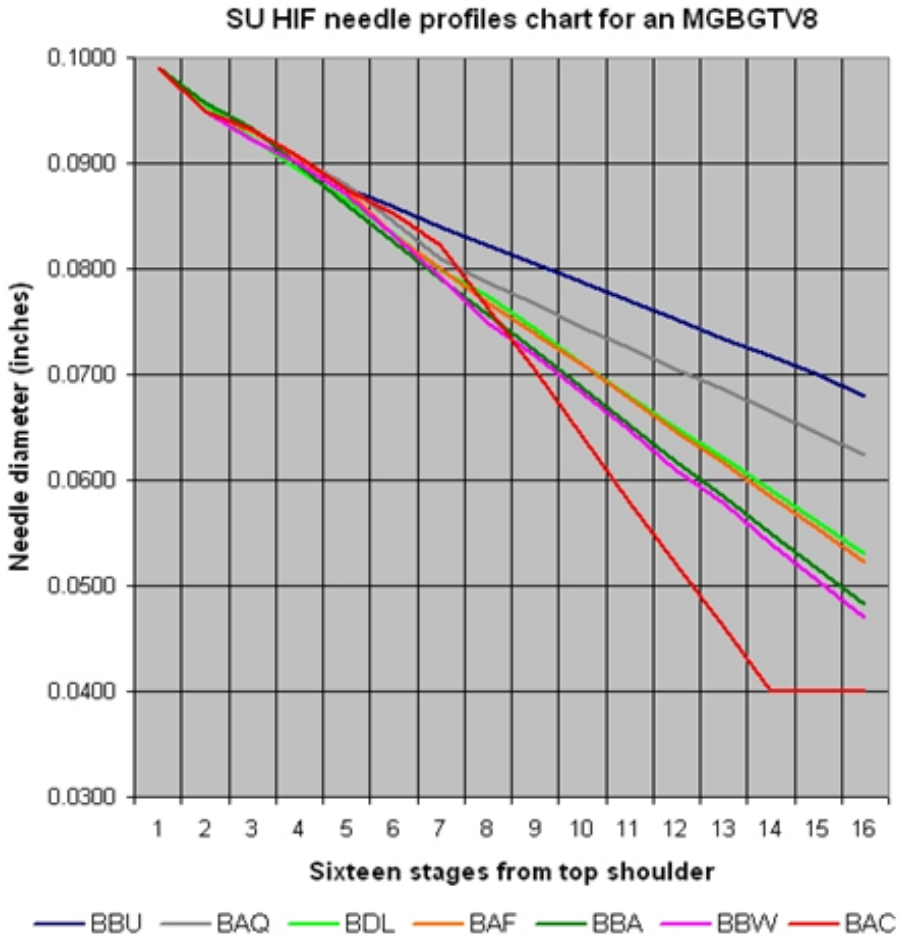
Needles for SU carburettors

A V8 Bulletin Board thread on needles for SU carburettor needles for the MGBGTV8, followed the release of V8NOTE400 from Alan Rennie on his rolling road test session with his V8. Here Gordon Hesketh-Jones describes his experience in checking SU needles on a rolling road.

Gordon Hesketh-Jones noted Abingdon originally specified the BBU needles for the SU carburettors on the V8 which give a broad spread of performance when used with the standard flat drum-type air filters. But those filters have a fairly high filtering performance which means a higher resistance to air flow. As an alternative, K & N filters are now widely used, particularly on cars with RV8-style exhaust manifolds. My car has run with this combination for the past eight or nine years and I have often noted that, even though the carburettors have been correctly set up on a KRYPTON machine, the plugs seem to be a whiter shade than might be expected, particularly after a long fast run. It seemed therefore that the K & Ns were allowing more air into the carburettors at say 2,500 rpm than the standard filters, so the engine was running lean at motorway cruising speeds. This in turn meant that I had to use extra pressure on the right-hand pedal when accelerating from 70 to 90 mph - in Germany of course!

A study of the SU needle charts suggested that using BBA needles (fifth profile down on the chart) would effectively allow more petrol into the engine at around 2,500 rpm to balance things out, but the only way to find out was to run a comparative test. So a round trip of just 650 miles from Cornwall to the NEC and on to Buckingham showed the improvement in mid-range performance with the BBA needles is dramatic – the pick-up, acceleration and "lungeability" is quite extraordinary and surprised many a BMW driver. The way the car will accelerate around 70 is astonishing – but it comes at a price, for the petrol consumption for that trip, 90% on motorways or dual carriageways, was 26.3 mpg. By comparison, on long motorway hauls with the BBU needles we would regularly show from 30 mpg up to 34 mpg, always on the basis of filling from brim to brim. On our many long-distance European type trips with the BBU needles in place we have had averages of better than 29 mpg for a whole 5,000 to 6,000 mile trip which would include city, country lane, and mountain driving.

So it seems to me that RV8 manifolds do off-set the effective power deficiency of the BBU needles at around 2,500 rpm (when using K & Ns) and the combination will give a reasonable balance between performance and economy. However if you want the improved performance, fit the BBA needles and accept the extra fuel cost!



Nigel Melbert posted a response noting his V8 is fitted with tubular manifolds and K & N filters and he has changed the needles to BAC (bottom profile on the chart) which produces acceptable average fuel consumption figures of 30 to 32 mpg on long motorway runs and 27 to 28 mpg elsewhere without any apparent detriment to the performance.

Bob Owen, who takes his V8 down to Italy quite often, commented "my V8 is a standard 3.5 with original cast-iron exhaust manifolds. I have had K & N filters fitted for the last ten years. Beech Hill Garage recommended that I fit BAF needles (fourth profile down on the chart) at the changeover to stop mixture weakening as a result of the improved breathing. These appear to perform well and give 30 mpg plus on a long mixed run (3,000 miles to, in and from Italy). For the same set-up Clive Wheatley recommended BBW needles (sixth profile down) but I have not tried these. So there seems to be a big choice!

Gordon Hesketh-Jones responded with some further thoughts. The carburettors on the V8 use spring-loaded needles of 0.1 inch diameter and there are in fact 124 needles in this range – all with different profiles of taper, so the variety of profiles is huge. The SU needle charts list sixteen measurement points at every ⅛" along the taper for each needle. Stage 1 is the idling speed and at 0.099" is common for the needles in the diagram above. Stage 16 represents full throttle.

The chart above shows the profiles for a selection of needles for the MGBGTV8 with the top profile for the original BBU needle. Probably the dimensions at stages 6 to 10 on the chart would best relate to our 2,000-2,500 rpm motorway cruising speed. Obviously, the smaller the diameter of the jet, the greater the petrol flow: The Factory-standard BBU needle is potentially the most economical and the BAC needle used by Nigel Melbert has the smallest diameters at those points which makes me think it might be the most petrol-hungry. The BAF used by Bob Owen sits neatly in the middle of this range so will be fitted before my next long run to check the fuel consumption with that needle.

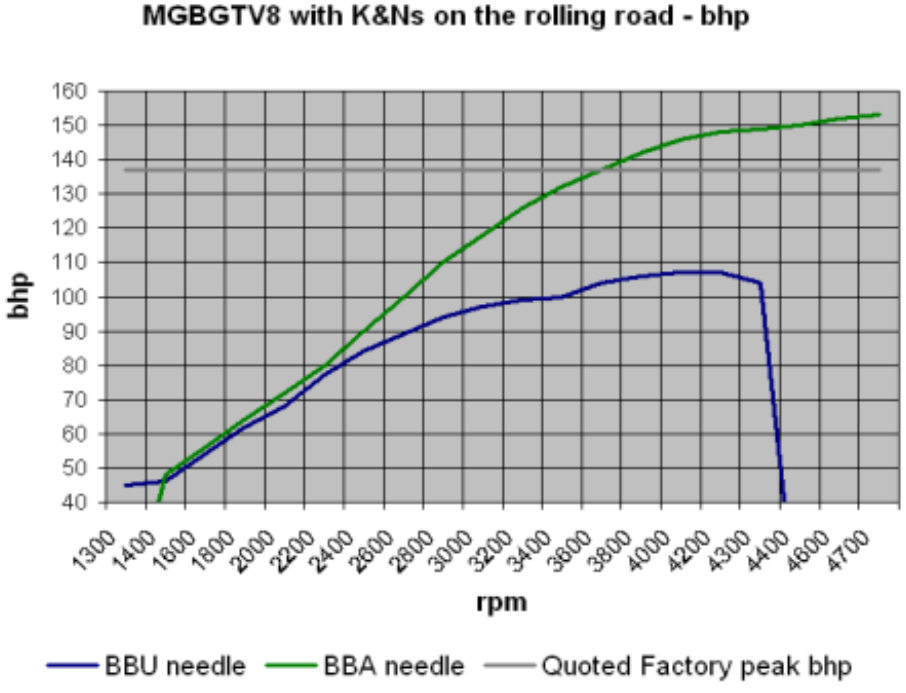
Rolling road test session

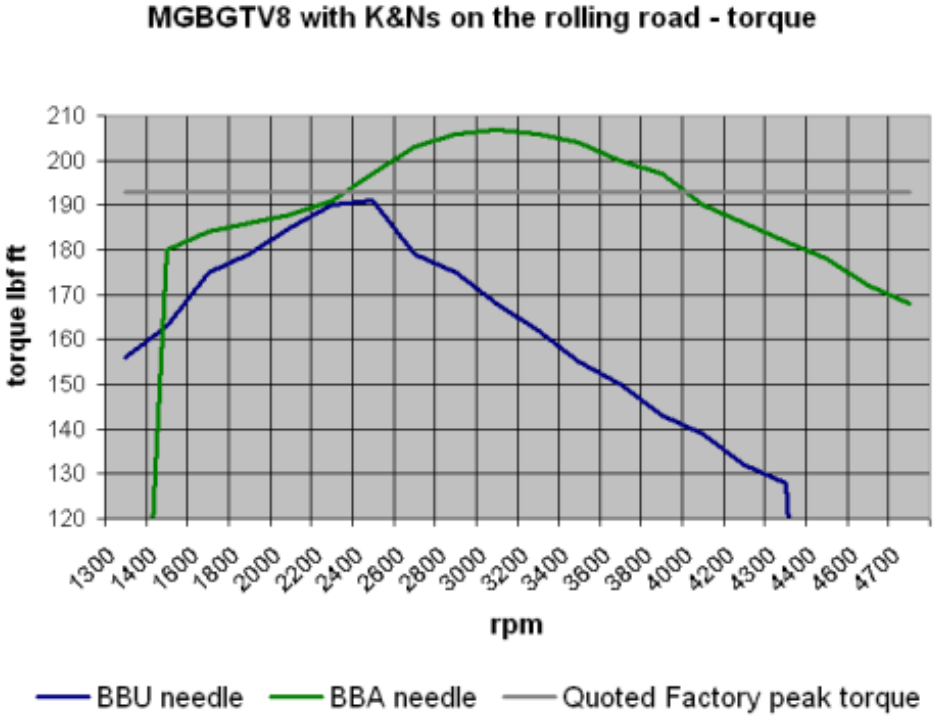
Gordon Hesketh-Jones (Harvest Gold 1904) from Cornwall has clocked up around 400,000 miles using his V8 a great deal in the UK and touring on Mainland Europe. He decided it was time to check out his carburettor needle choice and settings on a rolling road.

If you make any change at all from the original carburettor, exhaust, ignition and air filter arrangements from that tested and specified by the Factory, then you should go through a rolling road test to sort out the correct needles and settings for use with your new filters and other equipment. In my case I had covered around 100,000 miles with K & N filters plus RV8 manifolds and, whilst this arrangement gave excellent fuel economy on long continental runs, I could see that the power output was not as strong as it should have been. Recently I had changed from the original BBU needles to the much richer BBA. These BBAs gave excellent acceleration but at the cost of far worse petrol consumption, so I decided that some scientific tests were needed to find out more about the performance of the two types of needles I had used so far. I made an appointment for tests at Richard Bros Ltd in Redruth (tel 01209 212234) as they have an extremely modern and comprehensive TAT rolling road with all sorts of Bosch diagnostic and data acquisition computers.

It was encouraging on arrival to see an assortment of interesting cars there such as Lotus/Caterham Sevens, an “E” type Jaguar, a genuine rally Austin Healey 3000 and many others. Their set-up was capable of measuring up to 1,200 bhp but it was highly unlikely that my MGBGTV8 would exceed this figure at any time! The first stage is to mount the rear wheels centrally onto the rollers and then hefty luggage straps (similar to those used to fasten bulky loads on lorries) were used to secure the car at the front and the rear to eyebolts in the floor. They were tightened up with ratchets on those straps to prevent the car from moving. A huge axial fan (3ft diameter) was located in front of the car to provide a gale of cooling air during the power runs. After this a calibration run was carried out which entailed a run up to an equivalent of 60mph in both 4th and 5th gears, during which the emissions and ignition setting were checked. The computer also calculated the difference between the power delivered to the rear wheels and the effective fly-wheel power. This was needed for a comparison with the handbook figures which are often thought to be optimistic, particularly when reading American magazines.

During the power runs four graphs were produced showing the fly-wheel power, the road-wheel power, the torque and the lambda curve. The lambda curve measures the mixture going into the engine and should be basically a flat line at around 0.85 to 0.90 – roughly equal to between 4% to 5% on a full-throttle basis as opposed to the 3.5% CO2 reading you should see when your car is checked at tick-over during its MoT emissions test. The lambda curve therefore shows whether the mixture your needles are providing is too rich or too weak throughout the whole rev range as opposed to an MoT emissions test which is just done at tick-over speed. Having said that, the advice from Richards Bros for setting up SU carburettors is to have a slightly richer mixture at low engine speeds to improve pick-up and to overcome light-throttle flat-spots. A separate diagnostic machine





measured the CO2 and also the hydrocarbons - i.e. un-burnt fuel - which could point to a variety of problems such as worn or faulty spark plugs, timing errors, or lack of cylinder compression. The acceptable figures for carburettor-engined cars are in the range of 300 to 400 ppm (parts per million). These readings were monitored during the test and confirmed the subsequent lambda curves on the graphs.

The Factory figures for the MGBGTV8 engine are 137bhp at 5,000rpm and 193lbf/ft of torque at 2,900rpm, however the technique Richards Bros use is to run the engine speed up progressively until they see the power curve dropping off – there is no point in going further. To underline that I had already explained to them that I could not remember when I last took the engine over 4,000rpm!

So, the richer BBA needles showed a roughly 12% increase in power output and a 6% increase in torque over the Factory figures, however I already know that these needles result in a motorway petrol consumption of around 26mpg which these days is expensive no matter how exhilarating the increase in power and acceleration may be. The lambda curve was, surprisingly, below the ideal 0.85 reading up to 2,800rpm but slightly above this figure when over 2,800rpm.

The BBU needles fitted originally at the Factory clearly do not work well with the K & N filters which allow in too much air, so that the lambda curve showed the engine running weak at all times – something I had been aware of over the years from looking at the colour of the plugs after long motorway runs. As can be seen, these needles failed to produce anywhere near the peak bhp or torque figures, however in real-life driving conditions nowadays I rarely go much over 3,000rpm and my main focus is on the economy and reaction time at around 2,500rpm – the typical motorway cruising speed. It is worth noting from my records that over the past 100,000 miles with the BBU needles, K & N filters and RV8 manifolds in place the car has averaged 26-27 mpg on local running and 30-34 mpg on long motorway hauls. Also, if I look at the torque figures at 2,500rpm I see 198lbf/ft for the BBA and 181lbf/ft for the BBU so there is not a great deal of difference in the range of my main usage.

The rolling road session, including the calibration run, two power runs with the BBA needles, fitting the BBU needles and adjusting the carburettors plus two power runs with the BBUs, took two hours. As we drove home through the hills my wife and I both remarked how sprightly the engine felt even with the BBU needles in place. Had the high-rpm runs given the combustion chambers a good clean-out? We don't know but could certainly tell the difference. Richards Bros will consider these results and will let me know which SU needles best suit my driving pattern and economy objectives, then we will arrange fitting and a retest on the rolling road during which they will use a "retarded dyno technique" which simulates the actual work the engine has to do to accelerate the car from say 60mph to 80mph in fifth gear. This then gives real-life fuel consumption and a revised lambda curve.

Dyno sessions at MGLive! 2009

Bernie Bowden and his team from Novatech in Slough provided members with three power runs and then printouts of the brake horsepower and torque curves and air/fuel mixture readings for their roadgoing MGV8s. Ralph Coulson's attractive V8 Roadster in Tornado Red, produced a maximum of 193bhp at the wheels.