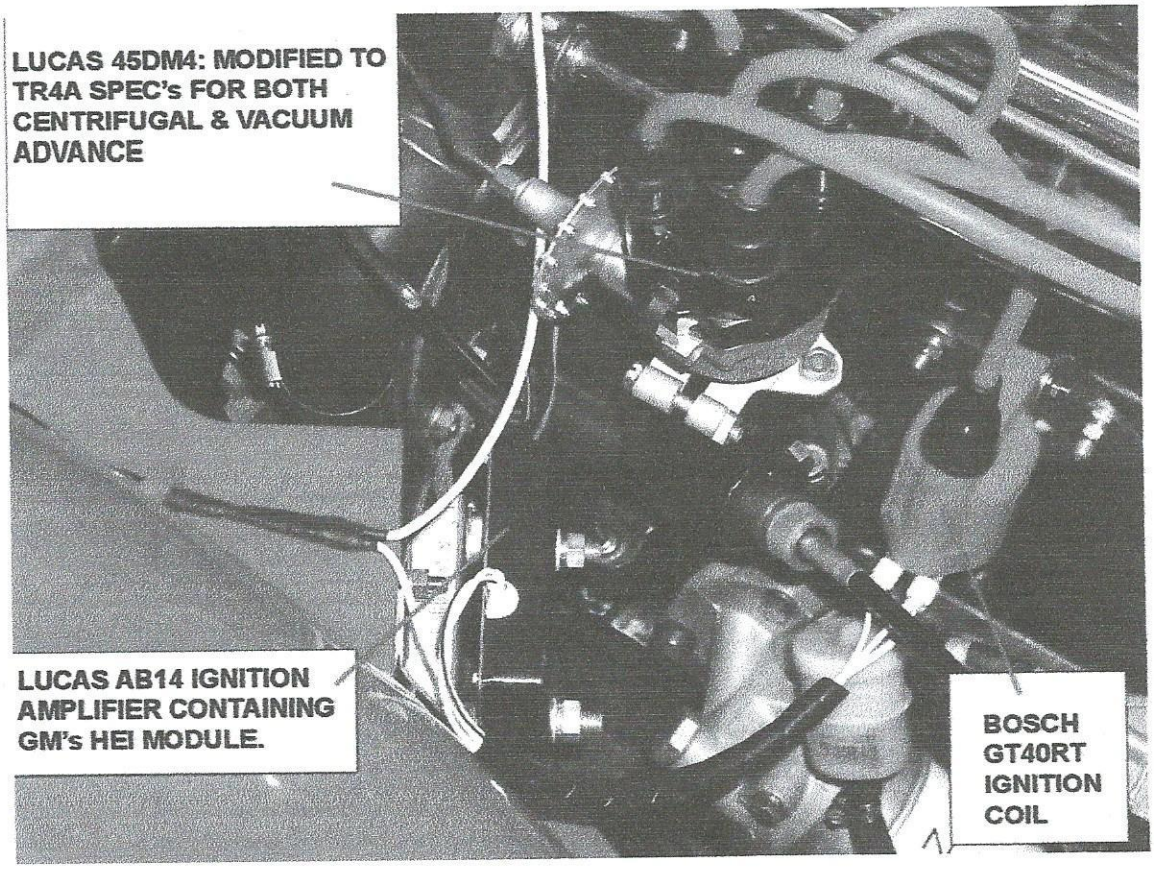
CUSTOMISING A RELUCTOR STYLE DISTRIBUTOR (45DM4) HEI (CEI) IGNITION SYSTEM TO REPLACE THE LUCAS 25D KETTERING SYSTEM IN A TRIUMPH TR4A.

Dr H. Holden. Feb. 2015. (see update in conclusion – High Voltage Rise times CDI vs MDI)



Why a Reluctor and Why HEI ?

The HEI (High Energy Ignition) is the General motors name for the system, Lucas called it CEI (Constant Energy Ignition) and both names are equally apt. A reluctor style distributor by its nature is superior to all other types of distributor sensor. Combined with the HEI system the spark energy is unbeatable. Perhaps bold statements, but these remarks are supported in the following text and in the spark energy recordings below.

Conclusion:

No existing auto ignition system beats reluctor- HEI for spark energy across the full RPM range. In addition it runs the ignition coil cooler at the low rpm range with dwell time limiting. It doesn't cook up the coil if the ignition is left on without the motor running. Both these features extend ignition coil life. It eliminates contact breaker issues. Also it provides good spark energy at low battery voltages during cranking. Reluctor-HEI produces about twice as much spark energy across the full rpm range as a conventional 3 Ohm coil, electronically assisted by distributor inserts/modules or not. This is because the inserts/modules neither raise the coil's maximum current to a higher value nor can they increase the rate of rise of coil current with time, because these parameters are set by the ignition coil properties, not the insert/module type.

Therefore in summary, we can now properly answer the question:

1) Why does the reluctor driven HEI module and 1.5 Ohm primary ignition coil such as the GT40RT deliver about twice the energy per spark (both in the ***high and low*** RPM range) compared to a standard 3 Ohm canister ignition coil regardless of whether the 3 Ohm canister coil is driven by a contact breaker or electronic module insert in the distributor?

ANSWER:

In the low RPM range; the HEI module raises the 1.5 Ohm coil primary current to 6 amps compared to the 3 Ohm coil at around 4.33 Amps (running of 13V), therefore the stored energy in the 1.5 Ohm coil could be expected to be about (6/4.33)squared or about 1.92 times higher, that is if the coils had the same inductance. This is because the stored energy is proportional to the square of the current. However the inductance of the 1.5 Ohm coil is 5.48mH compared to 8.16mH for the canister coil, so one could then expect the stored energy to be 5.48/8.16 = 0.67 times lower, since the stored energy is linearly proportional to the coil's inductance value. However the secondary resistance of the 3 Ohm canister coil is 17.5k and that of the 1.5 Ohm GT40RT coil is 8.46k and assuming 5k resistor spark plugs are being used in the car (as they are in the input to the spark energy meter) then the two total secondary load resistances are 22.5k and 13.46k, making the ratio 22.5/13.46 = 1.67 better for the GT40RT, since the resistances dissipate or waste energy during the spark time.

So the product of these factors is 1.92 x 0.67 x 1.67 = 2.15

Therefore, on approximate calculation, **the 1.5 Ohm GT40RT coil and HEI system should have roughly 2.15 times the spark energy as the standard 3 Ohm canister coil in the low RPM range.** The exact low rpm measurement shows 36mJ per spark for the canister coil and 65mJ per spark for the 1.5 Ohm GT40RT coil & HEI system which is 1.8 times higher, close to the value of 2.15 calculated above.