The Complete Spanner's Workshop Manual for:

Lambretta

'Slimstyle' Scooters

by Martin 'Sticky' Round

Models Covered Include Li-3, TV-3, Special, SX, GP, and derivatives

REPAIRING

RESTORING

MODERNISING

These chapters are written with all sorts of scooterists in mind. There is information for restoration enthusiasts as well as tuning freaks, but mostly for the middle ground of owners who just want a decent, reliable scooter to ride and aren't fussed if it will break the sound barrier, or has the original colour nylon in the wheel nuts. I make no judgement on what style your Lambretta should be, as long it is a source of enjoyment to you.

What Are These Icons All About?

Throughout the book you will notice various sections of text are highlighted and marked with an icon for ease of digestion:

These sections point to areas of potential damage, danger or confusion, so it is important to take heed of them.

These sections simply point to an alternative technique or part that may be employed to solve a particular issue.

These sections offer useful advice on parts, tools, methods, and even a glimpse at the meaning of life. Well almost.

The Future of Lambretta

At the time of writing the value of Lambretta scooters has never been higher, with certain dealers charging as much as £8,000 for a restored SX 200. Consequently, there are currently rumours circulating of several firms looking to restart the production of 'Lambretta' scooters in one form or another. A further result of these high prices is an increase in crime relating to Lambrettas, whether that is the theft of scooters themselves or the falsification of machine identities to raise their value. The current state of play is that you could get an imported 150 Special, and restore it using SX 200 panels, badges, forks and a 200cc engine. The result would be essentially indistinguishable from an SX 200 and the machine would be worth several thousand pounds. If it had the correct SX 200 chassis numbers however, it would be valued several thousand pounds higher. Since there is quick money to be made simply by changing a few numbers then I'm sure there are plenty of unscrupulous people out there willing to risk it.

Personally, I think a nice Lambretta is a nice Lambretta and that a few stamped numbers simply don't justify massive price differences. Those of you that do care about such things however should be very scrupulous about checking the identity of any machine you are looking to buy. If the numbers look like they have been tampered with – or even if whole section of frame tube with the numbers on looks like it has been freshly welded in – then just walk away. If you don't, then you may end up paying considerably over the odds for something that isn't what it purports to be. Anyone who profits from selling a scooter as one thing in the knowledge that it is actually something else is little more than a thief.

Chassis Number Location

A Lambretta chassis number is the figure between the two stars to the rear of the engine mount on the kickstart side of the frame. The figures preceding this are the machine model prefix.

The chassis number should be in a similar condition to that shown below on Italian machines, with no signs of stamping, filing or welding in this vicinity.

Do not panic if the numbers (and particularly the stars) on an Indian machine look like they have been produced by a toddler wielding a chisel. *They're all like that guv'nor.*

Indian GPs produced during the early-mid 1980s often have no number stamping on the frame and instead have a VIN plate mounted on the seat arch between choke and fuel taps.

Engine Number Location

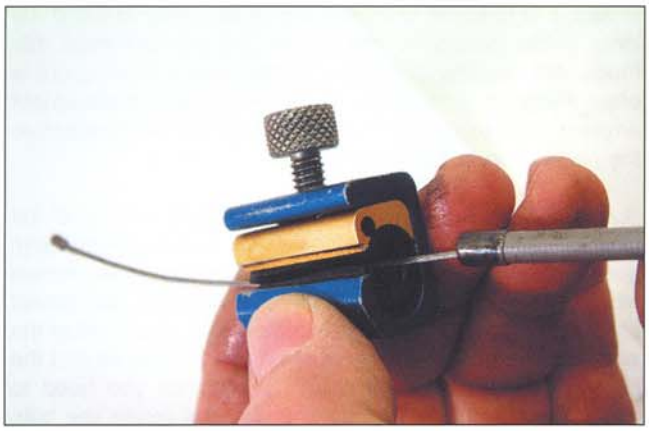
The engine number can be found (between two stars) on the flat area of the casing behind the clutch arm.

Don't worry if the chassis and engine number do not match up. During Italian production they were never intended to, though Spanish machines usually had matching frame/engine numbers.

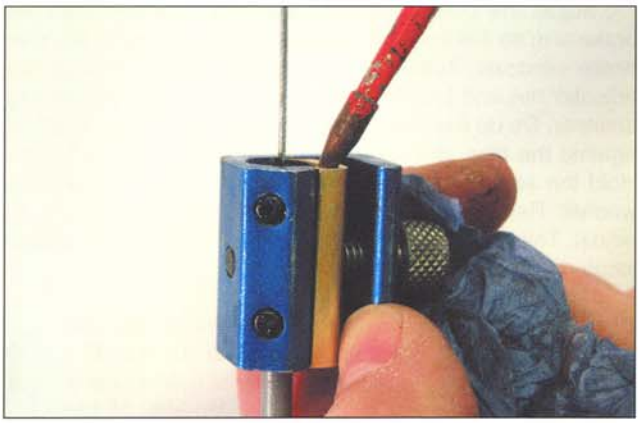
Do not be surprised if your GP 200 has an engine prefix 'SX 200' because they all do. Some models used engines with different prefixes, and this explained in chapter 6.2.

On some Innocenti GP 125s, the '125 LIS' engine number prefix may appear to have been re-stamped. It has been - in the factory! It's not uncommon to find badly re-stamped prefixes where you can still make out '125 LI' underneath the new '125 LIS' stamp. Innocenti were basically using up the LI casings they had lying around. This factory bodging can be found ONLY on Italian GP 125's.

Cable oilers can come in handy for non-lined cables since they allow for full lubrication even from the lower end. To use insert the cable with the inner poking through and wind the nut tight to seal the rubber part around both inner and outer cable.



Using an oil can pressed to the filling hole it is possible to force oil into the cable.



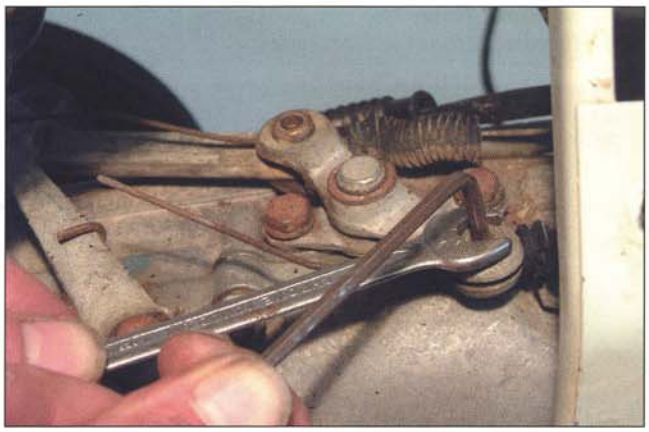
It is worth greasing your levers occasionally, particularly in the pivot points. Use a spanner or Mole grips to move the clutch arm on the engine forward enough to unhook the clutch inner, and undo the adjuster on a Lambretta front brake. This loosens both the inner cables, so you can remove the handlebar levers and have access to grease all around the cable ferrules and pivots.

Be wary of the anti-rattle spring and pressure cap fitted into the lever. If you aren't ready to catch them when the lever is withdrawn, they will fly off into the distance.

Original Italian trunnions 'adjustable nipples' are tightened with a 3.5mm Allen key which is an unusual size and hard to get hold of. Recent pattern trunnions have a common 3mm Allen key head, or a hex bolt head. Whichever sort you have, make sure your toolkit contains the correct one.

Always hold the outer part of the trunnion with a spanner when tightening or loosening. If not you will kink and weaken the cable, causing it to fail prematurely.

The Bedlam tip for placing gear cables is 'Front to Back, and Back to Front' – i.e. The cable at the FRONT of the machine in the headset (nearest the headlight) connects to the BACK position (next to the tyre) as you look at the engine, and vice versa.



Correct Control Adjustment

A set of correctly adjusted cables can make a scooter a pleasure to ride, but there is a lot more to it these days. With over 40 years of wear on some components, you can adjust your cables to perfection and still have several degrees of unwanted slop in your gearchange due to component wear in the headset or engine linkages.

GEAR CABLES: These should be adjusted so that the neutral marking on the headset does actually equate to neutral in the gearbox. The adjuster block fitted to the engine is where you should look to remove any unwanted slack. Wind the adjuster out from the block to tighten a specific cable, and vice versa. If the adjusters are at their limit and the cables still slack, then the only solution is to wind them back to a central position, loosen the cable trunnion and pull the inner cable through the trunnion before locking it back up. If this condition of slackness has recently developed, then it is usually an indication that the inner cable is about to fail and needs replacement anyway.

With the gear cables adjusted so that neutral is in the correct position, check that the two gear cables are not too taught by trying to squeeze them together between thumb and forefinger. If they are tight like piano wire, slacken both adjusters off a little and re-tighten the locknuts. Gear cables are often over-tightened when someone is trying to remove unwanted slop in the gearchange, but if this is due to wear in the mechanical components no amount of cable tightening will remove it. In fact the added friction of over-tight cables will only make things worse.

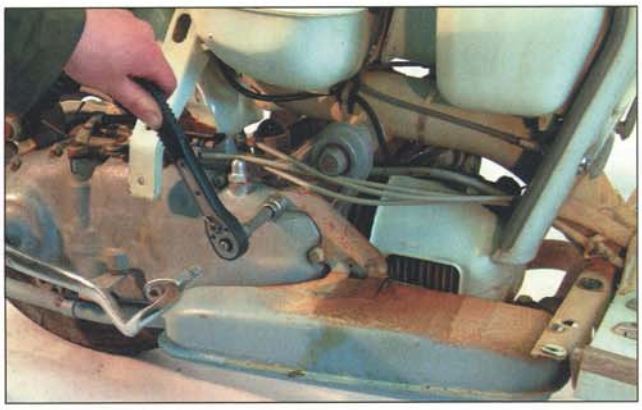
ENGINE STRIP – THE EASY BIT!

This chapter deals with a full engine strip and rebuild. On a Lambretta almost any job can be done with the engine in the frame – such as work on the clutch, gearbox and ignition system – but it is often far easier to work on an engine that has been removed from the chassis, and particularly to photograph.

Engine Removal Checklist:

(For more specific engine removal tips, see the Chassis Strip chapter.)

- Drain all crankcase oil.
- Remove bridge piece, running boards and running board support leg (engine side).
- Remove the carburettor from the manifold, but beware of leaking fuel.
- Removal of the exhaust body at this stage can be helpful but is not essential. With standard exhaust systems that haven't been shifted in a while, remove all the nuts holding the exhaust box to the engine (note a bolt under the engine to support the exhaust on later machines), loosen the clamp and from the flywheel side of the machine rest a block of wood on the exhaust and tap the wooden block with a hammer to ease it off. If you are going to replace the old exhaust anyway it may be easier to saw through the downpipe to release the main chamber rather than spending hours trying to separate them.



- Disconnect wires from stator plate to junction box or ignition/lighting system (and any retaining straps to the frame).
- Disconnect any earth wire fixed to the flywheel cowling screws.
- Disconnect the rear brake cable. The easiest way is to undo the 17mm nut on the brake pedal clamp. The cable is curved round the adjuster at the wheel end and prone to fraying if you undo it there.

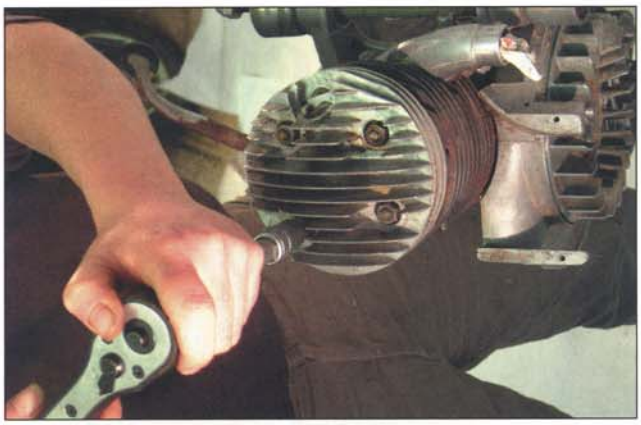
- Use an adjustable spanner over the clutch arm to release tension on the cable so that the trunnion can be unhooked from the arm.
- Remove the rubber cover and circlip/washer that connect the gearchange tie rod to the gear arm protruding from the engine casing.
- Remove the four 10mm-head bolts holding the bracket for the gearchange cable lever and gearchange adjuster block. If you do not want to replace your cables, then doing things this way allows you to keep them in the same position without needing readjustment.

- Remove the rear shock.
- Support the engine or ask someone to help you.
- Loosen the nuts on the main engine bolt, but before fully removing them, tap the bolt each way with a nylon or copper-faced mallet to free it from the frame cones.
- Undo one nut and withdraw the engine bolt.
- With the engine free, it is easiest to lift the scooter off the motor and wheel the chassis away.

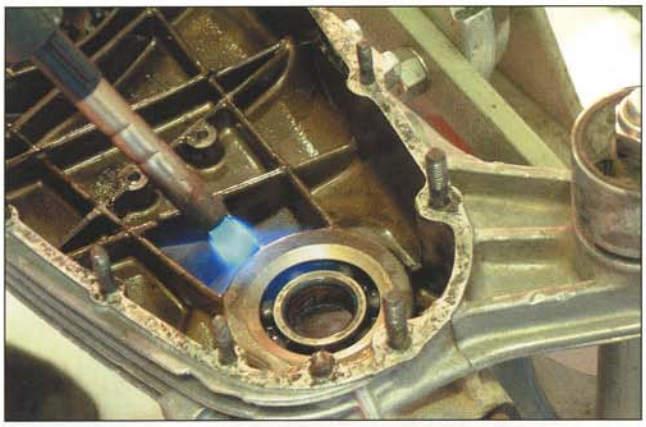
With the engine removed, mask off the inlet manifold with tape. Take off the flywheel and head cowlings and scrape off as much dirt as you can. Fully clean the outside of the engine with a brush and Gunk, Jizer or paraffin, being particularly careful of the potential fire hazard.

Cylinder Head Removal

Undo the four nuts holding the cylinder head. On original machines these M8 nuts are a deep 14mm or 13mm head and have a flat washer underneath. Undo them half a turn at a time in a diagonal pattern to avoid the possibility of warping the cylinder head. The head should come off easily but may not if the wrong washers have been used. If you must prise the head off be very careful not to break any cooling fins or score the gasket face. Remove the head gasket.



Gently heat the casing around the main bearing before drifting it out.



Again we used an Innocenti drift, but a Sundance handlebar grip works brilliantly too. Be careful not to let the bearing come out at an angle or it may crack the casing. Innocenti also supplied a puller to remove this bearing but it is not necessary provided you are careful.

Flywheel Side Main Bearing Removal

It is not always possible to remove this bearing without damaging it so if you know it is still OK just renew the large inner oil seal and re-pack the bearing with high melting point grease.

Inside the mag housing are a bearing, two oil seals, an oil seal retainer and a spacer (not used with the wider GP200 NU2205 flywheel bearings); all lubricated by high melting point grease.

Start by removing the circlip. You will need a large, strong set of circlip pliers to get it out. It is wise to wear some form of eye protection when working with such large circlips.

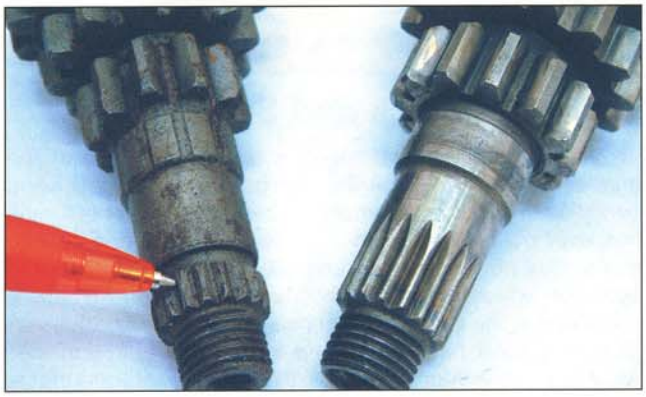
Next, lever out the large oil seal.

Note that both oil seals should have the spring-sides facing the crankwebs.

The GP 200 setup uses a wide NU2205 bearing, but most other engines use a narrower bearing with a spacer ring (shown) under the oil seal to take up the extra space.

hardening, and check the inner faces of each gear for rounding where it meets the dogs of the selector ('cursor').

Check the condition of the teeth on the gear cluster including the thread and splines at the top. See if a nut runs freely on the thread. Note that the way splines are machined on an Italian gear cluster (left) is different to a Spanish one (right). Despite the different machining the two are interchangeable.



Also examine the bearing surface at the bottom of the cluster for pitting.

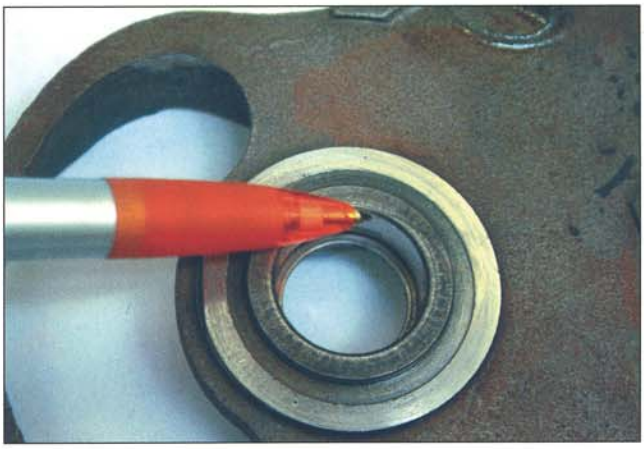
If your gear cluster is very badly pitted on the lower bearing face, it is possible to machine it down and fit a replacement bearing track. MB Developments offer this service.

Endplate Selection

Make sure you use the correct gearbox endplate for your side casing. It is possible (but not always advisable) to use the GP one with integral ramp on all earlier engines, provided you remove any separate ramp from the side casing. It is only possible to use an old-style endplate if your side casing is fitted with a separate bolt-in ramp.

While most of the changes made to the GP were improvements, one problem with the kickstart ramp being built into the endplate is that it has no adjustment. Early systems can be adjusted to get the kickstart to engage as soon as the pedal is depressed, which aids starting. Also operation of the kickstart in the GP system puts added pressure into the already over-stressed endplate studs, so the early system is really preferable in tuned engines.

Check the condition of the layshaft bearing track for pitting. If this is worn the track can be knocked out with a drift and replaced. Also check the endplate face that the large gear shim rests against. If this is very badly scored then the endplate requires renewal.



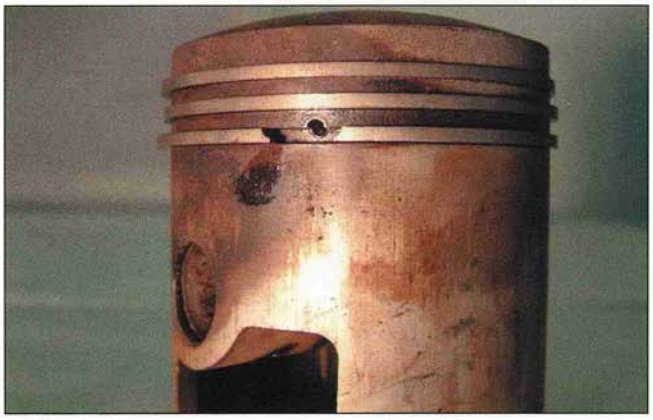
It makes more sense to measure your piston ring gap in the upper end of the bore where the rings actually run. Use the piston to push the ring into the bore squarely and at least a centimetre into the bore so that it is below the wear lip.

The Home Workshop Manual suggests all standard 125cc models must have a piston ring gap of at least 0.16mm (0.006") and all engines over 125cc should have a gap of at least 0.2mm (0.008"). Maximum gaps are 0.55mm (0.021") for 125cc and 0.6mm (0.024") for over 125cc engines.

On tuned engines Mark Broadhurst suggests a wider gap of 0.25 – 0.5mm (0.010" to 0.020") is better on assembly, particularly with Japanese pistons which often have such large gaps straight out of the box. If the gap is marginally too tight it is possible to lightly file the ring ends.

In standard applications the Lambretta piston's ability to cope depends on who manufactured it. Better brands are Asso, Vertex, Borgo, Hepolite or Mahle. Whoever produced it, check for missing or worn-out ring pegs, broken rings and cracks around the cutaways in the piston skirt.

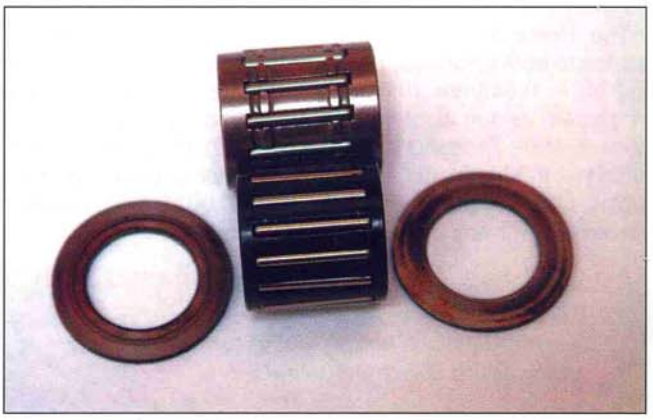
If one piston ring is broken or outside tolerances then the full set must be replaced. Avoid the use of pistons with brass ring pegs as these are prone to wear.



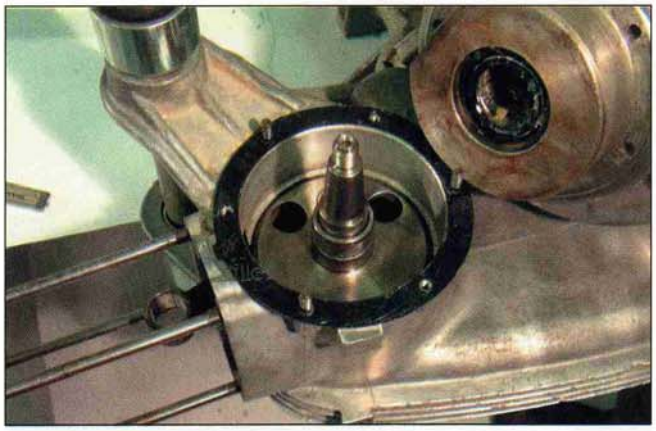
The blackening ('blow-by') so far down the sides of this piston indicates that the piston rings or the bore are badly worn. It is possible to buy new rings if the piston to bore clearance has not exceeded specification, but take care to order the correct type and size. Many different companies have produced pistons for the Lambretta so make sure to tell the part supplier how many rings are fitted, how thick they are and if the piston is an oversize.

Also check for wear on the gudgeon pin. If there is a lip that you can locate with a finger nail then the pin is worn out and should be replaced.

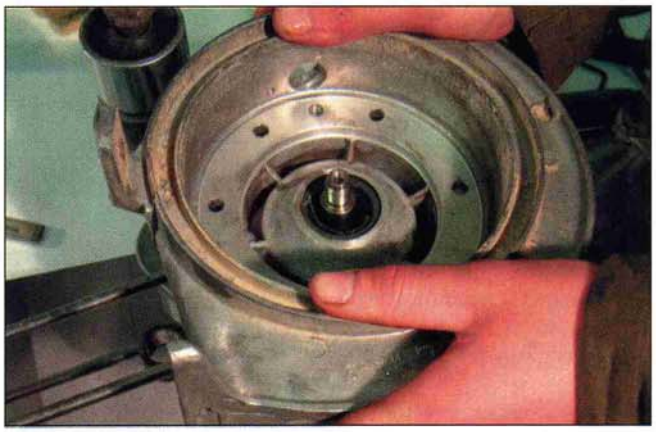
With later types of original crankshaft, gudgeon pin shims are specified to keep the con-rod running centrally on the big end bearing. The crankshaft appendix lists which types require shims. The problem for those seeking to use gudgeon pin shims is that good quality replacements are currently hard to find and poor quality ones can break and wreck your engine. If you do not have access to useable original Innocenti or Serveta piston shims (and quality replacements do not become available in future) then it may be better not to fit any. Wider Japanese type small end bearings can be used to take up the slack at the piston end, but the con-rod is still free to float from side to side, which is not ideal. Converting to a 'race' type crank which uses big end shims is probably your best option.



Some dealers advise the use of silicone sealant on this gasket for a more secure seal but this makes gasket replacement a messier job.



Slide the mag housing over the crankshaft and onto the studs.



Clean off any excess grease around the crank. On a standard motor use a plain M6 nut and wavy washer on each stud. Torque the nuts to 0.48 – 0.53 kg-m.

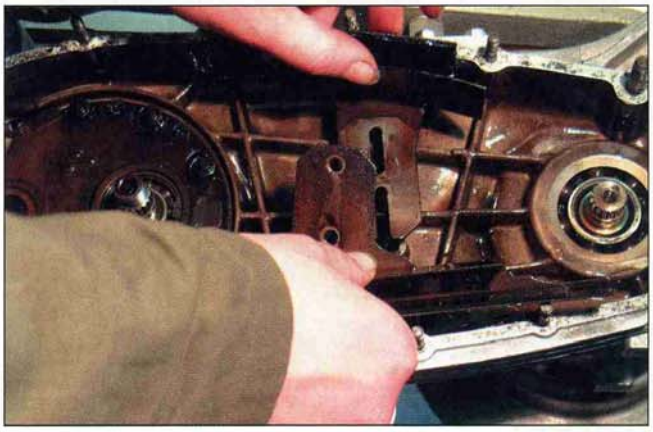
Transmission

The first step is to fit your chain guides.

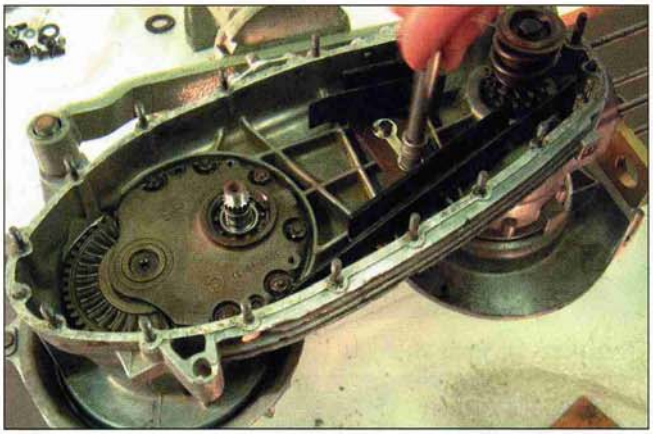
Different standard bottom chain guides are available to suit either 15 x 46-tooth (non-GP 200) or 18 x 47-tooth (GP 200) sprockets. Choose the correct one for your sprocket set-up. Good Italian and Spanish bottom chain guides are hard to find at the moment.

It is possible to use early chain guides together with GP 200 18 x 47-tooth (or larger) sprockets if you saw an inch off each end and ovalise the mounting holes so the bottom guide can sit lower.

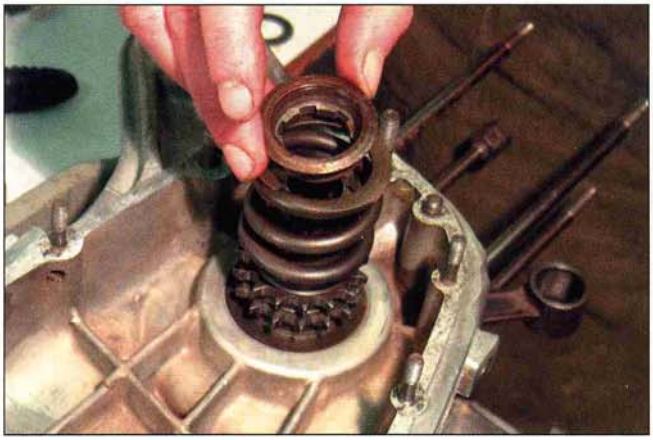
It is advisable to fit an uprated top chain guide in even standard engines. See the following chapter.



On standard engines, the chain guides are retained by bolts and a tab washer. The standard bottom chain guide overlaps the top one. Position the top chain guide as low as it will go. Do not do the bolts up tight at this point.



The front sprocket and cush-drive ('shock absorber') components are assembled as follows: first the thin dished oil thrower, then the sprocket sleeve, then the front sprocket itself, followed by the sliding dog and then the spring. The spring cap is the last piece to go on. Use a shouldered Innocenti front sprocket bolt or a British remade one in preference to the Indian 'bolt and washer' arrangement.

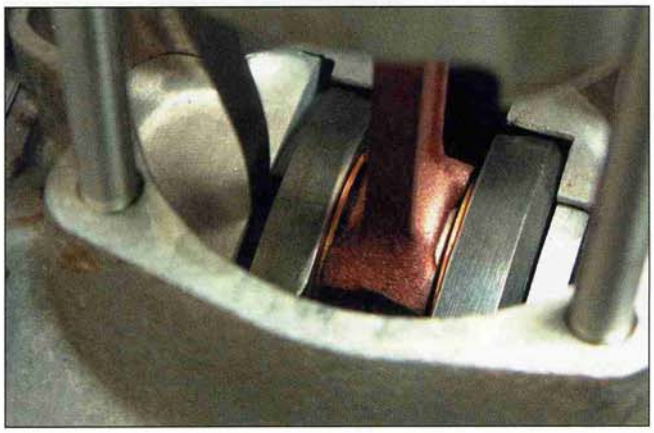


With the mag housing only locating onto studs, there is room for it to sit at a slightly different angle each time it is fitted. In order to locate it in the same position each time – so the ignition timing marks stay relevant – first centralise it with a countersunk M6 Allen screw.

Mark fits mag housing studs and nuts in one go by first winding a new Nyloc nut onto the stud until it is flush and then winding it into the casing as if it was a bolt. He fits a washer underneath the nut and uses a dab of Loctite on the stud. The casing threads have to be in very good condition for this to work.

The new studs will wind in until they bottom out whereupon the nut will tighten up to finish the job.

With the mag housing fitted, check that there is some clearance between it and the crankweb – particularly when using cranks built with aftermarket crankpins (e.g. MB Developments' 41mm long pins). If you do not have enough clearance you can either machine the mag housing face or add an extra mag housing gasket.



Engine Top End Assembly

Mark uses a 'long' cylinder head nut with a short bolt in it to act as a stud fitting tool. The stud bottoms out on the bolt and can be wound in using the nut. Once at the required depth the bolt can be backed off a little which frees the long nut to be wound off by hand. Mark only uses specially-made high tensile studs.

Genuine Vespa PX200 cylinder studs are very good quality and have a longer thread at the nut end which makes them suitable for use even with non-standard length cylinders. They also have slightly fatter threads which take up play in loose casing threads. Avoid the use of Indian or remade Italian cylinder studs.

Mark fits the cylinder studs with just a light smear of grease on the sides of the stud thread to help if they ever need to come out again. Never put any grease on the end of the stud or into the casing thread as the hydraulic pressure caused when the stud is wound in can crack the casing. If the threads are not in the best condition then Loctite would be preferable.

ELECTRICAL SYSTEM – THE SPAGHETTI NIGHTMARE

Lambretta electrical systems are perhaps the most difficult area of these machines, not because they were especially complex – which they weren't – but because they had so many variations. There were no less than four manufacturers of 4-pole flywheel and stators and three different ones for Italian 6-pole systems. With each of these having AC and DC versions and being altered from model to model you can see that it is almost impossible to catalogue every part and every variation accurately. Instead we have offered tips on each of the specific electrical components found on a scooter.

If you are hunting for spares (such as points, condenser or HT coil) for a specific machine then you are best to consult a knowledgeable shop quoting the model, year and component manufacturer. A Lambretta parts book can come in especially handy here for quoting the specific part number. The wiring system for most Italian Lambrettas came in two flavours: battery or non-battery. Many UK-supplied machines tended to have batteries as standard to power parking lights, whereas many of the more recent Italian imports were never fitted with batteries to begin with.

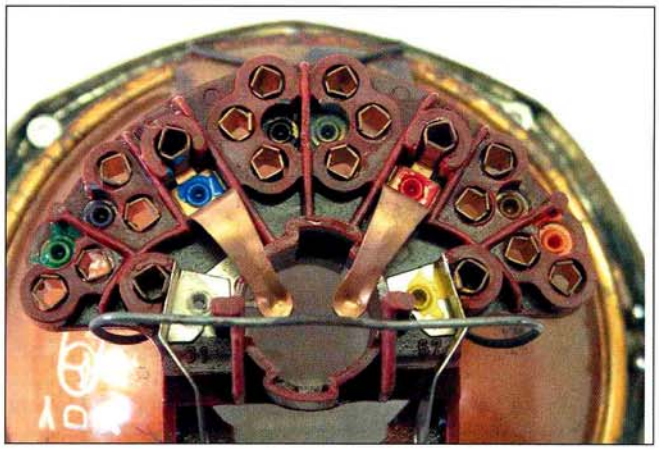
Subsequent Spanish and Indian production used more complicated and different wiring to include electronic ignitions and indicator systems, and these were changed regularly throughout production. Colour wiring diagrams for several systems are supplied in the appendix at the rear of the book, but these may not cover all the variations produced in Spain and India. For help on Spanish electrics consult Serveta specialists Bedlam Scooters or Totally Scooters. For assistance with Indian parts try AF Rayspeed or Scooter Restorations. Also see www.scooterhelp.com

Various Tips

- Swapping known good parts for suspect ones is the best way of tracing intermittent problems.
- A length of wire fitted with a crocodile clip at each end is useful for tracing broken wires or connecting substitute components.
- If you have to repair broken wires, solder and seal all connections with heat-shrink sleeving which is available from good electrical suppliers such as Maplins or RS Components.
- **IMPORTANT:** Note that on all 6-volt systems, the speedo light bulb should be 12-volt 2.5-4Watt. A 12-volt bulb helps to absorb excess electrical power.
- Early 4-pole models earth the ignition through the brake light switch, so if the stop light bulb blows the engine cuts out.
- The change-over from 4-pole to 6-pole ignitions happened from machines of the following engine numbers: LI 125 – 36626, LI 150 – 631475, and TV 175 – 507945. Variations of the 6-pole design were fitted to all subsequent models.
- Never run a battery type stator plate (Italian wiring: green, brown and two yellow wires) without the battery connected because the coils can burn out. To test for a damaged coil try sparking each of the yellow wires against bare metal with the engine running. If one of them doesn't spark then the coil is probably faulty.
- Machines wired with a second 6v battery in the toolbox, or Indian pre-'86 machines carrying a 12v battery which is wired POSITIVE EARTH have been given a UK 12v conversion using a Lucas rectifier and Zener diode. Full details of this system are available in Mark Haines' Unofficial Lambretta Manual Update.
- Indian non-battery GPs after engine number 73000 (but pre-electronic ignition) have a different stator and wiring so that the headlight bulb circuit is supplied at 12v, but the other circuits run at 6v.
- Do not trust the colour coding of Indian components!
- Always make sure there is a good earth wire between chassis and frame. Many Lambretta electrical problems are caused by this simple omission.
- Ensure that your bulb holder junctions are in perfect condition. Both ignition and lighting systems rely on good connections here.
- Indian points ignition components (flywheel, stator and HT coil) should be kept together and not mixed with Italian parts.

Headlight 'Bulb Holder' Junction

- The headset wiring does look complex but in reality it couldn't be much simpler because all the terminals are colour coded, and all the terminals of the same colour are connected together.



- Polish all wiring bullet connectors with wire brush to ensure good connections.
- Lambretta bulb holders are prone to having the terminals come slightly loose over the years, thus making bad connections. It is possible to re-punch the rivets that hold them, but it is often more reliable to solder across the back of them or place a small piece of wire to bridge connecting terminals before the bullets are pushed in.
- On all 6-volt models the speedo bulb acts as buffer to absorb any surplus power in the event of an electrical surge, and to prevent all the other bulbs blowing. The problem with this system is that the bulb only earths through the speedo cable, which both runs in grease and also can be known to snap. In order to provide a better earth for the speedo light bulb, some dealers make a small alteration to the wiring in the headset. This is explained in the Headset section of the Chassis Check chapter.

This system then used the original Vespa CDI box and regulator. Apart from disintegration of the occasional plastic fan and the aluminium cracking around the centre boss and ripping out of the odd flywheel, this was a fairly reliable conversion.

AF/Indian/Vespa/GP Ducati Ignition Fault Finding

This text assumes that if you have an Indian stator it has been wired up as per the AF/Vespa colour coding which is:

- WHITE = Earth to stator
- RED = black Pick-up coil
- GREEN = Low Tension (LT) power coil

These colours match up with the colour coding on commonly supplied PX-type black or blue CDI units.

Original GP Electronic stators are wired up this way:

- GREEN = Earth to stator
- RED = black Pick-up coil
- WHITE = LT power coil

A Vespa-type CDI box may be used with an original GP Electronic flywheel and stator if you swap the positions of the white and green wires.

To carry out the following tests you need to be able to use an electronic multi-meter set to measure resistance (ohms Ω). Check these figures in sequence.

1. Measure between the terminal of the White earth wire (Green on original GP) and the mag housing or stator plate backing. The resistance should be a short circuit (i.e. less than 0.1 ohm).

2. Measure between the terminal of the White earth wire (Green on original GP) and the terminal of the Red pick-up wire. On all stators you should expect a reading of 95 – 120 ohms.

3. Measure between the terminal of the White earth wire (Green on original GP) and the terminal of the Green LT power wire (White on original GP). The reading should be in the region of 450 – 540 ohms.

If your measurements from tests 2 or 3 show a much lower measurement this normally indicates a short circuit, possibly from a trapped wire or broken insulation, but occasionally from a faulty coil. If either of the tests show infinity (∞ or a flashing 'I' on digital meters) then it means a broken circuit, either due to a faulty coil itself or more commonly a loose earth tag or broken earth wire particularly coming from the LT coil. Both pattern LT coils and Pick-ups are available as spares and can be fitted to fix a dead stator plate.

It is possible to test the function of the CDI boxes, but substitution for a known good one is a far more simple way of testing. One of the good things about electronic ignitions is that they suffer far less from intermittent problems than contact breaker systems. Normally one works or it doesn't work. With that established it is a simple matter of isolating the faulty component and replacing it to get it working again.

The white lead and tag coming out of Vespa-style CDI units is a secondary Earth connection. While it should be connected to a chassis earth the CDI should still function if this short earth lead is broken, as long as the white wire from your stator is in good condition and well earthed (and vice versa).

Flywheels

If the crank taper shows any signs of prior damage file off any high points and 'lap' a flywheel onto it by putting a smear of grinding paste onto the taper and turning the flywheel backwards and forwards to improve the way they mate. When they match, both surfaces will have a slate grey colour. Thoroughly clean off all grinding paste.

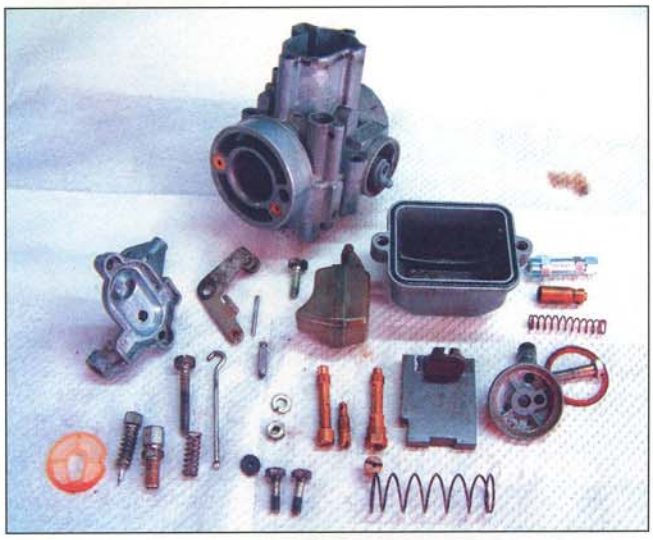
Brass 6-pole flywheels with a riveted-on aluminium fan – part no. 31.46 – are often found on early (post-4-pole) machines (LI-TV). These flywheels were prone to having the fans come loose and also loss of magnetism, so were superseded by the fully cast aluminium types. Magnets can be recharged at specialist dealers who still have the Innocenti flywheel re-magnetising tool.

If you plan to chemically clean the carb then continue stripping it down. Unhook the slide and spring, withdraw the slide rod, and remove the rubber sealing washer.

Two types of carburettor clamp were originally used. The older cast ones (left) are probably better than the modern folded steel ones (right).

Various types of float needle are available. The modern ones are red-tipped and are produced to survive the ravages of unleaded fuel, so it is important to fit one if your carb has the old black-tipped type. If the needle shows any sign of wear – or your scooter is prone to flooding if left stood with the fuel on – then renew it.

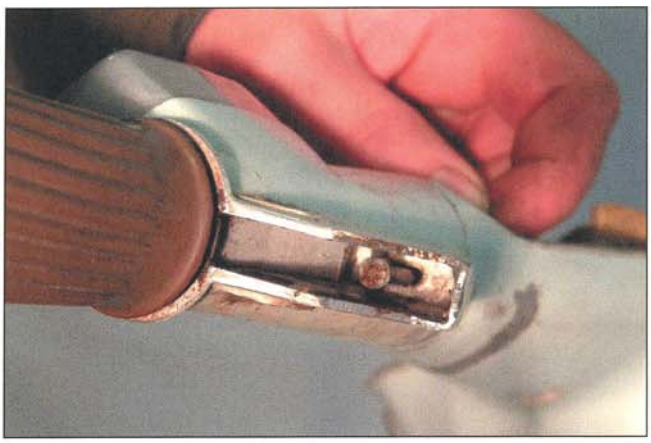
Once stripped, clean as thoroughly as possible with lint-free cloth and proprietary spray-on 'carb cleaner' and blow through with compressed air. Normally a good manual clean to this standard will set straight any fuelling problems.



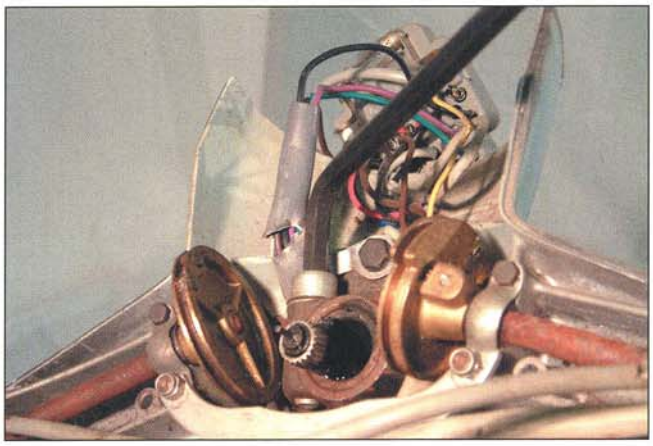
If your carb has been stood without running for a long period (i.e. several years) then the fuel can evaporate away leaving a filthy emulsion of two-stroke oil which can clog up all the internal drillings of the carb. Immersing the main carb components in an ultrasonic bath is the modern way of carb cleaning, and various companies now offer this service in scooter and classic motorcycle magazines.

Dean Orton was shown another quick – if more dangerous – way of cleaning old carbs by an Italian classic bike enthusiast. The carb should be stripped of all plastic parts – ideally including the plastic bush that fits onto the manifold. It is impossible to remove these bushes without damaging them, so do not attempt this without a replacement to use. Use a piece of wire to attach the four bare alloy components together and immerse them in a bucket of neat battery acid for 15 seconds. It will bubble like hell. Using a pair of pliers carefully withdraw the parts – being careful not to splash or drip acid on anything important like your skin – and immerse in another bucket of fresh, clean water for a minute or two. Shake the parts in the water to ensure all the acid has been washed out. Blow-dry the parts with compressed air or allow them to dry naturally before rebuilding with new gaskets, O-rings and a new plastic bush. This process will not remove thick, encrusted dirt which should be scraped off first, but it will clean out all but the most clogged internal drillings.

Depending on the type of cable used, you may now be able to withdraw it from inside the headset, but if the nipple is too large then the inner cable must be pulled out entirely. Since it will be badly kinked at the adjuster end it is better to cut the inner cable if withdrawal is required.



To remove the headset you will also need to detach the clutch, throttle and both gear cables before undoing the main clamp bolt with an 8mm Allen key.



If you only need to get the forks out, it may be possible to undo the clamp bolt and lift the headset off the forks with many of the cables still attached. You may need to undo a couple of the cable ties to do so. The best technique is to hold the forks steady between your legs while lifting and twisting the headset from side to side.

Front Wheel and Fork Removal

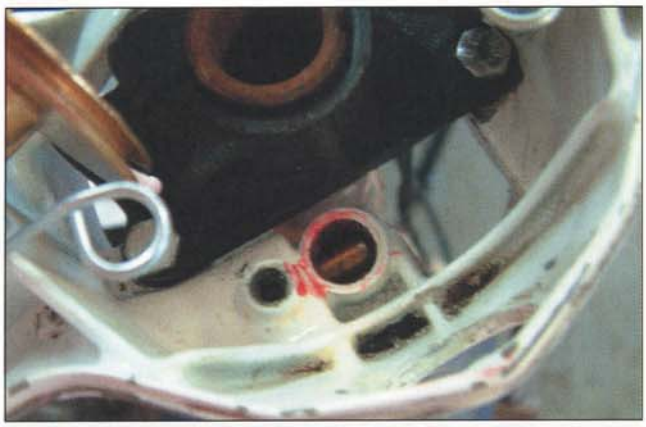
Start by undoing the two wheel spindle nuts. These have 21mm heads; which is the same as spark plug socket size. The wheel will not drop out until you pull out the special locating washers which sit in recesses in the fork links. Disc brake machines will also have the back-plate attached to the right hand link by a stud and nut arrangement which will also need to be loosened.

Occasionally if the spindle is in poor condition you will find that the spindle nut on one side does not undo because both nut and spindle turn together. In that instance you need to find a thin spanner that will fit the other spindle nut behind the link. If you tighten that nut it should hold the spindle tightly enough to remove the outer nut. Some cycle spanners are thin enough for this job.

A special C-spanner is used to loosen the fork locking ring.

If you don't have the right C-spanner then it is possible – but not recommended – to loosen the locking ring by putting a chisel into the cutaways of the ring and tapping the ring loose with a hammer.

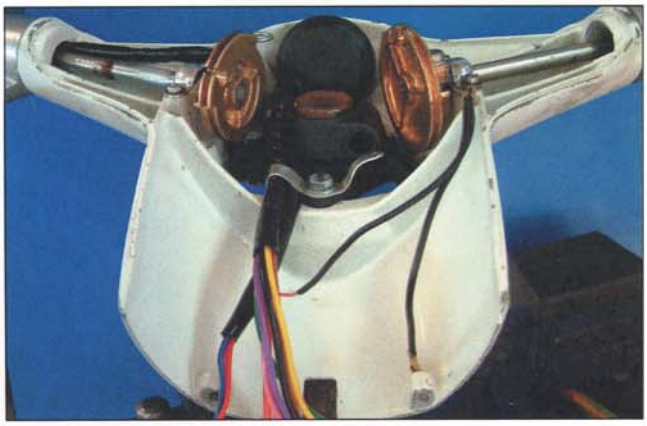
Grease inside the steering lock mechanism before fitting the lock itself.



Pattern steering lock kits are available and do work adequately (though never rely on one to prevent theft). A grub screw retains the lock and a metal cap covers the other hole once assembled.

The ignition switch fits with a thin metal shim outside the headset and a knurled ring which should be fastened with a dab of Loctite. Some Indian switches have a second shim inside too. The wiring from the switch is held down with the aluminium tab as shown.

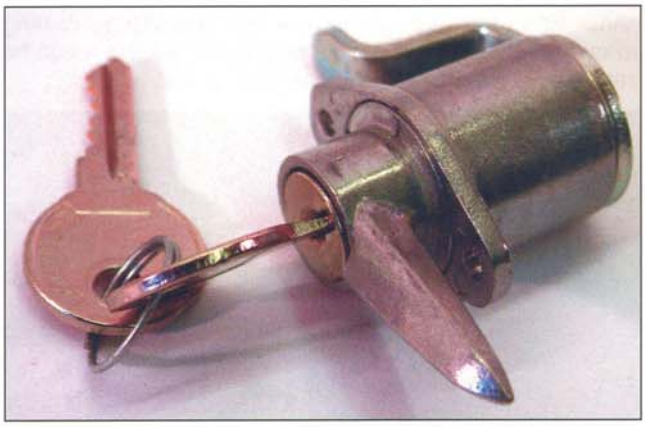
Dean makes up a round terminal with two 8-inch earth wires to fit to the screw shown (right). One end has a bullet connector which plugs into earth terminal on the bulb holder. This connection is more reliable than the original earth through the headlight rim. The other wire is left bare to act as an earth for the important speedo light bulb (see Electrical Chapter) and simply fits inside the speedo housing before the speedo light bulb holder is pushed in to trap it.



Locks

Do not throw away original steering or ignition locks just because you have no key. Each should be stamped with a three figure number and Weston Scooter Parts can supply replacement keys from that code.

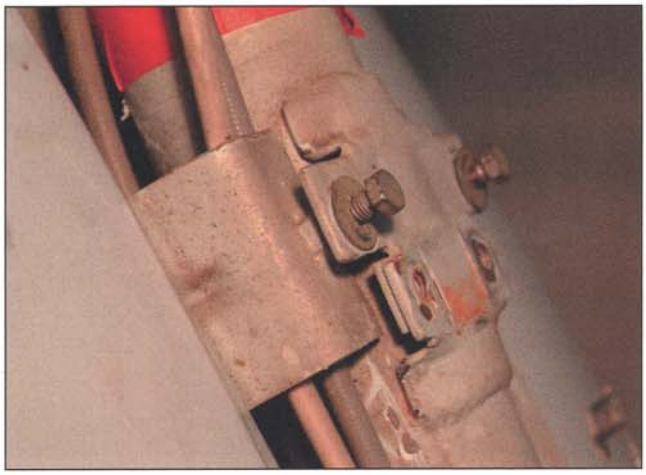
Toolbox locks fit from inside the toolbox door and are secured by special rivets.



Legshields

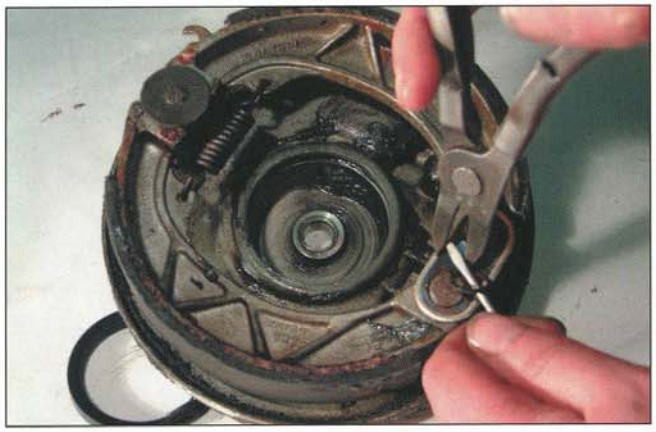
It will be impossible to detail here all the numerous changes to legshields during production in respect to badge holes etc. With original legshields now rarer than honest politicians, it should suffice to find a good condition set of the right type (i.e. 'chrome ring', 'non-chrome ring', 'GP' etc) and drill or fill badge holes to suit. Remember that this is best done before you get them painted!

The very first sort of legshields (early chrome-ring type) is identifiable by nuts welded to the outside of the bracket which bolts to the frame.



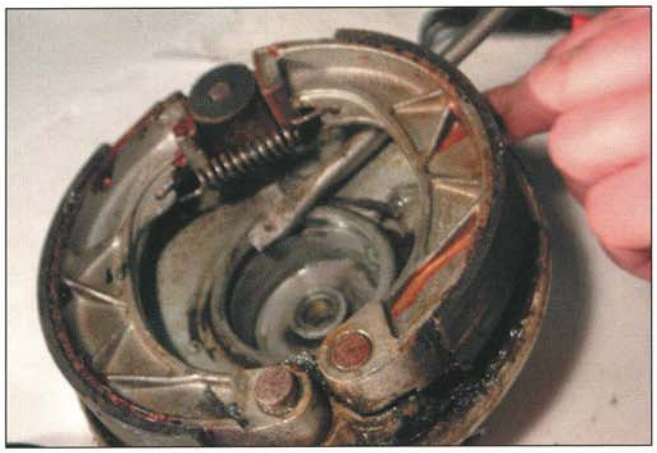
The lip of the grease seal had been turned inside out and damaged when the hub was last rebuilt, or more likely by over-filling the speedo drive grease nipple.

Remove the circlips, spring plate and flat plate holding the shoes in place. A small screwdriver can help to lift off the circlips once the pliers have opened them. GP drum brakes use single piece wire 'W'-clips instead of separate circlips and plates. These are only interchangable as a unit.



Turn the brake arm so the shoes are as wide apart as possible. Lever one shoe up, one end at a time.

If the shoes are seized on the pins then cut the spring and apply heat to each shoe to encourage it to come loose from the pin. The pins are cast into the hub and should not come loose.

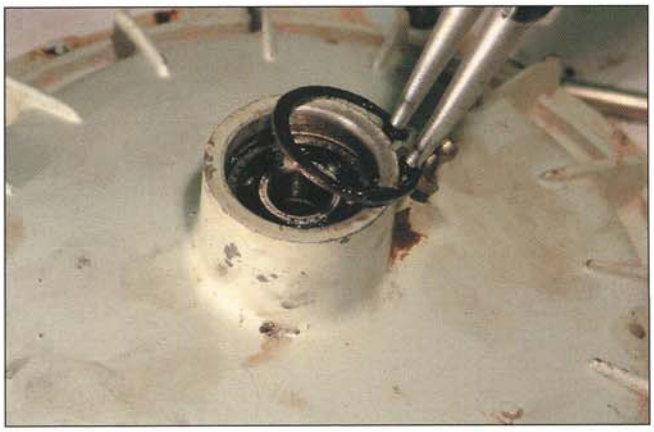


Lever out the front hub oil seals.

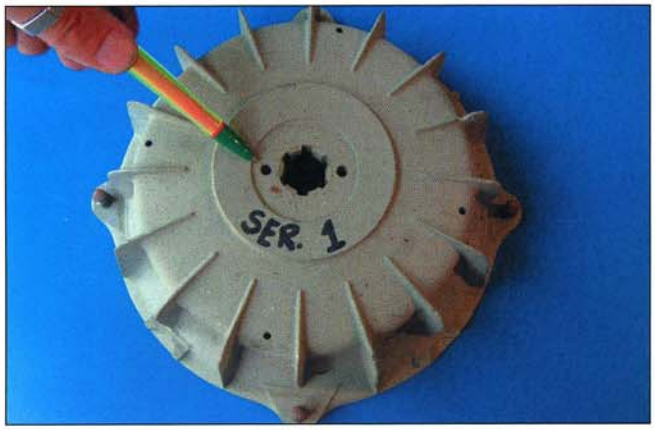
There is a spacer bush inside the inner seal which must be kept safe before the seal is removed.

You can rest the hub on a stack of two wheels to knock the bearings out. A 3/8-drive extension bar will shift the bearings, but throw them away afterwards. Any bearing knocked out by the middle of the race may reasonably be regarded as knackered.

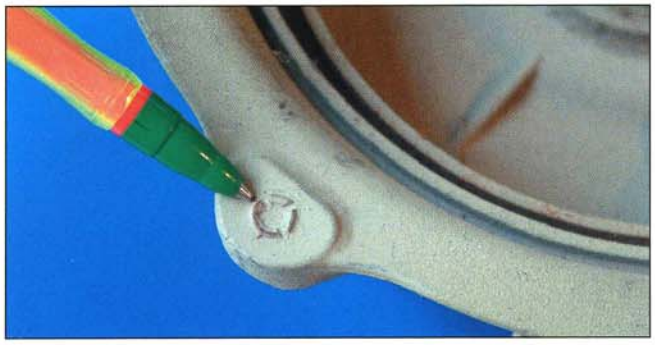
With the inner bearing and spacer tube removed you can now remove the circlip so that this outer bearing can be drifted out from the other side.



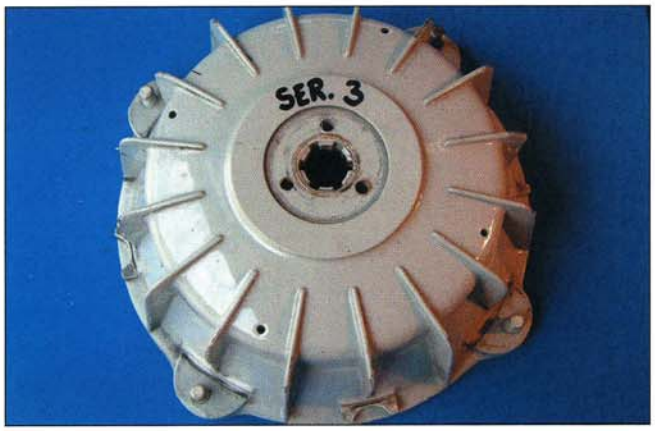
Series 1 and early Series 2 rear hubs only have two holes and will need a modified locking ring if desired as none was originally fitted.



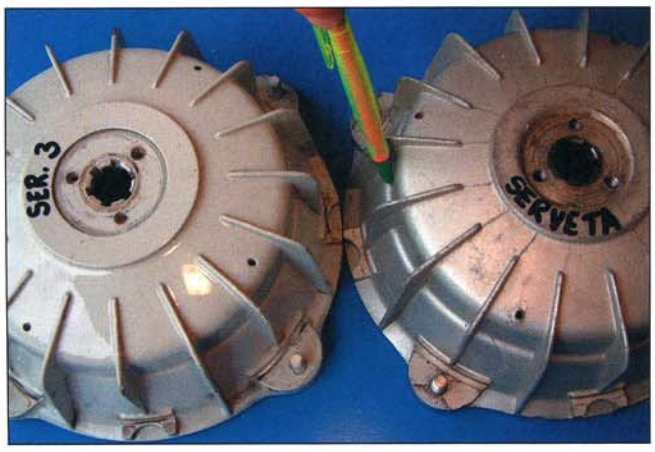
Early Series 1 hubs have the studs peened over at the back rather than the removable ones with a hexagon head.



Series 3 hubs have three threaded holes and a recess for the locking plate.



Serveta hubs (right) look similar to series 3 ones, but have a noticeable lip where they are thicker around the brake lining. They are also heavier. In good condition Serveta hubs are the best available.



Later SX and GP type hubs do not have a recess around the locking ring, and have a double lip around the brake lining.

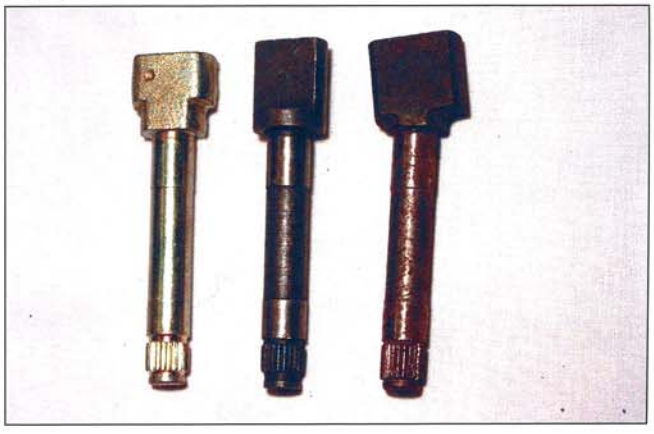
Top Tips for an Effective Rear Brake

- Use a thick rear brake outer cable (Indian ones are fine) with a good quality inner. The outer cable has to be exactly the correct length (65cm) for optimum efficiency.
- The problem with old hubs is that very few are actually round. If you take the rear wheel off, spin the hub and look from the back, most old hubs demonstrate a kink or warp where they have been whacked off with a bit of wood or lump hammer at some time in the past. As far as replacements go Serveta hubs were the best available, but are now hard to find. Genuine SIL Indian GP rear hubs and brake shoes do actually work pretty well and are strong, but not all Indian hubs are to the same standard. On the pot-holed roads of Ireland for the Euro Lambretta rally it was those with Indian hubs that had the least trouble. At the time of writing Italian remade FA rear hubs are the most commonly supplied spare, but these are usually fitted with very poor quality studs and are not highly regarded. Also check the fit with pattern rims which may need to be centralised on FA hubs.
- Use good quality brake shoes. The best are New Old Stock (NOS) Innocenti ones which were made with asbestos. It is possible to clean up old shoes if not too worn or oily with brake cleaner and careful sanding but DO NOT BREATHE THE DUST. Of the remade ones Ferrodo and Adige are good quality. Not all other Italian brands are so good.

Rear Brake Reassembly

First ensure you have the correct brake shoes for the cam you are going to fit.

There are three common types of rear brake cam. The LI/TV/SX type (left) is thick and uses brake shoes part no. 15044040. The GP type (centre) has a narrower cam face and uses brake shoes part no. 22044040. The offset type (right) is from a Serveta and uses the same brake shoes as LI/SX.



CHASSIS REBUILDING

Before We Begin

Lambrettas were a mass-produced item and not always built to the world's tightest tolerances, so don't expect everything to go together easily. New pattern parts are rarely a perfect fit so be prepared to file, bend or adjust everything to get it to fit correctly. You are working with the best that is available, but that isn't always up to much!

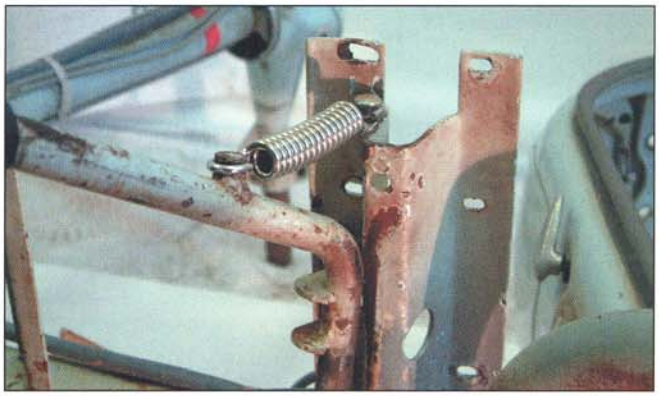
General Chassis Tips:

- If you aren't fussed about a 'perfect' restoration then change all the 14mm nuts used on early models (wheels, cylinder head etc.) to 13mm so you only need to carry one socket.
- If you want a really perfect restoration then you should use the 'blackened' studs and washers that were originally fitted to the scooter. The problem is that these have virtually no resistance to corrosion so if you wash your scooter or ride it in the rain then the fasteners will go rusty. That looks pretty grim on a restoration. The options are plated or preferably stainless steel fasteners.

IMPORTANT NOTE: The photos for this section were taken at different times and occasionally show components fitted that haven't already been mentioned in the captions. Please ignore this and fit parts according to the sequence suggested in the text.

Fit Stand

Grease and connect the stand spring before offering the stand up to the frame. Original offset-type stand springs have recently been reproduced and are a better fit than the common concentric type.



All good dealers use and supply stand support brackets to stop the stand bolts distorting the frame. These are an essential fitment. Thicker ones are better since they are less liable to distort.

Fit Rear Mudguard

Italian machines used metal mudguards while Indian models introduced plastic ones during early production. Spanish rear mudguards have a simpler single piece metal pressing. These bolt on through brackets either side of the main frame tube, and via a single hole at the rear of the frame.

Fit Bearing Cones 'Cups' and Forks

Use paint stripper to clean off any over-spray inside the frame so that the steering bearing cones can be fitted.

A Dremel or similar tool can be used to remove any paint so that the steering cones will fit properly, but be careful not to remove any metal.

Grease the outside of the upper and lower bearing cones and hammer them into place using a suitable drift.

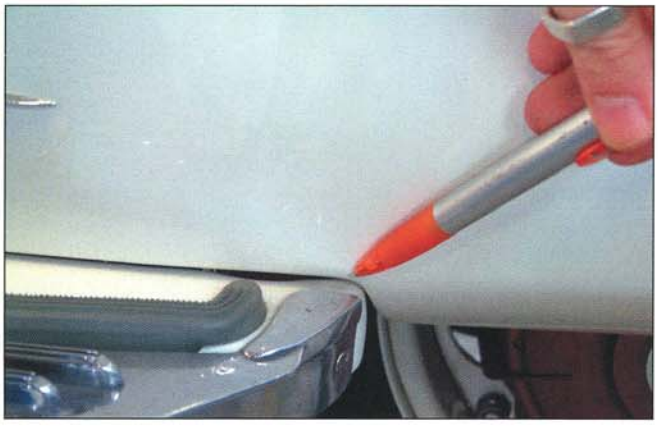
Thoroughly grease all the bearings before fitting the forks.

One racer trick to improve steering action is to not use caged bearings (as originally fitted) but loose balls. The increased number of contact patches gives a much better 'feel' to the steering. These can be a struggle to install since you have to rely on grease to hold them in place while the forks are fitted.

Bodywork Assembly – Which Order?

As you may imagine it is possible to assemble Lambretta bodywork in many different orders during a full restoration. According to Rimini Lambretta Centre there is only one correct way to do it if you are fussy about the fit and alignment of the various components. Ideally you should have already carried out a 'dry run' of bodywork fitting before any paint was applied so that the fit could be 'tweaked' where necessary.

1. Fit the L-shaped running board support leg (kickstart side) and ensure alignment with the main floor cross-members.
2. Fit the sidepanel rubber buffers to each running board support strut.
3. Fit the rubber sidepanel beading around the lip on the seat arch after first applying a coating of impact adhesive (e.g. Bostik) to ensure they stay in place. Don't use 'Superglue' as this will melt the paint.
4. Loosely fit the rear running boards with all the correct rubber spacers underneath.
5. Fit the sidepanels and ensure they are fully seated into position on the beading. Since these are the only component which can't be adjusted for position, all the other components must follow their alignment.
6. Adjust the positioning of the rear running boards so that they do not touch the sidepanels and there is a small gap of a few mm all around them. Do not fit the footboards too close to the sidepanels, as all the bodywork components will 'move' around due to vibration in use and will damage the paintwork if it rubs. Once you are satisfied with their position firmly fix down the footboards.

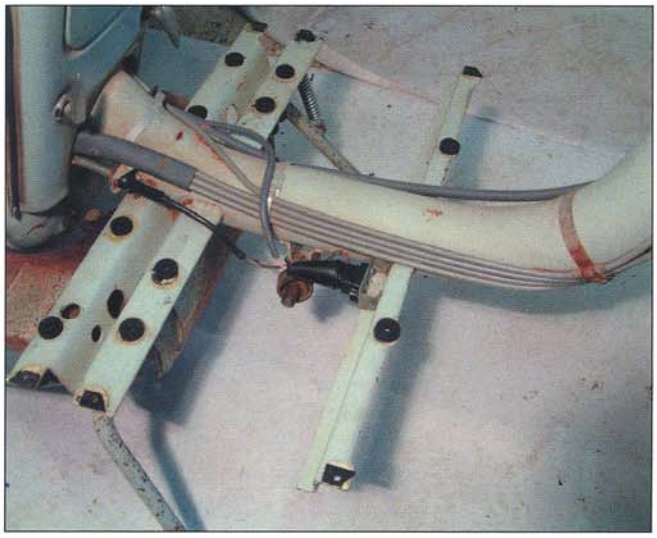


7. Fit and adjust the legshields so that there is a small, even gap to the running boards at the rear, and to the headset (or chrome ring) at the top.

Before Fitting Legshields

Many restoration specialists are now able to supply complete legshield and runner fixing kits. It will be easier and cheaper to buy one of these kits than try to assemble the parts yourself. Some of the rubbers are specially shaped.

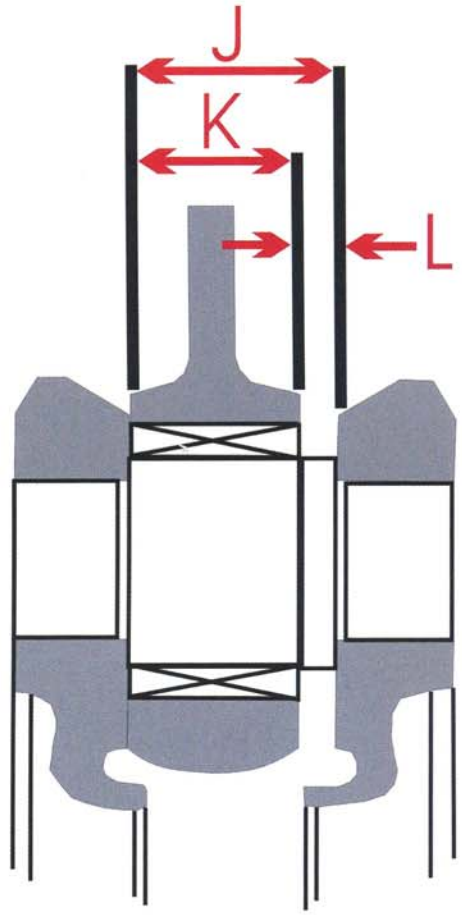
The rubbers can be held into position on the struts with clear silicone instant gasket which will allow the rubbers some movement if the holes aren't perfectly aligned.



On these original legshields there is a rubber spacer glued into the legshields between the bottom screw holes for the horncasting.

CRANKSHAFT SPECIFICATIONS

Italian Crankshafts (all measurements in mm)

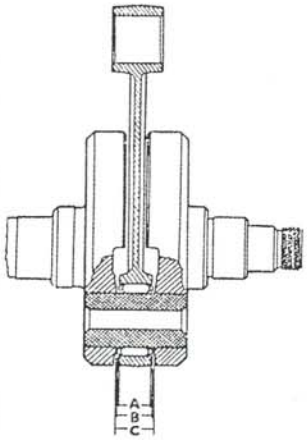


MODEL	(J) - Gap Between Crankwebs (mm)	(K) – Con-Rod Big End Width (mm)	(L) Sidefloat on Assembly (mm)	(L) Maximum Permissible Side float
LI 1, LI 2, LI 3 (Early), TV 175, TV 200	14.0	13.8	0.122-0.275	0.40
Later LI, Special, SX and GP using gudgeon pin shims	14.0	12.8	1.100-1.275	1.50

SIL Indian GP 150/200 wide con-rod type

Assembly tolerances and Wear limits between crank shaft and con-rod big end.

With of Crank shaft boss in mm **(C)**	With of Con-Rod big end in mm **(A)**	Roller Cage width in mm **(B)**
+0.1 15.8 -0.05	+ 0 15.5 - 0.5	-0.2 15.7 -0.55



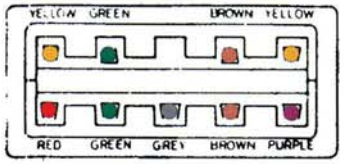
Assembly Clearances

(C-A)		**(C-B)**	
Min	**Max**	**Min**	**Max**
0.25	0.45	0.25	0.75

Original Type Crankshaft Notes

- TV 175 con rods have flats machined into the webs and a 116mm (centre-centre) length con-rod. All other standard cranks use a 107mm rod.
- Early TV 200 crank was replaced by part 42912150 which is noticeable by the flats on the crankwebs. The later cranks are intended to be used together with a revised piston and gudgeon pin shims.
- SX 200 crank part 19612150 identified by 19.5mm balance holes in the webs. Should be used together with tapered gudgeon pin (19612018) for optimum engine balance.
- GP 125 and 150 cranks have thick flywheel taper and balance holes. GP200 has thick taper and plain webs. Both are intended for use with shimmed pistons. Some GP 150s came fitted with GP 200-type cranks.
- Original SIL Indian GP 'wide big-end' type cranks supplied since the mid-90s. Identified by the rod being 15.5mm wide at the big end bearing, but having no big end shims. These cheap cranks have proved popular as spares for standard machines since no gudgeon pin shims are required, but the bearing and rod are not suitable for use in high-performance motors. These well-made crankwebs can be fitted with Italian 'race'-type rods and bearings with good results.

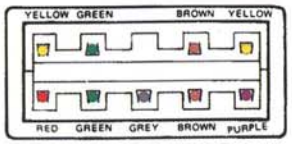
PART NUMBER	MODELS	PISTON SHIMS	CRANKWEB FEATURES	COMMENTS
19912140	LI125/150 ser. 3 Early Special 125/150	NO	no flats	Replace with 19912190
19912190	Later Special 125/150, SX 150	YES	no flats	
19212140	TV 175 ser. 3	NO	2 flats	116mm con rod (non-TV175 are 107mm)
42012140	TV 200	NO	2 flats + 2 small holes	Replace with 19612150
42912150	Spare for TV 200 & early SX 200	YES	2 flats + 2 small holes	Replace with 19612150
19612150	Late SX 200	YES	2 flats + 2 19.5mm holes	Use with tapered gudgeon pin
22012020	GP 125/150	YES	no flats 2 holes 19.9mm stepped crankpin	Thick flywheel taper. 13mm wide flywheel oilseal shoulder.
	Late Indian GP 150	YES	no flats no holes 22.9mm crankpin	Thick flywheel taper. 13mm wide flywheel oilseal shoulder.
43012020	GP 200	YES	no flats no holes 22.9mm crankpin	Thick flywheel taper. 10mm flywheel oilseal shoulder for wider NU-2205 flywheel bearing
	Late SIL Indian GP 200	NO	no flats no holes 22mm crankpin 15.5mm con rod big end width. No big end shims	Thick flywheel taper. 10mm flywheel oilseal shoulder for wider NU-2205 flywheel bearing



RECTIFIER
CONNECTIONS

LI 125-150 Series III 6-pole DC 6v (battery)

HANDLEBAR SWITCH
BATTERY
RECTIFIER
SPEEDO BULB
STOPLIGHT SWITCH
REAR LAMP
HEADLAMP
=White
CUT-OUT SWITCH
HORN
HT COIL
SPARK PLUG
STATOR
1
2
3
4
5



RECTIFIER CONECTIONS

SIL Indian GP 150 DC (battery and indicators)