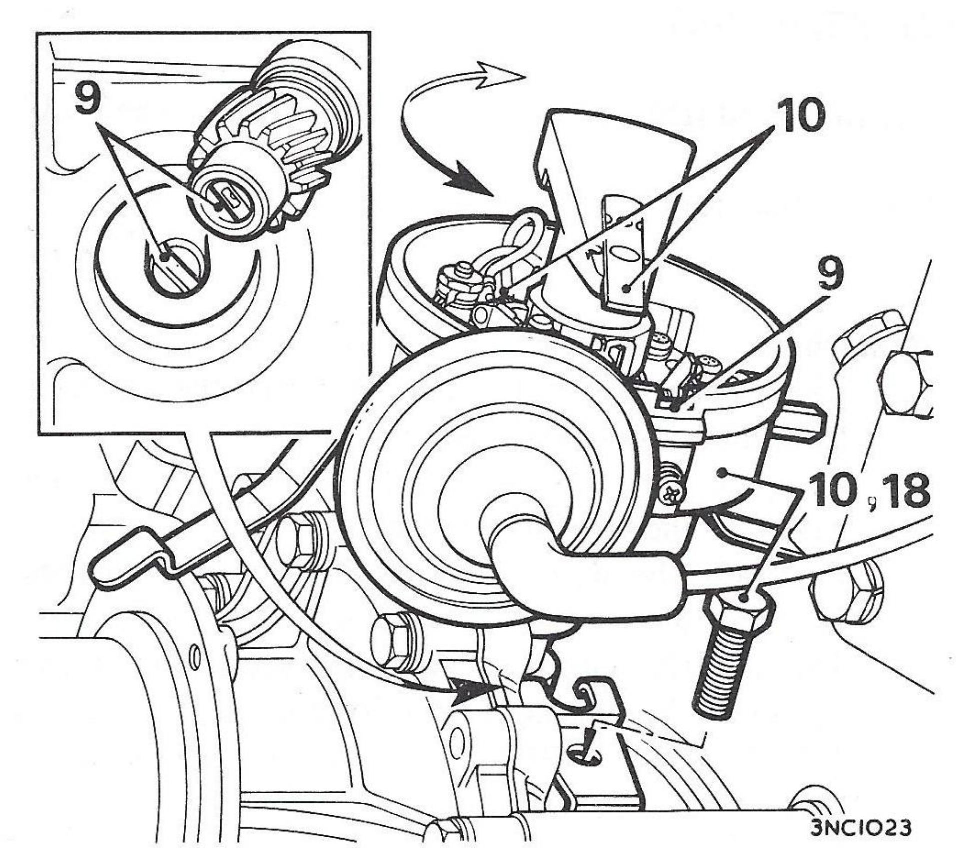

Ignition timing – why do we need to advance the spark?

Almost all distributors that we meet have a set of bob weights and springs as well as a vacuum operated advance mechanism, but it may not clear why it is needed. Nic Houslip admits it was somewhat of a mystery to me until he sat down one day and thought about it.

Everyone knows that as engine speed increases the spark must be advanced i.e. occur earlier in the combustion cycle but let's just think about why. As the mixture is compressed by the rising piston it is ready to be ignited. A spark across the points of the plug will do this very nicely, but the flame that it starts takes a finite, although very small, amount of time to propagate throughout all the compressed mixture. To ensure that the maximum burning rate and gas production occurs, **it is necessary to fire the spark a short while before TDC** so that the resulting build up of gas pressure can push the piston downwards and turn the crankshaft.

The flame propagation speed can be thought of as being nearly constant, but the engine speed can vary from under 1,000 RPM to, in the case of the V8, a maximum of 6,000 RPM. What this means is that at the lower speed the crank will make one revolution in 60 milliseconds. For clarity that is 60/1000th of a Second, and later I will use the abbreviation mS to avoid repetition. Now if we speed the engine up to its maximum, that revolution will only take 1000/6000 = 1/6th of the time or only 10 mS

So, you can see that as engine speed increases the spark needs to occur earlier to allow maximum pressure to develop when the piston has just passed TDC. The bob weights are rotated on the distributor spindle and want to fly outwards but are restrained by the springs. As they move outwards they cause the contact breaker cam to move relative to the spindle so that the effect is to open the points slightly earlier. The bob weights and spring selection are critical to giving a correct advance curve, the amount of advance compared to engine speed when plotted on a graph. The springs, bob weights and their pivots must be in good condition. Do not stretch the springs.

If the spark occurs too early the maximum pressure will occur when the piston is approaching TDC and the result is a sudden attempt by the burning gas to slow the piston rising, which causes a knock sound we call "Pinking". It really ought to be called Pinging, but it has stuck for almost a century now!

If the spark occurs after TDC the cylinder is losing some of the gas pressure that is built up as the piston is accelerated downwards by the crank. Both advanced and retarded sparks sap power from the engine, pinking can damage the piston, even making a hole in it if allowed to continue while retarded sparks cause increased exhaust gas temperature with the possibility of burned exhaust valves or seats.

Having got to the nub of the need for advance and how it changes with speed, let's now think about the vacuum capsule. Imagine bowling along a nice straight level road at 2,500 RPM, throttle opening will be small and manifold vacuum relatively high, so the vacuum capsule will advance the spark to near maximum. Now you start to climb a hill, so to maintain speed, you increase the throttle opening because you need more power, remember the throttle pedal controls power, not speed, but as you open the throttle the manifold vacuum decreases and the vacuum capsule retards the spark a little. If you applied maximum throttle with the spark advanced the engine would Pink,

Because of the difference between engines the rate at which spark must advance with engine speed might be different, so the bob weights in the distributor and the springs that control them are selected for optimum advance over the speed range. That is clear, but here is an important fact; the bob weight, spring and the vacuum advance capsule are selected by the engine manufacturer to give optimum performance for that engine and in its intended application. A Distributor for a different make of engine will probably not perform as expected, and a distributor from an engine for a light car might not work as well if that same engine were installed in a heavy car.

From this we are aware that **ignition timing is a sensitive issue**, but there are further factors we must include. The fuel used today is very different to that available when the MGBGTV8 was introduced, so your spark timing may not be optimum with today's fuel. If you changed anything affecting the **intake** (air filters) or **exhaust** (manifolds or silencers) it may again not be optimum. And last, but in no means least, if you changed to an electronic distributor, how do you know that the timing is optimal?

Normally ignition timing is set statically; the old way was with a piece of cigarette paper between the points, but an electronic distributor has no points! OK so you take stab in the dark and set the distributor roughly where you think it should be and with luck the engine will run. Now, by consulting the handbook you look up the data and find that it should be **8 degrees BTDC at 1,000 RPM**, so you set it at that with a stroboscope.

But is that figure optimal? Given that there have been changes to the engine and it ancillaries it may not be. Unless you are prepared to spend a large part of the rest of your life with an assistant with a stop watch and time the car's acceleration in various gears under various conditions which will enable you to adjust the timing by a small increment either way, the **only solution is to get it on a rolling road dynamometer**. The dynamometer is a device that absorbs the engine power and indicates on a dial or screen how much power the engine is producing. How it does that need not concern us here.

The dynamometer engineer will firstly set the carburetion correctly for optimum combustion, by measuring the exhaust gas constituents under working conditions, then do a maximum power run over the speed range, having noted the figure, adjust the ignition a little more advanced, run again, if power improved make further small adjustments same way to find the sweet spot, if not improved make an adjustment the other way, again to find the sweet spot. It is worth commenting here that if your carburettors have not been serviced or rebuilt for some years, it might be the right time to do this before investing in a dynamometer session.

Ignition timing is much more important in a time when we are concerned about emissions and fuel consumption. Getting it right also makes the car much nicer to drive. For those who are still using an original distributor with contact breaker points, the need for ignition advance doesn't change, and the bob weighs, springs and vacuum capsule are still needed, you have the advantage of being able to set the timing statically, but because of the changes in fuel over the years and the improvement in air filters and manifolds, you may still need to get the timing checked on a dynamometer.

Contact breaker distributors have another adjustment that electronic distributors do not have, that is also critical, it is called setting the dwell angle or dwell time. This adjusts the relative position of the contact breaker points and the cam that drives them to set the optimum closed time. Why? The way the coil and condenser work to produce a spark requires that the points are closed for long enough to allow current to flow through the coil to "charge" or build up a large magnetic field inside it. The collapse of this field when the current ceases as the points open allows the coil to discharge through the condenser. Simply put, if the coil does not have time to charge properly, it will not have enough energy to discharge into the condenser to produce a nice fat spark. Because there are 8 cylinders to fire every two revolutions setting the dwell angle is more important on a V8 than on a 4 cylinder, as it maximises the time to charge the coil. Some V8s have in the past used two four-cylinder distributors driven together to maximise the coil charging time.

Interesting thought

Diesel engines are noted for their much higher torque output than petrol engines and do so at lower RPM. Why do they exhibit this characteristic? The burning of petrol air mixture is more like an explosion, very rapid, but the burning of diesel fuel and air is much slower, and the combustion process is producing gas for much longer, maintaining pressure on the piston for longer. Diesels tend to be longer stoke engines to develop the higher compression ratios needed to ignite the fuel, which means the crank is also longer, and the leverage at the crank is greater. But as the combustion is slower diesels must develop their power at much lower RPM.

Adjusting the dwell angle

With the original distributor fitted to the Factory MGBGTV8 the dwell angle can be adjusted to 26 to 28 degrees whilst the engine is running using a dwell meter. On the side of the distributor there is a **convenient hexagon headed screw** (**17**) on the distributor body – turn clockwise to reduce the dwell angle and anticlockwise to increase it. Simply clip the positive lead of the dwell meter to the negative connector at the base of the coil (that's the low tension lead from the coil to the distributor) and the earth lead of the meter to a suitable earth on the car. With the engine running, the meter will then read the pulses to calculate the dwell angle. The **dwell angle for the V8 engine is between 26 and 28 degrees**. If you have a dwell meter for a four cylinder engine then you will need to set the dwell on the V8 engine with that meter to show a reading on the meter screen of between 52 and 56 degrees.

Footnotes

TDC or Top Dead Centre is the position of a piston in No 1 cylinder is at its highest point on the compression stroke.

A Millisecond (mS) is a thousandth of a second.

Dwell angle is the amount of time measured in degrees of rotation that contact breakers close in a distributor. For the V8 engine in an MGBGTV8 the **dwell angle is 26 to 28 degrees**. It can be measured with a dwell meter.

Distributor diagram – (**9**) oil pump spindle, (**10**) distributor body, (**18**) securing clamp and external dwell adjustment screw (**17**)

Below: diagram in the MGBGTV8 Supplement AKD8468 page "Sheet 2 86.35.20" showing the distributor and the convenient external dwell adjustment screw (**17**).