



# A BREATH OF FRESH AIR

**Better airflow equals more power, but it's not always the obvious modification that'll give best results.**

Some short while back, I was graced with a visit from editor Hughes. Being in the area he took the opportunity to drop in for a chat about various stuff, including what we thought we ought to cover in the coming year as special topics. Always a difficult thing to sift through, as there are so many different subjects to cover. The past four years (gulp!) have mainly been concentrated on getting over as

much basic information about the many subjects covering Mini modification as possible. This culminated in the well received series on building a budget weekend racer. The biggest problem is space. I want lots more of it to fill, but there are only so many pages available.

The answer was agreed on as being a more detailed look at specific items, supported and

Words and photography by Keith Calver





And the first contender is... as this is a straight fight between the K&N replacement element and the cone type, I didn't bother with trying the standard paper element. It's known to be seriously restrictive as far as maximum power is concerned and gets horribly inefficient when dirty. So we have the standard plastic element with the hot air intake removed, leaving an open nozzle. This ensures the coolest intake temperature from the standard set-up. It's also the set-up I've been recommending over the cone type for years, if for no other reason than it's a great deal quieter. I have also had my reservations over the years as to the 6-7 bhp claims from K&N — all my testing hadn't shown this. My original tests conducted some 14 years ago went AWOL along with all my other stuff in a case alleviated from my car by some low-life, so I didn't have hard proof. This test was going to hopefully set that right...

## Contestants

underlined by the frequent number of questions concerning certain popular subjects in the Knowledge section of the magazine. Hence articles on tuning specific engines in specific ways, what the deal is when fitting 13 in wheels, etc. And this month's missive is the first of these popular subjects — air filters.

In the forefront of Mini tuning and improving the breathing capability of the very asthmatic A-Series, the air filter set-up is something that needs priority attention.

All the widely available (and widely varying) Stage 1 tuning kits include (at the very least) a replacement high-flow air filter element to fit into the standard plastic case. Others go for the complete replacement cone/pancake type.

The oft-asked question associated with this is 'which one's best?' The answer to that will be this month's test then.

All manner of materials have been tried and tested to establish suitability for air cleaner duties — ie the filtering of as much engine-damaging crud from the air as possible, while not restricting airflow at all (if it can be helped). Two materials seem to have been settled on and are widely used by a number of manufacturers. Each has its own camp of followers — the 'cotton gauze' mob and the 'foam' mob.

Comparisons have been made, extensive tests carried out, verbal and literary battles fought and many a personal experience thrown in in an attempt to establish one or the other as being 'the champion'. The cotton gauze disciples usually carry the day and the one holding sway in the Mini market despite all-comers' attempts to oust it, is the original (and many acclaim the best) cotton gauze filter manufactured by long established K&N. The range it produces is massive and

To add a little flavour to this 'shoot-out' I decided to throw something else into the fight — a variation on the standard casing. Giving credence to the rumours that the standard filter case is restrictive as far as breathing potential goes — moons ago I carefully calculated the cross sectional area of the 'nozzle' versus that of the opening that sits up against the elbow on the back of the carb (bottom of picture): the nozzle proving slightly smaller.

The filter case itself is more than big enough, and the filter surface area is unquestionably large enough when you consider the cone type filter has sufficient filter area to cope with 110 bhp! So to eradicate the nozzle area as a possible restriction I have bored holes in the plastic casing in the past, with seemingly good results.

I decided to try it here and tried holes in both the position you see here and also around the front vertical 'wall' on the casing. The ones shown here seemed to give the same results as those in the front 'wall' of the case but without the fierce increase in induction roar that accompanied the others. The total cross-sectional area of the six, 3/4 in diameter holes is very nearly the same as the oval elbow hole — so the original nozzle is a bonus.

Those paying attention in the first picture (above left) will have noticed the black duct tape around the edge of the casing. To save time at the rolling road, I pre-drilled these holes then simply covered them over. Note that the holes are drilled around the front edge of the filter so they are between the filter and the outside world. Pointless drilling where the air won't be filtered.



the quality outstanding for the Mini/SU market.

Testing the whole range would have been brilliant, but time and finances are short — and we really wanted to look at specific applications. Considering I'd just covered tuning small-bore engines, and these are perhaps the most popular engine size to which these Stage 1 kits are fitted, it was obvious where the starting point should be.

Add to this that the filters tested should be the popular, true direct fit/bolt on replacements (with no other jiggery-pokery

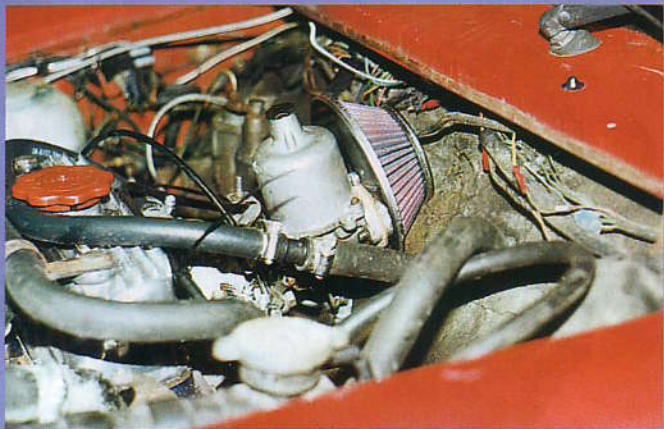
needed when fitting) the candidates list was shortened to two — the replacement element that fits inside the standard plastic case (in place of the standard paper element) and the cone type (that replaces the standard filter casing as a whole).

Now, K&N generally states that fitting said cone-type filter would find another 6-7 bhp on the A-Series engine over the standard set-up. There's no meaningful figure given for the element-type, but 'a marked improvement' should be seen. So what did we see... ➤





Beautifully made and aesthetically pleasing — the cone type K&N. Stainless steel backing plates, perfectly formed cotton gauze filter with moulded sealing edges, and very simple fitment. The promise of an extra six horses for such a simple and good looking swap proves to be beyond temptation for thousands of folk. But then all that glitters ain't necessarily gold. Long term the investment for any K&N filter is worth it, as you'll never need to replace it ever again. A million-mile warranty will see to that, providing you wash it and re-oil it carefully (following the manufacturer's instructions to the letter, of course). The main drawback with this type of total replacement filter is the noise. The induction roar when putting the engine under load (accelerating and when cruising at speed) is ear-bleed inducing. But then again — there's those that love it.

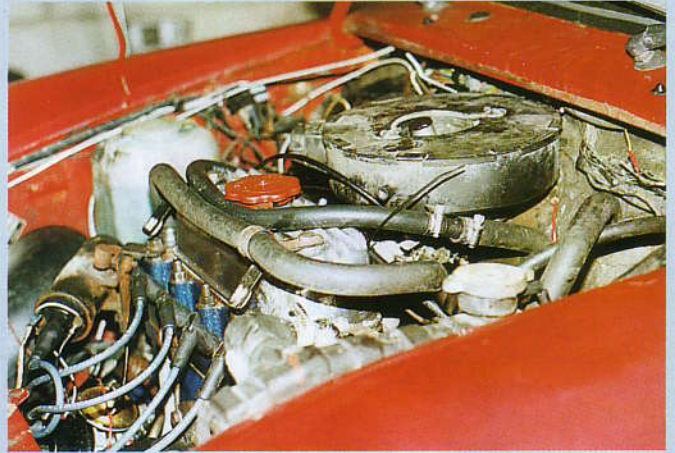


Oh the shame — that beautifully crafted shiny new filter being forced to dwell in that messy, dirty engine bay. It's a really easy-fit job though, which is why it was chosen for this test and can be installed in minutes by even the most unaccomplished DIYer. The only drawback is tuning it. This style of filter creates such a massive increase in fresh airflow available to the carb, it can cause fuelling calibration problems. There's absolutely no way the standard needle will be anything like adequate.

And this is a continual bone of contention for me. I'd love a pound for every time I've been asked what needle would be needed for such-and-such an engine with one of these filters on it, or even why a person's engine isn't running very well since they installed one. Every shop that sells these should alert the purchaser to the problem and be able to supply a needle that may not be spot on for their engine — but at least have a fighting chance of getting the fuelling somewhere near so the car can be driven to a rolling road for proper attention.

That's an extra expense vendors often neglect to mention too — a rolling road session is absolutely vital to get the best out of either of these filter conversions. Not only is the fuelling affected — but ignition timing too.

The bonus of using the replacement element is it keeps it looking very standard under the bonnet. Can be very useful in certain instances... It's a neat and tidy fit too — more than can be said for the state of the under-bonnet/engine area of my poor old nail. More than 120,000 miles and still just hanging in there. The mechanicals are all OK, but the bodywork — yoy! Andrew at GRV finds it highly amusing. He's concerned that if I get it to go any faster, the front is just going to disappear in a cloud of rust particles. And note, the holes drilled through underneath are invisible with the bonnet up.



Fine gentleman, that Andrew at GRV (Littleborough, Lancs O1706 377410). Doesn't mind mucking in to help things go smoothly/quickly. Once we'd done the two tests on the standard filter case, he was in there like a shot to whisk the old filter assembly and elbow from the back of the carb and stick the shiny new cone on. Mere minutes later we were ready for test three.

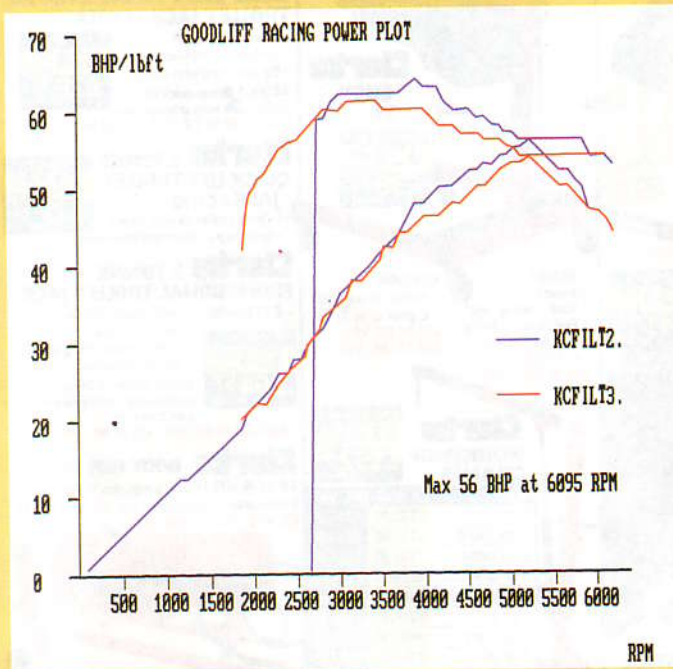
Before it was done though, I asked Andrew what he thought the result would be. He said: "Seen plenty of K&N equipped cars on 'ere of all sorts. 1300 Minis seem to benefit from them most, but I reckon the cone'll win by a couple of extra horses." Now that's what I'd generally heard and had been advising for some years — as in 'it's not worth going to the pancake/cone filter unless you want to be deafened, there's only a couple of extra brake at the top end and fuelling's a pain to sort'. Sound familiar to you regular readers? Turning the tables, Andrew asked me for my forecast on the fight. Having driven the car with the standard case, then with holes in it, I was sure there wasn't going to be anything in it. Andrew just smiled.



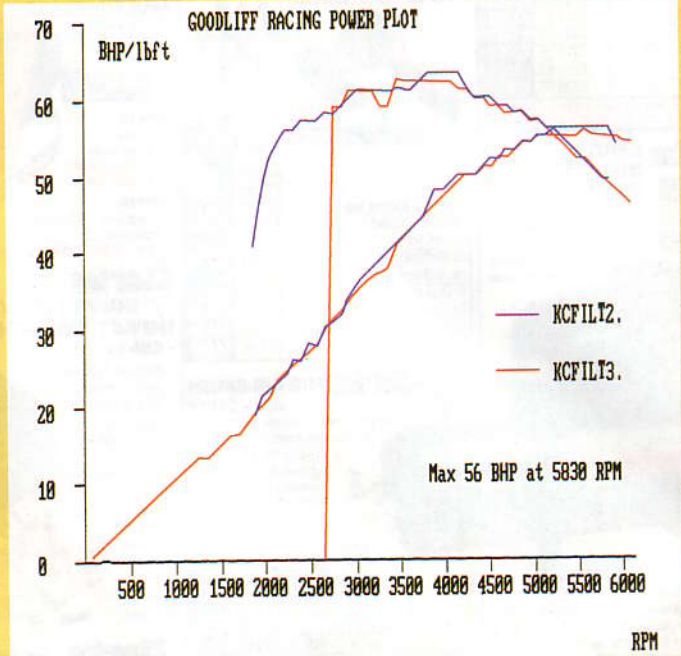




## Graph A



## Graph B



Another thrashing on the rolling road for this supersonic 1100 engine. I have to tell you I'm enjoying driving around with this engine immensely. It is so tractable, pulls so strongly, and is such fun. I'm starting to look for reasons to 'pop down the road' in it. I always come back with a silly grin on me mosh! Anyway, back to the plot. Or plots in this case.

Graph A shows the results of the standard case with element (KCFILT2 trace), and the standard case with the holes untaped (KCFILT3). A quick buzz up on the standard case to get a base line (KCFILT2) — and it gave the same figures as when I had it tuned up last month except we picked up an extra 2 lbf.ft of torque (now 61, as opposed to 59 last time). Possibly because the engine now had 1500 miles on it instead of 300. Consistent that. Even that bloomin' vertical 'hiccup' is still there.

The second run was preceded by a quick run up to check the fuelling wasn't going badly wrong. Last time on the rollers the mixture was slightly rich but was left alone, as finding a needle to provide spot-on fuelling wasn't likely. And 'tweaking' (filing) was out of the question as it would be impossible to reproduce it accurately and definitely not available from any shop.

I wanted to be able to use the results as recommendations for future inquiries. It proved to be spot-on with extra air supplied by the drilled holes everywhere except at maximum load/peak power where it had leaned out slightly. To rectify this, we changed the needle from the AAA to an AAM.

The result is trace KCFILT2. A further 2 bhp was gained, and another 3 lbf.ft of torque. Serious stuff for such a mildly modified small-bore engine. These peak figures don't tell the whole story though — the graph clearly shows the gains were widespread.

Now the 'big one'. Graph B shows trace KCFILT2 with KCFILT3 overlaid — the result of fitting the cone type filter. From the K&N 'blurb' and the prospect of an extra few horses, we were expecting a leaning out of the mixture everywhere — but particularly at the top-end. Boy were we surprised! The CO leaped from 3.8 per cent with the standard case with holes to 5.5 per cent with the cone — wild. And as the trace for KCFILT3 shows — a drop off in power and torque — a max power of 54 bhp and 63 lbf.ft. The CO wasn't out of the ballpark, and certainly not enough to cause the power loss. And again, the graphs show these differences weren't restricted to peak power.

## Summary

Andrew was more surprised than I was. My prediction seemed proven, but better than I expected. Andrew was amazed the cone filter actually made less power. But why?

Experience and a great deal of testing over the years suggest the answer is in the way the standard filter case is designed. The A-Series engine with its Siamese five-port design causes some very powerful shockwaves within the induction system. I believe the elbow on the back of the carb and the volume of the filter case dissipates these very effectively. The cone/pancake type filters reflect these shockwaves back into the induction system, causing induction pulse problems.

The unexpected increase in CO reading at peak power would also suggest that the cone filter is causing a constriction at the carb mouth, reducing airflow. A reduction in airflow will cause power loss through depleted volumetric efficiency.

## Conclusion

That famous phrase 'all that glitters isn't gold' is perfectly illustrated here. Sometimes, something that looks and sounds like it should produce the optimum results doesn't. Without a doubt, the optimum set-up on a small-bore engine is the standard plastic filter case with half a dozen 3/4 in holes drilled in it and using a K&N element, rather than the complete replacement cone/pancake unit so often fitted.

And there's a bit of good news here for those 'noise' junkies — those extra holes I cut into the casing give an induction sound very close to that of a Weber side-draught when under load, but it's as quiet as a mouse when on part throttle. The noise is addictive though...

Thanks once again to Andrew Preston and all the gents at GRV in Littleborough for their help in producing this feature. If you need any advice on tuning and are in the area, give them a call on 01706 377410.