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DWELL vs POINT GAP

WHAT IS DWELL ANGLE?

The question is often asked, how does one calculate dwell angle from the manufacturers specification for point gap? Actually, it is the other way around - point gap is derived from the requirements for dwell angle. Because, in "the good old days," most mechanics didn't have dwell meters, the dwell angle was expressed in terms of point gap. Any competent mechanic had a set of feeler gauges. To understand the relationship between point gap and dwell, consider the operation of the 4-stroke internal combustion engine, using the Kittering ignition system, as used in nearly all Austin-Healeys, Triumphs, MGs, etc.

For each complete combustion cycle, i.e., two revolutions of the crank, the distributor rotor makes one revolution, or 360 degrees. During this 360 degrees of rotation, each cylinder receives one spark. For a six cylinder engine, there are 60 degrees of distributor rotation between each spark event (360/6 = 60. For a 4 cylinder engine, 90 degrees, and for an eight cylinder, 45 degrees, etc.).

During this 60 degrees of rotation, the points must: open to allow the magnetic field in the primary winding of the coil to collapse, generating a high voltage discharge from the secondary side; remain open long enough for the spark energy to do its work and for the secondary circuit to reach equilibrium; re-close; remain closed long enough to allow the magnetic field to build up in the primary side of the coil again; and then reopen. If the points don't stay closed long enough to build the magnetic field, a weak spark will result. Too long, and the discharge time is reduced, and the coil can over heat (at low RPM).

Dwell, then, is defined as the number of degrees of rotation of the distributor, during which the points remain closed. How is it set? There is only one link between the engine and the points, and that is the rotor button, or cam, on the distributor shaft - how does one set both the timing and the dwell with only one link?

ADJUSTING DWELL ANGLE BY SETTING POINT GAP

The time at which the points open is set by rotating the entire distributor body, and the time at which they close is set by adjusting the gap. The wider the gap, the more the distributor must rotate to get the points to the maximum opening, and the more it must rotate to allow them to close again. Thus, a wider gap leaves the points open for a longer time, or a larger angle of rotation, which reduces the dwell angle, and a smaller gap leaves the points open for a shorter time, which is equivalent to being closed for a longer time, which increases the dwell angle. Larger gap, shorter dwell angle, smaller gap, larger dwell angle.

MEASURING DWELL ANGLE

That's how dwell is set using a set of feeler gauges, but how is it set by using a dwell meter. What is the dwell meter actually measuring? It certainly isn't measuring the actual rotation of the distributor rotor button. Probably the best way to understand that is to make a dwell meter. It is very easy to do, and very cheap as well. **Figure 1**, below, is a simplified diagram of a dwell meter, one that can be very easily made at home. Since a set of points is nothing more than a switch, they have been replaced with a simple ON-OFF switch in the diagram below.

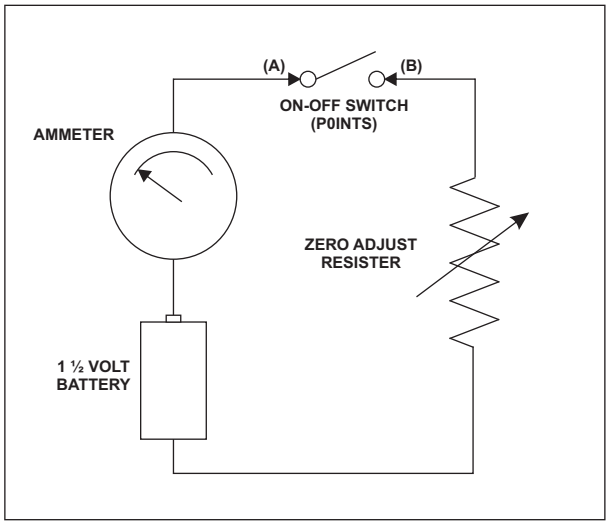

FIGURE 1

There are two extreme conditions of point operation: 1) the points never open, which would be, for a six cylinder engine, the equivalent of 60 degrees of dwell, and 2) the points stay open, which would be the equivalent of zero degrees of dwell. In the circuit above, leaving the switch closed is the same as 1), or 60 degrees, and leaving them open is the same as 2), or zero degrees. With the switch closed, the meter will read full scale (as set by the zero adjust resister), and with the switch open, the meter will read zero.

What if we continuously open and close the switch, having it open 50% of the time, and closed the other 50% of the time. The meter will swing back and forth between zero and full scale. If we open and close the switch fast enough, however, the meter needle will not have time to complete the movement from zero to full scale and back

again, but will settle out at half scale. Since full scale is 60 degrees and zero scale is zero degrees, half scale will be equal to 30 degrees. If we change the ratio of closed to open, say closed two thirds of the time and open one third, that would place the needle at the two thirds mark on the scale, which is equal to 45 degrees.

Notice that nothing was said about the units on the meter dial. It doesn't matter if the meter is a 0 - 1 ma, 0 - 5 ma, 0 - 100 ma, or whatever. It is the ratio that counts. To convert the ma. units to degrees of dwell, simply divide the full scale value by the maximum number of degrees of dwell for the engine of concern. If you are using, for example, a 0 - 10 ma meter, on a six cylinder engine, 60/10 = 6. Therefore, each major unit will equal 6 degrees dwell.

Since most meters scales are subdivided, you can divide the total number of marks by the maximum dwell to get the number of degrees dwell per mark. Again, using a six cylinder engine and a 0 - 10 ma meter, with each ma marking further subdivided into four sub-marks, we get 60/(4x10) = 1.5 degrees per mark. By reading between the marks, the meter can be read to less than one degree.

CONNECTING DWELL METER TO THE POINTS

Now that we have a good understanding of just how a dwell meter works, how is it connected to the ignition system? As usual, the instructions that came with the dwell meter, if you are using a commercial unit, should be followed, but if you are using a home made meter, as shown above, some precautions are in order. Before connecting the dwell meter to the ignition system, the ignition coil should be disconnected from the distributor by removing the wire from the coil minus terminal to the distributor. The lead marked (A) should then be connected to the wire you just removed from the coil minus terminal, and lead (B) should be connected to ground. Actually, you can reverse the connections as well, with no problem, as the ignition points are isolated from the rest of the car by disconnecting the coil lead. Polarity across the points, since they are nothing more than a switch, is immaterial.

OBTAINING DWELL ANGLE FROM GAP SPECIFICATION

Which brings us back to the original question, how do you determine the dwell angle from the gap specification? Unfortunately, you can't; there are too many variables. The best thing to do is to set the gap one time using a feeler gauge, and then measuring the dwell and recording it. Then, in the future, you can use that number. In general, though, the points are closed for about two thirds of the total angle available, and open the other one third. For a four cylinder engine, this would be a dwell angle of 60 degrees, and 40 degrees for a six cylinder engine. This rule of thumb is akin to the old timer's trick of using a match book cover to set the gap in an emergency, when feeler gauges are not available.