Fitting, Engines – Electronic Ignitions

FITTING AND SETTING UP ELECTRONIC IGNITIONS

These instructions are to help you understand the correct fitting and setting up procedure for an electronic ignition system used in a Lambretta engine, but is relevant to any single cylinder two stroke. These systems are most commonly the Indian GP, Li, Sx, Tv systems, AF systems the Vespa electronic conversion systems and the BGM Electronic ignition systems. All three systems look different but work in exactly the same way, therefore requires the same basic setting up procedure.

The electronic kit may look like a points system but uses a flywheel with 2 internal magnets which cross over causing the spark when then these magnets move over the black pick up box on the stator which is powered up from the stators low tension coil into the HT coil. The magnets energy firing from the pick up and energy from the LT coil goes to a new electronic coil where this power is turned into high tension and produces a spark. The ignition circuit is separate to the lighting circuit and regulator or rectifier or combined BGM regulator/rectifier which produces power for the lights or battery or both. The description below is all about setting up the firing side of the electronic ignition.

This procedure is basically the same for all other electronic systems including Varitronics and the Motoplat systems. (it is also relevant to setting up points systems)

Ignition timing is very important especially in this day and age with modern poor fuels with no added lead and now mixed with an increasing percentage of Ethanol which does not help.

These instructions NEED reading and an engine and new cylinder kit needs setting up to suit these modern fuels.

Forget what you did in the 60, 70, 80 and 90’s, forget the old manuals and what a mate says down the pub it’s all gone out of the window. If you want your new cylinder kit and engine to work and be reliable then make sure you do this job right, if you don’t know what you are doing take it to a professional.

IGNITION TIMINGS SET UP

From day one all Lambretta ignitions used the simple points ignition system with fixed firing. Fixed firing means the spark fires in the same place on every revolution from tick over to flat out. This fixed ignition timing is done to work at the engines peak power where the most heat would occur so the timing is set to keep the engine working well under it’s highest load. On a standard this is fine, as it’s not really a performance high revving engine

and would have a lot of torque pulling through the rev range.

When you turn an engine into a high revving much more powerful engine using this static timing it’s a compromise to have a timing which keeps reliability for flat out work but does not help with low down power. Later Innocenti, AF and Indian Electronic systems carried this on with fixed timing.

Points ignition and setting up procedures can be found in

- Spanners manual
- Old workshop maintenance book
- Unofficial manual update book

Fitting the stator, flywheel and connecting the wires to the coil, regulator, loom and fault finding can be found in the Spanners Manual along with further descriptions on how to set up a electronic ignition. Electrical fault finding can also be found elsewhere.

Standard ignition timings

- Standard Sx, Li, Tv engines used 23 degrees
- Standard GP engines used 21 degrees

If you look a pattern starts to appear, the more the engine performs the further towards top dead center the ignition timing gets. This is to keep the engine running cool and stops pinking and blowing up. That’s the basics but there are many other factors that come into it like higher compression ratios which would increase power and then heat and it’s all about controlling this heat.

In the mid 80’s we were coming across pinking and holed pistons on some engines with high compressioned heads, I simply looked at 23 – 21 degrees and altered timings to 19 degrees and it seemingly cured engines which then ran cooler, we set the standards and everyone followed. Looking back we were using compression ratios beyond a joke even up to 16:1 with exhausts with small tail pipes, but we had leaded 4 star fuels and was so good most engines were very reliable and were probably quicker than today’s engines.

When the anti knock lead was removed from the fuels in 2000 suddenly long term reliable motors started to fail for no reason, putting it down to the fuel we went the next step and moved the timing to 17 degrees and again every one followed! We lost some power but on most engines gained reliability. But it high lighted the fact that high compressions were going to be old hat and every engine I came across required the heads to be totally reworked. This was important after the year 2000 and even more important after 2010 where the quality of fuel and octane ratings really dropped especially with the added Ethanol.

Today it’s hard to keep an engine running correctly with high compressions and standard timings, both need altering all based on our crap fuels.

To get around these problems, auto advance coils or addon’s from Replay Scooters with their Agusto boxes or Chiselspeeds M – Tech box are now

becoming more popular. The Agustos comes with one setting per box so there is little adjustment and you have to buy and swap a few boxes to get perfect. The Chiselspeed M – Tech has a little switch to give 16 different boxes in one – a must for every engine. Instructions for the M – Tech the Agusto setting up procedure is very similar. The new KyTronik goes further than the MTech or Agusto these are only linear lined add ons and can only be a compromise to perfect ignition timings. The KyTronik Smart Booster system has pre built in curves which can push horse power and aid a smoother running motor and more importantly keep the engine cooler and more reliable.

More can be read here on ignition add on advance retard boxes.

Advance ignitions are nothing new I developed an advance retard Japanese Suzuki system in the late 1980's but was too expensive to mass produce, we used advance boxes on our race engines using Motoplat ignitions and we also found an auto coil which gave 5 degrees advance but only on some flywheels. So it's nothing new, but worth the swap. What these boxes do, is decrease ignition timing as the engine revs higher.

Lets say in simple terms

- 25 degrees at tick over 1500rpm
- 20 degrees at say 4000rpm
- 17 degrees at 6000rpm
- 15 degrees at 8000rpm

As the spark retards towards Top Dead Center TDC it makes the engine run cooler but it increases low down pulling power and torque with the advanced timings from tick over. This advance retarding of the spark is more common in the Varitronic ignitions. With Varitronics and addons the ignitions need setting up a little different which will be cover later separately.

Suggested timings using fixed ignitions ie the BGM, Indian, AF, Vespa, Motoplat and points systems

- Standard Sx, Li, Tv – 21 degrees
- Standard Gp – 19 degrees
- Modern day tuned engines – now at 17-15 degrees

If you run an engine on a dyno to check power out puts, using the old settings then in theory this should happen;

- 21 degrees would show the best bottom end to mid range power, with a lack of top end power
- 19 degrees would show the best mid range power
- 17 degrees would show the best top end power, with a lack of bottom end

With the introduction of these poor fuels it does nothing to keep an old under cooled Scooter engine running as reliable as in the old days. Most tuners have tweaked what they can to improve reliability. The main thing to check is head designs and compression ratios, if your motor is prone to blow holes, seize or melt pistons always have the head checked. All MB heads are machined to suit the dome of the piston and the combustion area is opened out

to suit each kit to lower compression ratios to 10:1 or lower. This does not mean you can not use higher compressions which can gain power. What you have to do is lower the compression to suit customers who have no idea when it comes to setting up an engine and knowing when an engine is dieing from a over heating problem. BUT even the experts just do not know what the fuel was like on the last fill up and will catch even the best of us out at times!

Exhaust Gas Temperature gauges and Air fuel meters will become normal fitment soon if you want a reliable engine and something we are working on.

TOOLS REQUIRED TO SET UP AN ELECTRONIC IGNITION CORRECTLY

- Small tools i.e. normal metric spanners, sockets, screwdrivers etc
- Flywheel holding tool
- Flywheel extractor
- Dial gauge or timing disc
- Timing disc
- Strobe timing light

SETTING IGNITION TIMING MARKS

What are timing marks? If you read an old manual it states the timings required for that engine, in the factory a mark was stamped on the mag housing which would correspond with an arrow on the flywheel, when the arrow is opposite the mark this is the firing point. This is all well and good with a standard well built engine from the factory but an engine with a different flywheel or a different mag housing or an after market crank where the woodruff key maybe a degree or two out and you can see your timing marks are suddenly no where near where they should be.

It is very important to get the timing marks set correctly for your engine, this will get your ignition timing set at the correct point.

There are a number of methods to set your timing, what is listed below is MB’s suggested ways!

Correct ignition timing marks have to be put onto your mag housing or engine casing…… do not trust other peoples timing marks and do not trust standard factory marks, do every engine as a one off!

The old standard way of setting the static timing is by using the small notches on the Electronic flywheel viewing hole and raised marks on the pick up box, once lined up the arrow should be opposite the timing mark on the mag housing. If not then you have to move the stator either way until the arrow is opposite to the mark, this method is OK when using genuine Innocenti Electronics and old AF Electronics. But these days with Indian flywheels where these marks are hand stamped in the factory or a cam is riveted in the wrong place or a woodruff ket is machined wrong and timings can be anything up to 10+ degrees out either way. Use them as only a guide when bolting the stator plate into position. Every engine fitted with an electronic ignition system should be timed and strobed in the methods listed to make sure timings are going to be correct which will lead to a more reliable engine.

For this reason MB has not given the method of setting up the ignition using old timing marks. They are a few ways to accurately set timing marks, but do it slowly to make sure you are doing it correctly and got over and double check what you have done. I find the most accurate way to obtain this is to set the timing marks using a dial gauge bolted to the top of the cylinder, others would disagree as there is some dead area rock where you can get it slightly wrong, it depends on how accurate you are as a workman. Another way is to use a 360 degree timing disc or protractor then the dead stop method and finally by a straight line measurement.

The best timing disc or protractor is a draftsman's 15'' 360 degree protractor these are very accurate to with in .25 of a degree and also work perfect for checking port timings I've used one for years setting engines set up on the bench. But there are also many smaller timing discs freely available from different sources, we make our own MB version or BGM also do one and are usually ok if you are careful.

Lets presume we are doing the timing on a new engine rebuild, as it's easier, but it can be done with an engine fitted in the frame. Obviously the crank needs to be fitted correctly and turning free. The flywheel needs to be fitted but not tight the chances are it will need removing anyway to get to the stator which unless you are very lucky will need moving.

TIP when you are assembling your engine I always tighten the mag housing down with a counter sunk drive screw in the hole top right at around 1 o'clock……. this centralises the mag housing, in the future if you strip your motor and do this every time your timing marks should be in the same place and you don't have to go through this rigmarole again! The reason for this is some mag housings are very loose and can rock either way on the studs so the timing marks can be out by say 2-3 degrees! Once the counter sunk screw is tight, tighten two nuts on the mag studs, remove the screw for when the stator is fitted.

TIMING BY DIAL GAUGE

For this method you need the piston fitted on the crankshaft and the cylinder fitted but leave the head off.

You need a metric dial gauge and mounting clamp.

Attach your dial gauge solidly some where so a reading can clearly be seen from the flywheel side, we make a mounting bracket which clamps the cylinder tight across 2 studs and the dial gauge screws onto it. The dial gauge should be visible as you work from the flywheel side, set the gauge so whatever timing is required in mm's the gauge can move in its full travel. Once fitted rock your flywheel slowly to find TDC looking at the needle on the gauge, take your time as there is a delay rocking at TDC, keep rocking back and forth until you are happy you have found the mid point, there is a mid point honest. When happy, set the dial gauge to zero, and repeat until you are again happy that you have found a true TDC and the gauge is zeroed correctly. At this point put a scribe/pencil line opposite the flywheels arrow on the mag housing. (If you have no arrow on the flywheel then first scribe your own

line on the flywheel at around 1 o’clock when the piston is at TDC) This is TDC, turn the flywheel anti clockwise and watch the dial move to its required travel in mm’s (see chart below) put another scribe line on the mag housing opposite the arrow this is your static timing mark and your engines firing point. When you are happy lightly tap a flat screwdriver over the mark and the TDC mark.

BGM FLYWHEEL TIMING MARKS

These are easy now as they are printed on the flywheel for you. Find TDC as described above, put a mark opposite the arrow, check the timing marks on the outer edge of the flywheel, turn the flywheel anti clockwise until you get to the desired timing mark and put a mark on the mag housing, this is the timing mark! Easy! The BGM flywheel simply marks TDC (arrow) 15 – 20 – 25 – 30 just use some common sense if you want 15/17/19 degrees.

The chart below has been rounded off to make marking timings easier, how each person reads a dial gauge is different, so lets say each mark is + or – 1 degree. If your not sure errr on the lower side.

Crank	58×107	58×110	58×115	60×107	60×110	60×115
Degrees						
11						
13						1.00mm
15	1.25mm	1.25mm		1.20mm	1.30mm	1.30mm
17	1.60mm	1.60mm	1.50mm	1.60mm	1.70mm	1.70mm
19	2.00mm	2.00mm	1.85mm	2.00mm	2.00mm	2.10mm
21	2.45mm	2.40mm	2.15mm	2.40mm	2.50mm	2.50mm
23	3.00mm	2.90mm		3.00mm	3.00mm	3.00mm
25	3.35mm			3.40mm		3.45mm
27				4.00mm		4.00mm
29						4.60mm

TIMING BY DEGREE DISC AND THE POSITIVE STOP METHOD

For this method you need the piston, cylinder and head fitted and turning freely. This is ideal if your engine is already fitted and running and you are not sure if the timing has been set correctly in the past. It’s easier if two people do this as one can hold the screw driver as the other does the marking out.

For this method you need a timing disc, or protractor or vernier gauge or accurate ruler.

If done correctly this can be very accurate and is cheaper than buying a dial gauge. Remove the spark plug and put a small screwdriver down the plug hole far enough in so when you turn over the engine by hand using the flywheel the piston locks up against the screwdriver and cylinder head (hold the screw driver solid so it doesn’t move) Put a pencil line opposite the flywheels timing arrow onto the mag housing (if your flywheel has no timing arrow

scribe one as above). Turn the flywheel back in the opposite direction. When the flywheel locks again put another pencil mark on the mag housing opposite the timing arrow. If done correctly you should have two marks on the mag housing. Adjusting the screw driver so the two pencil lines get closer together makes life easier. Using a steel ruler or vernier gauge measure in a straight line between the two marks, exact center of the marks is TDC, put a scribe line on the mag housing to mark TDC.

- Attach your degree disc or a protractor to your flywheel using blue tack or similar, spend a little time to get 0 degrees in line with the timing arrow (or scribe mark) and the center of your timing disc to the center point of the crankshaft
- Or with your flywheel tight on its taper, remove the flywheel nut, fit an extractor tight and the timing disc can be tightened up with the extractor bolt and a spacer, adjust the timing disc until zero is where the arrow is at the TDC mark
- Or remove the flywheel, fit the timing disc tight to the crankshaft using the flywheel nut, using the positive stop method still mark the disc with an fine marker pen where the piston locks on the screw driver, turn the disc in the opposite direction until it locks and mark it again. Count the degrees between the two marks and divide it by 2 this is TDC.

With any of the 3 methods hold the flywheel with 0 degrees opposite the TDC mark, slowly move the flywheel ANTI CLOCKWISE (for all Lambrettas and Vespas) to the degree that is required. (See chart) Then put another scribe line clearly on the mag housing and stamp it. This is now your static timing mark and your engines firing point, it pays to mark TDC also.

TIMING BY MEASUREMENT

This system is only as accurate as the person using the other two methods and could be a quick way for a dealer. It requires finding TDC, once TDC has been found and accurate marks done then you can measure from TDC anticlockwise in a straight line using a vernier gauge.

As an example;

- 17 degrees (1.60mm) = 24.0mm
- 19 degrees (2.00mm) = 26.5mm
- 21 degrees (2.45mm) = 31.5mm
- 23 degrees (3.00mm) = 34.5mm

These measurements only work with a Genuine Italian, Indian or BGM flywheel measured close to the flywheel using marks on the mag housing. The examples are using a standard 58mm stroke crankshaft with a 107mm con rod. Crankshaft stroke and con rods alter ignition timings so this is probably best if you are doing lots of engines regularly and you have set timings as listed above, different flywheel diameters like the AF or Vespa conversion flywheels are smaller so give different straight line measurements.

To gain this information you will need to make a list based on;

- Flywheels diameter
- Stroke of crank
- Length of con rod
- Ignition timing used

VARITRONICS AND ADVANCE RETARD BOXES

If you are fitting an advance retard box or Varitronic you can add various timing marks but don't over complicate it by doing too many, all you are interested in is getting the static timing mark for where the engine comes into it's power and flat out engine work, this would be around the normal old fashioned static timing. Depending on what box is used really depends on what marks to use.

I would suggest you do these or something like these but make sure you finely write or engrave on the mag housing so in future you know what they are, or do a little drawing and save it;

- 25 degrees
- 20 degrees
- 15 degrees

or

- 23 degrees
- 21 degrees
- 19 degrees
- 17 degrees
- 15 degrees

STROBING YOUR ENGINE

Once you are happy that your timing marks are correct then paint your flywheels arrow (or new line) and your timing mark on the mag housing in white or yellow paint (a small thin line is all that is required) It helps in a bit if you use a marker pen either side of your line about 6mm each side. Depending on which timing method you have used make sure your flywheel is torqued down tight, fit the cylinder head and get the engine ready for starting. Start the bike to make sure it runs, at this point it only has to run to around 2 – 3000rpm so don't worry if the timing is miles out.

To check your engine is set to the correct timing you need to strobe your running engine. A strobe is a workshop tool which will light up your timing marks on the flywheel and mag housing when the engine is running. There are two type 1) to use no battery and one to use a 12 volt battery.

1) no battery

To do this you can get away with a cheap strobe timing light available from any car spares shop or tool shop. You need to connect it between the plug and cap in series, basically one wire goes on to the spark plug the other into your HT cap, use a bit of electricians tape to insulate the joints (full instructions come with the strobe) by fitting the strobe onto your system

with the engine running it will shine a flickering light every time the scooter fires. This in turn’s lights up the two painted timing marks.

2) using the 12 volt DC version

These are easy and freely available. You have 3 leads one Red to the 12 volt + of the battery, one Black to the – of the battery or the third lead there is a clamp this goes over the HT lead in the direction marked on the clamp.

Start your motor with the flywheel cowling off and point the strobe at the position where you have painted your timing marks. Some just light up others need a trigger button pressing. All being well as you rev up your motor you should see the marks on the flywheel and mag housing light up. How bright the marks will be depends on the strobe gun, one used with a battery as a power aid are best. It helps to do this in a dark room, at night or in the shade. Perfect timing is when the two marks are opposite each other when the engine is at around 2-3000rpm (just above tick over or use a rev counter). If the timing marks don’t line up with each other then your stator needs moving either way, then try again until they do.

With advance systems you need to rev the engine to the desired rev range, so you need a rev counter. With these boxes fitted as you rev the engine up you will see the timing line on the flywheel move clockwise towards TDC. If you want 17 degrees and you have this marked and you want your ignition to be at 17 degrees at say 6000rpm then hold the engine steady for a couple of seconds at 6000rpm and the flywheel line should advance and stay in line with the mark on the casing.

A word of warning; care should be taken when revving the engine flat out on the stand. Always tighten all nuts and bolts as per manual, flywheels can come off and cranks have been know to snap, flywheels with fins don’t stop at your foot or leg they go through them! This is very unlikely to happen if you rev up steadily and have quality parts and have fitted them correctly.

Don’t forget an engine will rev much higher and freer on the stand, ideally you could do with a rev counter or setting your engine on a dyno to allow for road and wind drag.

Perfect timing may take a little time but will be totally worth it in the end and you can have piece of mind.

MB WORKSHOP WAY

All engines rebuilt by Mark Broadhurst with an electronic ignition are run up on the bench and strobed to 2000rpm using a powerfull drill turning the engine using the flywheel nut. This is done with no head fitted or with the plug out. Any customer can also do this but you need to fit a socket in a drill. Our factory timing light and timing procedure is used to check every engine, in this way we guarantee that the stator plate works and the ignition timing is perfect! All engines set up in this way should be set up using the correct coil as coils can fire in different positions. You need to make sure the drill can rev to 2000rpm as it takes this amount of revs for the

electronics to stabilise so you can see some movement up until it stabilises. Ideally this is just a basic set up when setting up a Kytronik or add on box, the rest should be done on a dyno as we do or when the engine is running.

Once running it is advisable to keep an eye on spark plug colour and some jetting may be required.

NEW BGM FLYWHEELS

In August 2013 the new one piece BGM Electronic flywheel arrived for both Gp and Li type cranks. This new flywheel comes with top dead center and timing marks already marked on the flywheel for you. This simple idea helps set up you engine easier. Basically all you have to do is find top dead center by the dial gauge or the positive stop method and mark the mag housing opposite the BGM's flywheels arrow. Now using the marked degrees on the flywheel paint a line for the timing marks you want and paint the TDC mark on the mag housing. These are your timing marks which should line up when you strobe the engine. The new BGM flywheel doesn't have the old style window marks so strobing is the only method you can do. Strobing and altering the the timing is the same as mentioned above.

NOTES

A quick mention is required here, the stroke of the crankshaft and the length of con rod alters the ignition timing settings! (See chart)

Hopefully these instructions are clear enough to follow and you set your engine up perfectly.

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If you have any questions email mark@mbscooters.co.uk