



ALL-TERRAIN RUNFLATS: THE BASICS

Vehicle Evolution: In the constantly evolving theatre of operations, the primary element of saving and protecting lives in high mobility vehicles is key to operations. More recent changes have seen the focus shift to more urban operations where wheeled vehicles have a major advantage over tracked vehicles. The line between wheeled or tracked vehicles has further broadened with the significant growth of ultra-maneuvrable 6x6 and 8x8 wheeled platforms.

Light-Weighting: The current growth in additional “Active Protection Systems” and the consequential increase in mass has now coined the phrase “Weight Budget” or, how to offset the increased vehicle mass. A simple solution in working towards the weight budget is the inclusion of Carbon Cored Rubber multi piece runflats, achieving circa 40% weight reduction in the runflat alone. With forged aluminium additionally reducing mass compared to conventional steel wheels, future non-metallic developments that give improved blast protection whilst reducing weight will further enhance vehicle dynamics.

Why Are Runflats Important: All-Terrain Runflats are fitted to manage the durability and capability of a wheeled vehicle to run on one or more deflated tyres, whether by ballistic attack or simply rapid deflation, ensuring the strategic safety and protection of personnel and the mobility of ground forces.

What is an All-Terrain Runflats? All-Terrain Runflat technology goes back some 40 years, with the intent to give a wheeled vehicle with one or more tyres deflated the potential to continue to manoeuvre to a place of safety, over any terrain.

How Do They Work: Mounted to the rim and inside the tyre, they fill a percentage of the internal air capacity of the tyre. On rapid deflation, the tyre can run on the runflat insert instead of collapsing directly onto the wheel rim, which will cause a lack of traction.

Alternative Solutions: Depending on the application and theatre of use, alternatives such as a Beadlock or tyre well filling safety band may be an alternative solution.

Central Tyre Inflation: In many off-road terrains, there is often a need to deflate and reinflate the tyre to increase the tyre footprint, aiding vehicle grip and mobility. This is achieved with the use of an onboard compressor that gives the driver/operator the added drive and grip flexibility, however without a full rubber beadlock in place, the tyre bead may not seal and therefore not reinflate when called to do so.



Why Rubber or Rubber/Carbon for Military and 4x4?

There are a couple of obvious challenges when assessing Rubber, Composite or Plasticised materials for All-Terrain Runflats for use on Military, Security and 4x4 vehicles.



Rubber will absorb shock from impingement caused by curb strikes, potholes and operating in generally hostile environments. Rubber drastically reduces the vibration and stresses that are transmitted through the runflat to the wheels, axles and drive shafts allowing you to continue with little change to the handling of the vehicle whilst retaining a degree of comfort for the driver and passengers.



Rubber is a compliant material and therefore prevents the damage caused to the tyre from impingement between the runflat and the inside of the tyre. The tyre manufacturers have sent out circulars with regards to these problems.

Michelin statement:

“Metal, hard plastic or other non-compliant materials will create damage to the interior surfaces of the tires when used in off road and/or reduced inflation pressure”.

Bridgestone statement:

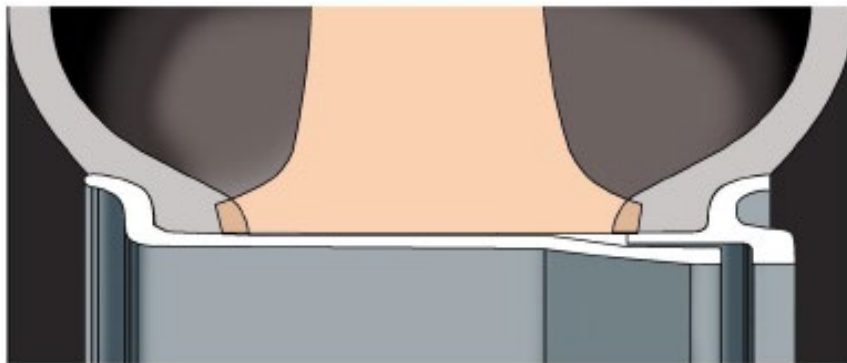
“Devices made of hard or rigid materials such as metals, plastics or composites, may cut, tear, scrape or abrade the inner liner, body plies and/or bead areas of the tyre. Such damage may occur intermittently depending on the operating conditions and may not be immediately apparent from a visual inspection of the tyre exterior. However, the damage may progress to splitting, blistering, bulging and/or separation of tyre structural plies and cause pressure inflation loss or tyre failure. **Only install runflats/beadlocks devices made from flexible material.**”

Advantages of Beadlock

The greatest influence in facilitating the achievement of the Finabel standards is the function of '**Beadlock**'.

Without adequate compression of the tyre beads against the flanges of the wheel, (Beadlock) the vehicles are incapacitated with deflated tyres. With only the 'drag' from the deflated tyres, the wheels will slip inside the tyres on level ground, let alone trying to negotiate any obstacles or inclines etc.

Military vehicles are required to continue their mission and/or return to base with one or more of the vehicle's tyres deflated. Therefore, the military (Finabel 20.A.5 and A.20.A Standards) demand a guaranteed minimum runflat performance of 50km, preferably 75km with two and more relevant, a minimum of two hours off road negotiating hills and obstacles like curb strikes with two tyres deflated.



Rubber runflats are over manufactured in width to allow for the manufacturing tolerances of the wheels and tyres, ensuring tyre bead compression during the installation, guaranteeing the beadlock, as you can see in the above illustration.

An additional necessity for beadlock is to prevent foreign objects such as sand, stones, and other debris from getting inside the tyres. When the runflats are installed a high temperature, synthetic lubricant is inserted into the tyres to reduce friction, therefore any sand and dirt will mix with the lubricant and reduce the distance you can travel.

Foreign objects in the tyre cavity can also affect the Central Tyre Inflation system (CTIS).

So why not composite or hard material?

The answer is in the manufacturing tolerances of the wheels and tyres. Michelin for example informs us that there is a bead tolerance of +/-3mm on all their 20" military tyres, therefore we have a total bead variance of 12mm. Add to this the wheel tolerances and we have up to 20mm variance in spacing internally between the beads.

Composite runflats must be manufactured to the MINIMUM tolerance, otherwise the runflat will either break during installation or the wheel will not seal properly. In any event, it is not technically possible to guarantee adequate compression to prevent the tyres from slipping or spinning on the wheels.

When to use composite

That said, composite runflats do have a role to play in protecting vehicles. They are lighter and less expensive to manufacture and are generally designed to fit the existing single piece steel or alloy wheel. They work very well on vehicles using the public highways like armoured limousines and heavy vehicles like water cannon operating in riot situations. It must be stressed though, that all manufacturers of composite runflats have a performance disclaimer stating an "Up To" runflat performance distance rather than a "Guarantee"!

So, the only solution to all the above challenges is to use rubber!

Tyron Multi Bands:

Originally designed for the RUC Landrover Defender snatch vehicles in Northern Ireland in the 1970's, the Tyron multiband locks the tyre onto the wheel by filling the tyre well. Now mandatory in some countries for blue light vehicles, school buses and steering axles of commercial vehicles, the driver easily retains control of the vehicle when punctures or rapid deflations occur. Easily fitted and weighing around 1kg for 15" to 2kg for a 22.5" band, they are ideal for commercial vehicle, automotive and 4x4 fleet safety.

Tyre Replacement and fitting:

There are fundamentally two systems on the market, either a single piece rubber runflat or a modular runflat, and the replacement of tyres has two distinct processes:



The one-piece system, common in many markets around the world, requires a large hydraulic press to insert or remove the runflat from the assembly when changing tyres. This requires the wheel & tyre assembly, or indeed the whole vehicle to be taken to a base with the appropriate equipment on site, or in many cases, the logistical challenges, and costs of freighting the assemblies to a third-party base or even another country.



The TYRON patented modular Rubber All-Terrain modular systems are designed to be fitted and removed with standard workshop tools in the field. Not only do they make large, heavy, and expensive hydraulic machines obsolete, they significantly reduce the costs of logistics mentioned above, and the significantly reduced vehicle down time means the soldier remains best supported and protected.

Finally, why TYRON ALL-TERRAIN RUBBER RUNFLATS??

Runflats: With the ability to design and manufacture to customer weight and performance characteristics, all Tyron rubber single piece and multi-piece runflat solutions are designed, tested, and manufactured in-house. The runflats can be manufactured to fit all existing wheel and tyre combinations and tailored to suit specific customer applications.

Wheels: All TYRON supplied wheels are manufactured and tested to a minimum of SAE J1992, and range from 16" with 1650kg load rating, 18" with 1900kg load rating, through to all the military specs sizes and offsets.

Tyres: With proprietary tyre partners, we have a solution for all applications.

Value to Land Forces:

- a. **Value:** Being completely field serviceable without the need for special tools, vehicle down time is minimised. Whole of vehicle life (35yrs) and logistics support can be reduced by 50% compared to existing systems.
- b. **Measure:** Improved runflat capability as the runflat sections are manufactured specifically to match the tyre dynamics in standard and low-pressure operational conditions as well as full tyre deflation situations, thereby easily achieving and exceeding the current Finabel standards.
- c. **Technology Readiness:** Tyron Runflat solutions are already in use with many defence and security organisations, from the extremes of high temperature desert to arctic cold conditions.
- d. **Interfaces/Interoperability:** The Tyron Runflat solutions work with existing wheel, tyre, and central tyre inflation systems.
- e. **Training:** No special tools are required. Training is purely workshop based and supported by the Tyron team. The Tyron solutions are lighter and more user friendly, so there are no HSE issues for staff/engineers.
- f. **Weight:** With solutions allowing up to 40% weight reduction in the runflat, and significantly more in the wheel, an 8x8 with 16.00r20 tyres, could save more than 250kg in unstrung mass, a huge benefit in vehicle capacity!



ATR-SP



ATR-MP



BEADLOCK



SAFETY BAND