



# ALL CHOKED UP

We put four air filters to the test to see what's really best for your engine!

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All too often we let the air filter in our 4WDs go unchecked following a few off-road trips. Every air filter deserves some attention following a trip off-road, regardless of what type of filter you're running. The air filter plays such an important role in delivering a good, clean supply of air to your engine and it'll have a big impact on economy once it gets all choked up. While the servicing aspect of the air filter remains a given, our choice of filters is always a passionate talking point around the campfire.

The debate about what air filter is best has raged for as long as we can remember. What really is best for the longevity of your engine? Are washable filters as effective at filtering that fine bulldust as a factory filter element? Can a foam filter really flow more air? Do any of these filters give you a performance or reliability advantage? We take four styles of air filters and put them through a series of tests designed to separate the fluff from the facts.

We enlisted the help of Andrew at Berrima Diesel to conduct back-to-back dyno testing with each filter fitted to our test vehicle. We also put each filter through a filtration test to

determine the filter's ability to do its job sufficiently. Let's take a look at the results.

## HOW THEY WORK

### PLEATED PAPER FILTERS

Manufacturers spend a lot of time and money when they develop an engine so it works efficiently over a wide range of conditions. The air filter in your engine is no exception to that rule. In the majority of vehicles, the factory-fitted air filter will be a pleated paper designed filter. These are made up of a long length of paper-based fibre filter that is tightly pleated around a centre mesh core, or across the mesh on flat panel filters.

The reason behind the pleating is to give the filter a much larger surface area than a single flat layer of filter paper could achieve. The wider and tighter this pleat is, the more surface area that can be covered, giving the filter a much better chance to catch stray dirt particles while still maintaining a good amount of airflow.

This type of filter is often cost-effective to produce, making them a cheaper option for vehicle manufacturers at the time the vehicle is first built. Both the genuine and aftermarket paper filters are often the cheapest options when it comes time to replace your air filter.

## CLEANING A PAPER FILTER

In most cases, these paper filters are considered non-serviceable. Besides the odd blow-down with an air-compressor, the filters will reach the end of the serviceable life once they become heavily soiled.

Some filters, like the genuine Toyota filter, have basic washing instructions outlined on their air filters. There are also companies that offer filter-washing services to extend the life of the filter to some degree. These cleaning options can allow good quality paper filters to be washed up to six times before the filter needs to be replaced completely.

## THE FILTERS



Genuine Toyota – Pleated paper filter



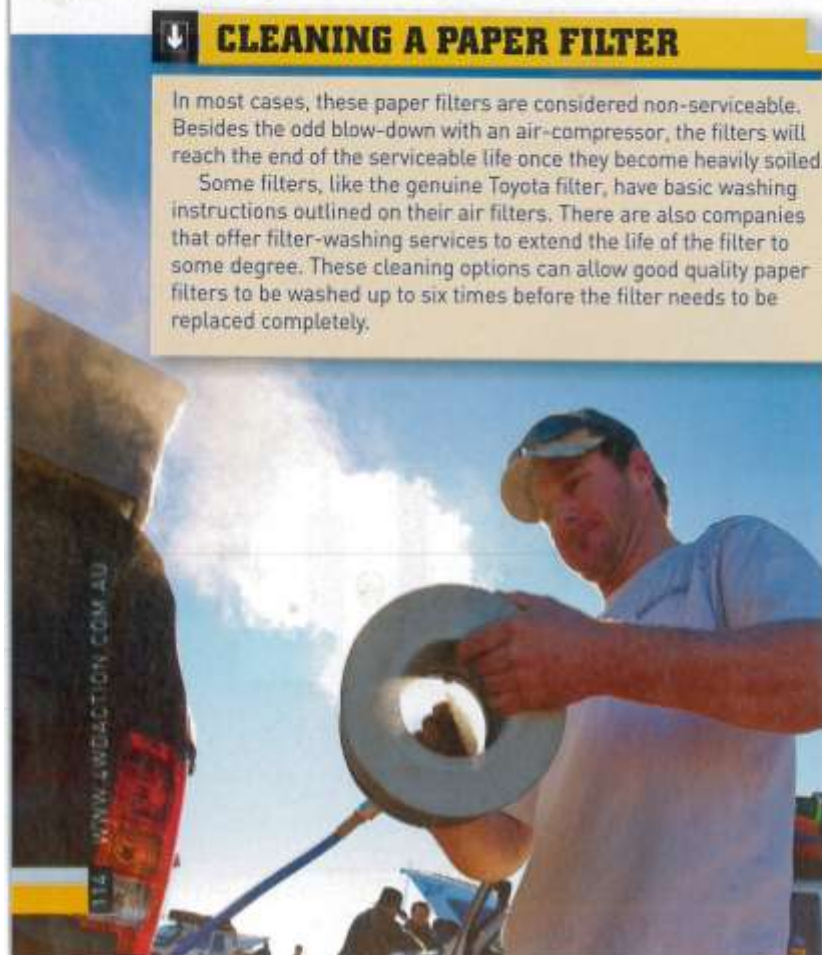
Terrain Tamer – Pleated paper filter



Uni Filter – Washable dual-stage foam



K&N – Washable pleated cotton





## OILED FOAM FILTERS

Oiled foam filters, like the Uni Filter we tested, rely on a dual layer of foam along with a special blend of oil to filter out dust from the air. There is an inner steel cage that gives inner and outer filter foam a solid frame to help retain its shape. The filter foam is oiled using a blend of heavyweight mineral oil and non-drying glue agents. Given that the foam itself is made using a rather open cell structure, it needs this oil to help trap the small dust particles before they reach your engine.

One of the key benefits to the oiled foam filters is serviceability out on the track. To be able to take

away a spare outer filter foam that takes up very little space, which can be changed midway through your trip if the conditions are extremely dusty, is definitely a plus in our book. Both the inner and outer foam filters can be washed, re-oiled and put back into use when it comes time to service the filter following a trip.

The initial purchase price of washable filters is a little higher than the standard paper filters, but the cost is recovered following just one or two services where you can simply wash and reuse the foam filter, as opposed to replacing it once it's dirty.

**DUST ENTERING THE CYLINDERS CAN DESTROY AN ENGINE IN NO TIME!**



## MICRON RATINGS

The size of foreign dust particles a filter is able to trap, before restricting its airflow, is often used to gauge its efficiency. It's compared between filters using a measurement called microns. One micron is equal to one millionth of a metre – a speck of dust that is not even recognisable to the naked eye. The micron rating refers to the size of dust particles that the filter is able to filter down to.







Using a NATA-accredited particle count unit and an external fan feeding into the standard 'Cruiser' airbox, we set up the filtration test on each air filter

### OILED PLEATED COTTON FILTERS

Similar to the pleated paper filters in some ways, oiled pleated cotton filters consist of a pleated filter media to remove contaminants from the intake air. The difference with pleated cotton filters is they use multiple layers of cotton gauze held in place with aluminium wire mesh on either side. The cotton filter material is then oiled to increase its filtering ability.

These filters can be washed, re-oiled and put back into use, making them a cost-effective replacement filter in the long term. Like the oiled foam filters, the oiled pleated cotton filters cost more initially, but can be washed and reused time and time again.

### CHASING PERFORMANCE

With many of the aftermarket air filter manufacturers claiming increases in power when using their particular filter, we were dead keen to see just how much could be gained. So we headed down to Berrima Diesel in the Southern Highlands and spent the day on the dyno with Andrew and the team.

Our test vehicle was a 100 Series live-axle 'Cruiser' that has been fitted with the 1HD-FTE engine. Throughout the day, we

monitored the ambient air temperatures to ensure there weren't any inconsistencies in intake air temp that would impact the results. With the vehicle on the dyno, each filter was given three runs to gain the average for our comparison. Between each new filter, the dyno and vehicle were allowed to cool for a period of 20 minutes. This took away any chance of the dyno giving exaggerated figures once the heat builds in the dyno itself.

Interestingly, on the dyno when it came to performance increase in the big 'Cruiser', it was extremely close between each run, putting to rest the theory that upgrading the air filter alone could dramatically increase your engine's power. While it might be true for a race-bred circuit engine, for the average 4WDer, the slight variance in performance between each filter would be almost impossible to notice out on the track.

When it came to monitoring the intake airflow restriction at the airbox, the results were just as surprising. The restriction from the air filter in the intake airstream is directly related to the air filter's airflow capability. The higher the air filter's airflow rate, the less restriction it will create when it is fitted to your airbox.

Just like the power output figures, it was difficult to split the

### WHAT'S YOUR EXPERIENCE?

We want to hear about your experiences with aftermarket and genuine air filters! Have you got your own favourite? What air filter set-up did you run on your last big trip? How did it work out? Jump onto the 4WD Action forum and let us know at [www.4wdaction.com.au](http://www.4wdaction.com.au)

### AIR FILTER PARTICLE TEST

AIR FILTER	PARTICLES / M <sup>3</sup> @ 5 microns
Uni Filter	2349.8
Terrain Tamer	4081.3
Genuine Toyota	4664.3
K&N	4982.3

Duration: 1 min

Pass Value: Less than 29,000 p/m<sup>3</sup>

Average of two test cycles

difference in the restriction stakes. As you can see in the dyno graphs, besides the no-filter run, each filter was extremely close to each other. The biggest discovery was just how much difference no filter made to the intake airstream. This can be put down to the excessive turbulence that's introduced inside the airbox. It just goes to show the lengths that vehicle manufacturers go to when they're designing every aspect of our 4WDs.

While we tested four different styles of filters using the one vehicle, the results can differ from model to model. Airbox design and intake plumbing play a big part in the engine's capability in using the available air.

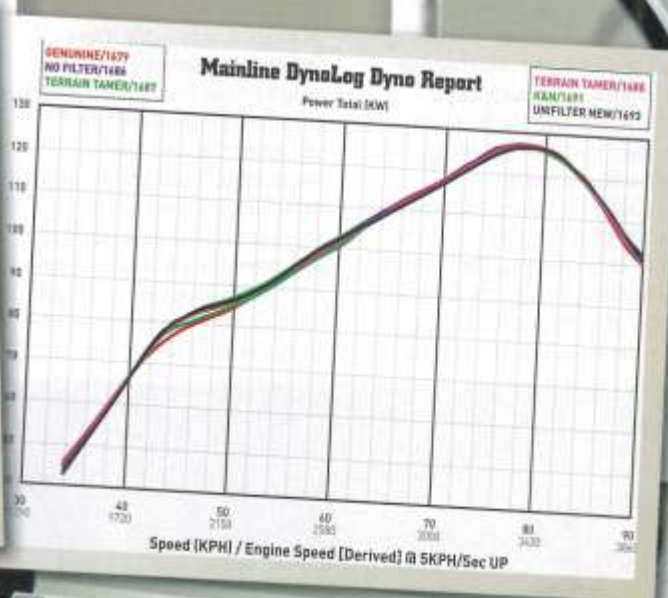
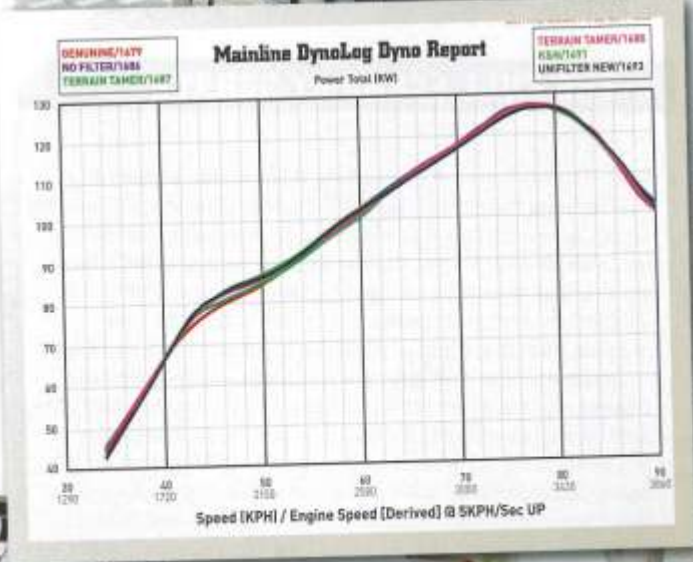
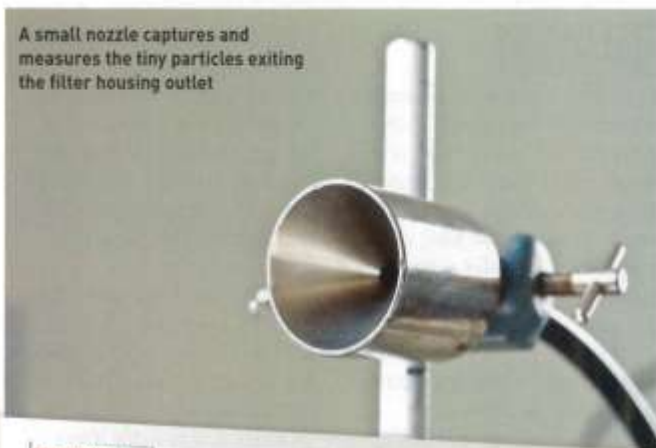




With the nozzle positioned at the filter's outlet, it feeds an air sample into the data collection unit to provide the filtration readout for each filter being tested.



A small nozzle captures and measures the tiny particles exiting the filter housing outlet.





## FILTRATION EFFICIENCY

As 4WDers, filtration for our engine is paramount if we want long-term durability. The finest amount of dust entering the cylinders can destroy an engine in no time. Whether it enters through the air filter, passes around a poorly sealed airbox or split intake pipe, it's going to give you grief in the long run.

To gain an insight into just how well each filter would deal with the fine bulldust we come across off-road, we put each one through a fine particle filtration test. We had the test conducted by a NATA-approved test facility to ensure the readings were as accurate as possible.

Using the factory Toyota airbox, we had a fan plumbed up to the inlet of the housing. The fan kept air flowing through the airbox and filter at a designated test speed. On the outlet side of the airbox, a

small nozzle was positioned to capture and measure any escaping dust particles. The specially designed nozzle is linked to the particle counter that logged the data from each test. Two tests were run back to back for each filter and the average particle count was determined.


The results from this test show which filter is best at removing dust from the engine's intake air. Given that a reading of less than 29,000 particles per cubic metre is classified as a pass, the filters performed remarkably well. The results ranged from a mere 2349p/m<sup>3</sup> to a maximum of 4982p/m<sup>3</sup> – something that each filter manufacturer should be proud of. While Terrain Tamer, Genuine Toyota and K&N were all close to each other, the standout performer in the filtration test was Uni Filter. The thick foam combined with their sticky blend of filter oil really

worked a treat, removing the most particles in the five-micron test.

## WHEN THE DUST SETTLES

We all want the most out of our 4WDs, but performance should never come at the cost of durability. Considering the harsh conditions we push our 4WDs through, reliability is what gets us home every time. Although any filter can be made to flow more air, ultimately it's the filter's ability to retain destructive

small particles of dust while still flowing well that makes it efficient. Holding back those harmful tiny particles of dust from your engine should always be the filter's number-one priority.

Don't forget that any air filter is only as good as the seals around your airbox housing and the plumbing up to the engine's intake manifold. If you're running a washable filter, regular maintenance is the key to long-term reliability. 

## THE FUEL ECONOMY DEBATE

When it comes to your engine running economically, sucking in big gulps of air easily and then expelling it out the exhaust freely has a big impact on how efficient your engine can be. Any major restriction in the intake or exhaust system will reduce your economy. While there are a number of external variables that impact your economy, ultimately in controlled conditions, less restriction in the inlet manifold equates to the best achievable fuel economy for your engine.

Often the air filter itself isn't the only restriction in the engine's inlet. Convoluted plumbing and variations in pipe diameter to get the inlet pipes to fit into a tight engine bay also have an impact on intake restrictions.

One of the biggest inlet restrictions that we can all easily avoid is a heavily blocked air filter. It will choke your engine causing you to bury the right foot more than usual, essentially using more fuel. Basically, the better an air filter can flow, the less restrictive it will be influencing a gain in fuel economy. Bear in mind that the air filter will still have to maintain a high level of filtration if it's going to be less restrictive, otherwise your engine's internals will pay the ultimate price.

## PRICE COMPARISON

**Terrain Tamer** – \$60.50

**Genuine Toyota** – \$66.90

**K&N (washable)** – \$123.00

(\$28.00 for the filter recharge kit).

**Uni Filter (washable)** – \$105.00

(\$135.00 for a combo kit including spare outer band, oil, cleaner, servicing bucket, gloves and towel, \$43.00 for a spare inner foam, \$26.50 for a spare outer foam)

Note: Prices listed are the RRP for a 100 Series Toyota LandCruiser fitted with the 1HD-FTE turbo-diesel engine.

## FOR MORE INFO

Thanks to the following companies for providing their air filters:

### K&N – MOTOSPECS

[www.motospecs.com.au](http://www.motospecs.com.au)

(02) 9847 5777

### UNI FILTER

[www.uniflow.com.au](http://www.uniflow.com.au)

(02) 4322 2007

### TERRAIN TAMER

[www.terraitamer.com](http://www.terraitamer.com)

1300 888 444

Thanks to Berrima Diesel for assisting with the dyno testing during this air filter comparo.

### BERRIMA DIESEL

[www.berrimadiesel.com.au](http://www.berrimadiesel.com.au)

(02) 4877 1256

Thanks to Mr Spares for sourcing the 100 Series air filter housing.

### MR SPARES

[www.mrspares.com](http://www.mrspares.com)

(02) 9757 1405

