The Dead Stick Flyer

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Tech Corner:

RC Gas Engines "Electronic Ignition Timing"

By Gary Gunter

I thought I would do an article on properly setting the Electronic Ignition Timing on an RC gas engine like the ones we use in our planes. This is very straight forward and easy to do. I am doing this article on a 61cc DLE but it's the same for most RC Gas Engines.

DA (Desert Aircraft) RC Gas Engines are preset and some of the older magneto style engines use a rotating timing plate.

The reason for timing an engine is so that it will have the spark plug ignite the air/fuel mixture at the perfect time creating the most power from the engine's intake of air and fuel in the combustion chamber. Advanced timing, which is what we will be discussing here is like hunting birds with a gun. If you're going to shoot a bird, you have to aim in front of the bird so it flies into the shot by the time the shot actually gets there. The same thing goes for a gas engine. The time that it takes for the air/fuel charge to burn and start pushing the piston down is optimally when the piston is at TDC (Top Dead Center). At that moment, the full effects of cylinder pressures are realized from the burning air/fuel charge which is why timing is set to "X" number of degrees before TDC. (Note: Top Dead Center refers to the point at which the piston is at its highest point in the cylinder head nearest the spark plug.)

The effects of engine timing set too far advanced BTDC (Before Top Dead Center) means the spark plug fires and ignites the air/fuel charge at a point too early in the cycle and tries to push the piston back down before it has reached TDC. This causes extreme cylinder pressures and a dramatic rise in engine temperature, the effects of which are burned pistons, broken rings, and scored cylinders. Conversely, engine timing that is set too far retarded means the flame goes across the piston late in the cycle after the piston has started its downward movement, causing low power, unburnt gas, carbon buildup, and sticking rings. So it is important to get the timing correct so the engine runs optimally producing the most power from the air/fuel charge.

There are two tools needed to properly set the engine's timing, a small screw driver and a degree wheel. I made mine from an image I downloaded off the web of a protractor, cut it out and glued it to a piece of plywood and drilled a hole in the base so it can be slid onto the crankshaft and you're in business. You will also need some kind of pointer to let you know where you're looking at the timing mark. I made mine from a piece of wire soldered onto an alligator clip so it will attach to the cylinder fins.

The first thing to do is remove the spark plug and find TDC of the piston. Remember, TDC is the furthest a piston will travel upward in the cylinder.

This can be done in two ways:

1) With a TDC tool, which can be made from an old spark plug with the insides knocked out and a nail soldered to the inside of the threaded portion of the plug extending about ¾ of an inch. Place a degree wheel on the crankshaft of the engine and put the pointer so it looks at the degree wheel, and with the tool inserted in the cylinder rotate the engine until the piston makes contact with the tool and the crankshaft stops rotating. Center the degree wheel to 0 at this point. Rotate the engine in the opposite direction and note where the crankshaft stops. For example, if you centered the degree wheel at zero and rotated the engine in the opposite direction and it stopped at 20 degrees. Split that distance in half and move the degree wheel to zero. That is TDC. Remove the TDC tool.

2) Or, with a small screw driver put it in the spark plug hole while bringing the piston all the way up to TDC slightly rotating the crankshaft back and forth finding the point at which the piston does not move up and down any more. Notice the crank will still have a little "rock over" which is about 20 degrees of movement at top dead center. The crankshaft will have a little movement but the piston is really at TDC and the connecting rod is making a transition from coming all the way up to starting to go back down. <u>The crankshaft moves but the piston does not</u>. It takes a bit of fines to feel this middle point and get the crankshaft positioned properly at TDC. I close my eyes and just feel it and almost always can come within one degree of TDC.

Once TDC is established. Put the spark plug into the plug cap and properly re-seat it. With the ignition turned on, rotate the crankshaft around about 75 degrees from TDC and then rotate the shaft in a normal rotation direction up to the 28-30 degree mark and you should hear an audible click from the spark plug or see the spark plug fire. Sometimes it is very hard to see the spark fire unless it's dark. Do this several times to find the exact point at which it fires. A properly set timing should be around 28-30 degrees before TDC. If it fires at 35 degrees, or higher, it is too far advanced. Loosen the screws holding the Hall Sensor, (nothing more than a magnetic on-off switch) which has slots for adjustment, and move the Hall Sensor in the same direction as normal rotation to retard the timing. If it is firing late or retarded, it should be moved in the opposite rotation to the advance timing.

This only works for engines with slotted hall sensors like DLE, Zenoah, and RCG engines. It will not work on DA engines as they have preprogrammed timing maps and they also will not put out a spark until the engine sees 150 rpm, (basically the speed it is while flipping a prop manually). Do not be overly concerned if you can't get it perfect, the slotted Hall sensor does not have enough variation in the adjustment to harm the engine. Only about 3-4 degrees.

Some of the other pictures are of proper plug to cap seating and other components of a typical capacitive discharge ignition system. As much as I like DLE engines, the spark plugs that come with them are guaranteed to fail prematurely. Replace them with an NGK CM-6 or Nippon Denso plugs. Always make sure your wiring is tied down to something, i.e. Zip-Ties or sticky back hold downs.

Never rotate a gas engine with the <u>ignition system on and no plug</u> in the plug holder. This will cause the capacitor inside the ignition box to discharge and burn out. The metal casing around the plug wire is the ground for the system.

Everyone knows how much vibration is in these gas engines and any chance for something to vibrate against something else will cause high friction wear in short order and cause a short or an open circuit. Also make sure the plug wire does not come into contact with any other piece of metal. This will cause wear and even worse radio interference. A piece of silicone tubing works good to insulate around mufflers. See the following pictures for reference.