

The Ignition Coil – how it works

For those of you that read the article on how the alternator works you may also be interested in how ignition coils work? Anyway, I'm going to tell you, so either read on or ignore this section of the magazine.

In a very similar way to the alternator the ignition coil works using a magnetic field. Now those of you who paid attention to the alternator article may well say but the ignition coil doesn't have any moving parts so how do we get a moving magnetic field as in the alternator and its rotating centre, the rotor. This will complicate things a little more as it's the action of the points that cause the magnetic field to move, but it doesn't rotate as in the alternator either but they do open and close. Any clues yet?

As most of you will know we have primary and secondary 'sides' to the coil, the primary side is powered from the battery and the secondary side is powered by this mystery magnetic field (it's all magic really). You can easily tell which side is which as the primary side won't bite you, the secondary will if you let it!

The coil is actually just a transformer, like you may have used years ago (or maybe still do?) for your train set. However, it works in reverse to a normal transformer. A 'normal' transformer also has a primary and secondary side, the primary is connected to the mains at 240V and the secondary would be at some reduced voltage of say 12V (AC). This is achieved by the ratio of the windings on each side, in this case a ratio of 20:1, it's that simple. Our ignition coil could well have a ratio of around 1:2000, so for a 12V primary side an output of around 25,000V would be produced, hence our nice spark at the plug. 25,000V is well capable of jumping a bigger gap than we're likely to give it in a spark plug. I don't know the actual ratio in the GT750 coils but you get the idea. Although I've said the coil is like a transformer it does differ in the way the laminated iron core is used and in fact its form, and it is this core that acts as a magnetic 'store'.

I still haven't explained how the magnetic field moves, now this is the crux of it. When the points are shut it allows a feed from the bikes battery to pass through the primary winding down to earth (battery negative), this produces a magnetic field, but it's stationary, it just sits there as long as the points are shut, doing nothing, minding its own business. Now as the engine rotates eventually the points will open, now things get more interesting, the magnetic field in the primary will collapse as the circuit from battery to earth via the points is broken. As the field collapses it is moving, our moving field is now passing through the secondary windings of the coil, this induces a voltage at the 1:2000'ish ratio, somewhere around 25,000 volts, this then jumps the plug gap in its need to discharge somewhere. At 7000RPM this cycle of magnetic field build up and collapse happens around 116 times a second or every 8.6 thousandths of a second. Just to add a little more detail the primary coil and the capacitor (condenser) across the points form what is called a tuned circuit and begin to oscillate much aiding the generation of the secondary voltage. The capacitor plays a dual function in that it also helps to prevent pitting in the points contact faces.

I have simplified a little of the above but hopefully you'll get the idea. Some of this may help if you need to diagnose any ignition problems as you now know what each part of the system performs.

One point to note on health of the coil is that you shouldn't leave the ignition switched on for too long without starting the engine. As there will be at least two of the coils drawing current from the battery, this will obviously start to drain the battery but heat will also build up in each of the energised coils, too much heat is not a good idea and may well damage or destroy a coil.

Nick Lowe - Club Secretary

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