used to advantage and may still be necessary)

Improved engine braking

1. LOKKA is completely symmetrical in its design and in its forward and reverse operation thus its use with engine braking in steep downhill descents is excellent.

2. With a standard differential it is possible to lock up a single wheel while braking and loose steering and traction. In fact what actually happens is (the reverse of normal one wheel spin up) that the wheel on the more slippery side locks up first and the other wheel due to normal differential action speeds up (ie 0:100 power split ratio). Since this accelerated wheel is actually the wheel which is on firmer ground the increase in its speed acts to accelerate the vehicle even faster down the slope ! Just what you don't want. This is fact and underlies the real problems with steep slope descents and correct engine braking procedures.

3. LOKKA will ensure that both wheels under the effect of engine braking will remain locked and hence provides an unparalleled level of downhill braking and safety.

Do it yourself fitting

LOKKA is designed to fit directly into the existing differential carrier as a replacement set of gears. Since the original carrier is not replaced and the crown wheel, pinion and bearings do not have to be "set up" onto a new carrier, LOKKA is capable of being fitted by almost anyone with a basic tool kit, without specialist diff knowledge. The simple configuration means that the LOKKA installation itself only takes around 10-15 minutes with the differential access/removal taking between 1/2hr to 2 or 3 hours In simple terms if you can change brake pads you can fit a LOKKA. There are a few exceptions however.

Warranty

LOKKA is an extremely reliable product and has an extended three year unconditional manufacturers warranty.

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