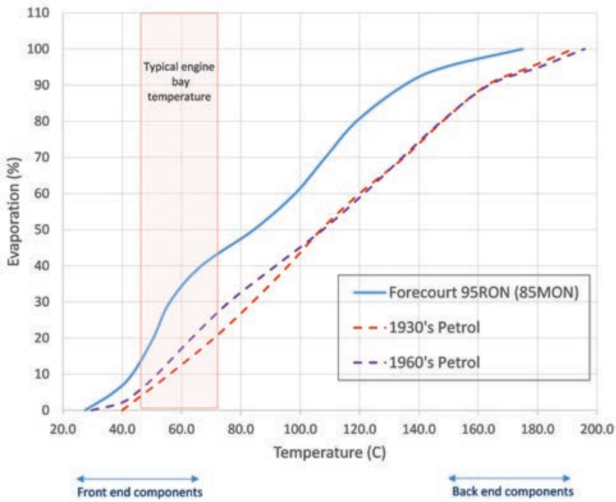
Volatility profiles – modern v/s classic petrol



2-1: Evaporation v/s temperature.

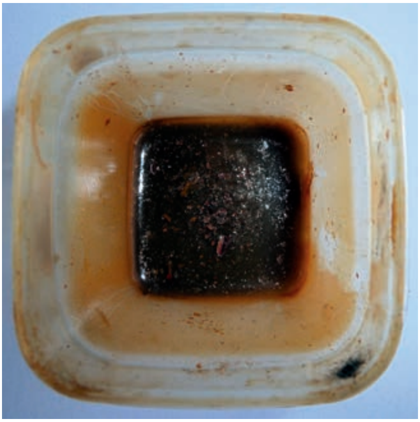
At a temperature of 75°C (167°F) 45 per cent of modern petrol, nearly half, will have evaporated, twice the volume of classic petrol. This temperature is typical of those that may be found in the engine bay of a car.

Storage problems

If a car, classic or modern, is not used for a few weeks, the petrol stored in its tank can 'go off.' Owners have reported that their cars are difficult to start. When they finally do, they run rough until filled with a fresh tank of petrol. The front end components of modern petrol evaporate at ambient temperatures, changing its characteristics. Data from BP Australia Ltd produced in 2005, demonstrates this effect:

Time	1 Week	2 Weeks	3 Weeks	4 Weeks	5 Weeks
Per cent volume of petrol lost	3%	5%	8%	10%	15%
Density (gm/cc)	0.75	0.76	0.765	0.78	0.79

With fewer front end components, the petrol does not evaporate as readily; it is harder to start the engine. When it does start, the increased density will cause the engine to run rich and rough.



3-3: Over-winter storage container – ethanol and water.

Figure 3-4 shows the severity of the corrosion. The top photograph shows the steel and aluminium before the test. The bottom photograph is the two samples after they were removed from the container. The degree of corrosion of both the steel and aluminium is extreme.

This problem occurs in practice. Figure 3-5 shows similar corrosion inside one of my float chambers, possibly caused by rain entering through the tickler pin when driving in heavy rain.

The dark line about 12 o'clock on the bottom of the chamber is caused by the corrosion. When the float chamber was opened, there was what looked like a worm, sitting underneath the petrol. This was almost certainly a small quantity of water that had absorbed ethanol.

Figure 3-6 shows the petrol

3.4: Before …

… and after.

3-5: Corrosion in float chamber.

The SU carburettor is a volumetric device. It measures volumes of air and petrol. AFR is defined as a mass ratio. The volume of a given mass of petrol or air depends on its density. The density of petrol is defined by the producers and changes very little. However, the density of air can vary with ambient temperature, barometric air pressure or altitude. Fortunately, the SU is relatively insensitive to these changes, allowing our cars to work in the cold of winter, the heat of summer, at sea level and when driving over the top of alpine passes.

What is amazing is that it achieves all this with only one moving part!

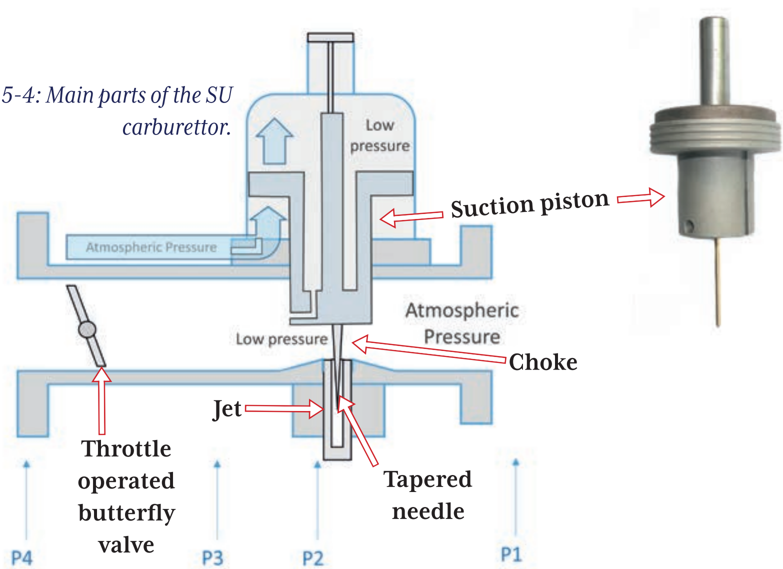
For many, the SU carburettor is something to be left untouched. Once set up, it will continue to work for many miles, but it does benefit from regular maintenance. Changes in modern fuel means they may need to be re-tuned to deliver the best performance.

How does an SU carburettor work?

The two functions of the SU or Stromberg carburettor are to control and measure the volume of air flowing into the engine. The butterfly valve, connected to the accelerator, controls the volume. Measurement is achieved by a piston fitted inside the suction chamber. Sitting on top of the carburettor body, this is the most recognisable feature of these carburettors.

The carburettor inlet can be thought of as consisting of four different areas (Figure 5-4). These are labelled P1 to P4 under the diagram.

5-4: Main parts of the SU carburettor.



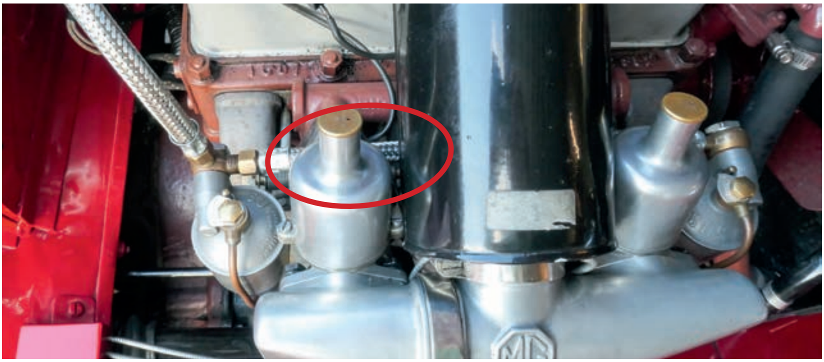
the bottom of the fuel pump rather than from the top. Pancake air filters fitted to the carburettor would draw in colder air from the slits in the bonnet (hood).

Another example is shown in Figures 9-1a and 9-1b.

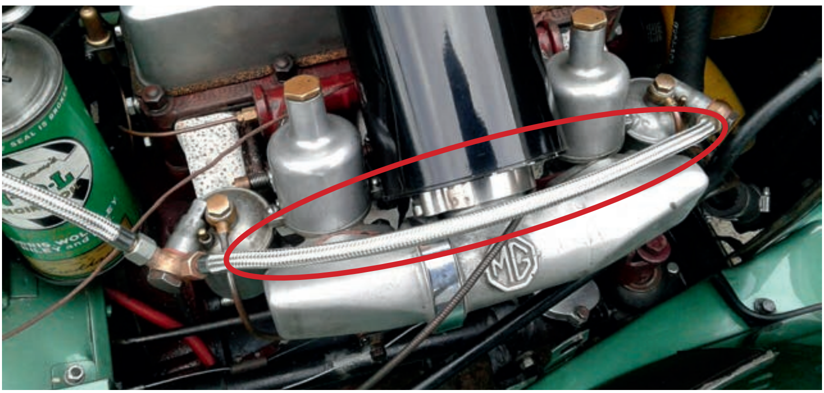
Figure 9-1a shows the standard routing of the pipe linking the two carburettors on the MG TC. The braided pipe is just visible passing underneath the black air filter. It passes directly over the top of the exhaust manifold.

Figure 9-1b shows the modification. The pipe is looped over the top of the air filter away from the exhaust manifold into the cooler air.

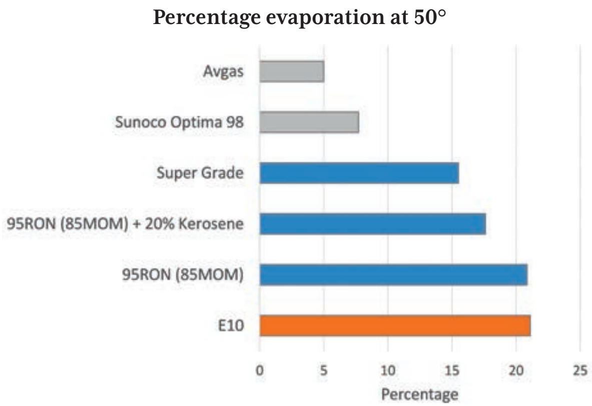
Some models of Triumph cars suffer from similar issues with the routing of their fuel pipes. In this case, the pipe from the fuel pump to the carburettors runs around the front of the engine. Passing behind the radiator cooling fan. Hot air from the radiator is blown directly onto this pipe. Re-routing the pipe to pass below the radiator fan may be one option.



9-1a : MG TC before re-routing …



9-1b: … and after re-routing.



10-2: Percentage evaporation at 50°C.

volatility below 50°C. A better solution is to add kerosene to a super grade petrol to further reduce its low temperature volatility.

Distillation tests must be performed by specialists. Even so, it is possible, but not always easy, to find the specifications for standard pump fuels. Perform an internet search for a fuel brand and type followed by 'product data sheet.' This may give a reference to the manufacturer's test data for that fuel.

Typically they will contain a Distillation section, eg:

Parameter (BS Methods)	Units	BS or HM Revenue & Customs Limit		Typical
		Min	Max	
...				
Distillation:				
Evaporated @ 70°C	% (V/V)	22.0 (W) 20.0 (S)	50.0 (W).48.0 (S)	**42 (W) 40 (S)**
Evaporated @100	% (V/V)	46.0	71.0	59
Evaporated @ 150	% (V/V)	75.0	-	91
Final Boiling Point	°C	-	210	185
Residue	% (V/V)	-	2	1

The figure of interest is the 'Evaporated @ 70°C.' For the winter version of this fuel (W), 42 per cent of its volume will have evaporated at 70°C, for the summer fuel (S) this figure is 40 per cent. Choose a brand and type of fuel with the lowest figures for the evaporation at 70°C.

For every test, the timing was set to give the maximum power. From this data it is possible to calculate the ideal centrifugal and the vacuum advance curves.

Figure 12-4 compares the centrifugal advance curve from the Manchester data (blue curve) with the original (red curve). For the original curve, the static advance is set to that recommended in the manufacturer's handbook.

This reflects the previous findings. Below 3000rpm the engine does not run as well as it did originally. Up to 3000rpm, the original advance curve is too retarded. Above 3000rpm it becomes a better match to that measured at Manchester.

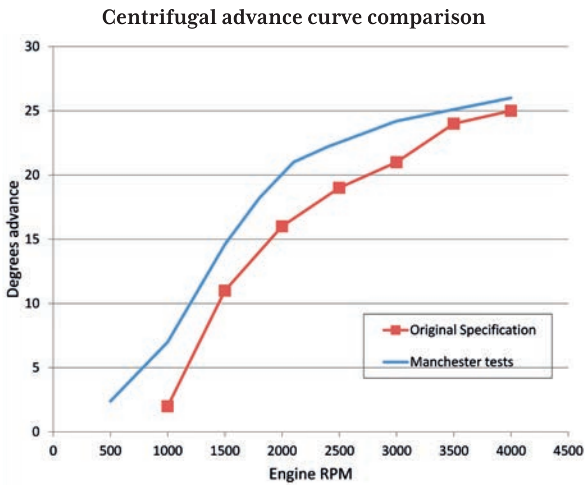


Figure 12-4: Measured v/s original centrifugal advance curve.

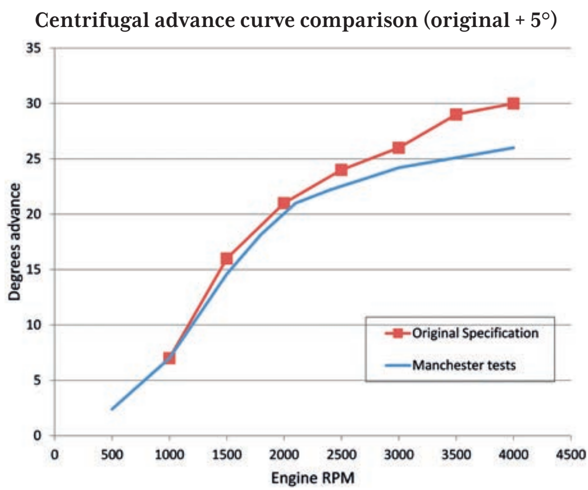


Figure 12-5: Original advance by 5°.