

LAMBRETTA & VESPA SPARK PLUG SELECTION & USE

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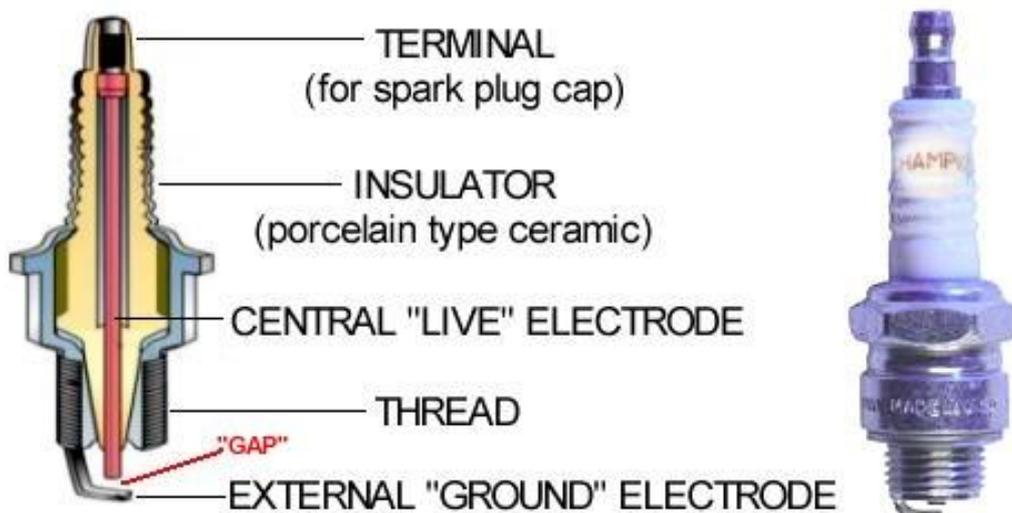
Selecting the correct spark plug for your classic scooter is not as easy as one might believe, because today there are far more varieties of spark plugs available than in the 1960's when your classic scooter was most likely made. To make matters worse, many of the spark plugs being sold today are manufactured with internal resistance that reduces the voltage to the spark plug and so reduces spark size. Some spark plugs have protruding tips, which can damage a scooter piston very quickly.

This classic scooter spark plug guide has been prepared for both Lambretta and Vespa engines and includes the correct equivalent spark plugs from **NGK** and **Champion**. It also includes the most appropriate spark plug gaps, which straight out of the box will be around 0.7mm, which is far too large and must be reduced (*see page 8 for recommended spark plug gaps*). I have also tried to illustrate the best type of spark plug from both manufacturers depending on the intended running conditions of the scooter, be it normal day to day street riding, or longer trips on the freeway with lots of full throttle.

This is a spark plug selection guide, not a bible and does not fully consider tuned or modified engines, but it should stand you in good stead with most classic Lambretta and Vespa scooters, including the more recently made Vespa PX Range. If in doubt check your scooter manual, one of the main reasons I prepared this article is because manuals for classic scooters are rare and the correct selection, fitting and setting of the spark plug gap will have significantly affect the performance and working life of your scooter engine.

BASIC ELEMENTS OF THE SPARK PLUG

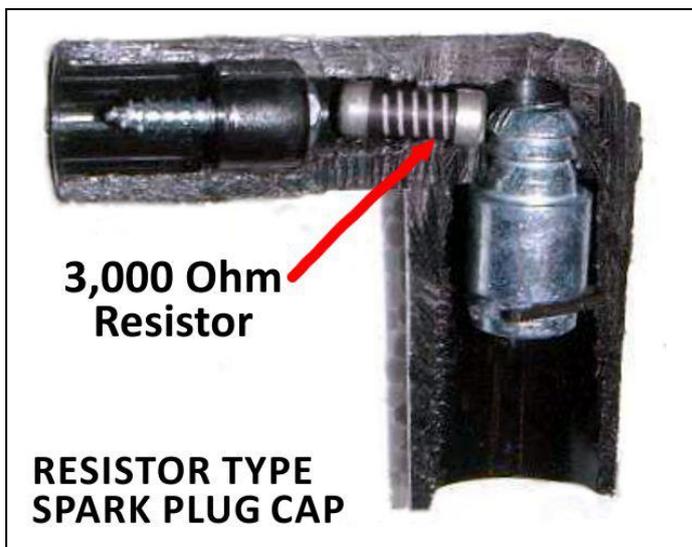
The diagram below shows the basic elements of a typical spark plug. Always handle with care, if dropped it possible to break the ceramic insulator. This may result in a hairline crack that cannot be seen, but will render the spark plug unreliable or even useless.



'R' TYPE SPARK PLUGS

Prior to the introduction of resistor type spark plugs and resistor type high tension (HT) leads many spark plug caps had an internal resistor fitted which ranged from 3000 to 5000 ohms. The main purpose of this resistance / resistors is to reduce RFI (Radio Frequency Interference) to protect your and other vehicles electronic devices, such as radios, engine management systems, GPS systems, reversing cameras, DVD players etc. To ensure the best spark in your engine this guide recommends that resistor spark plugs, resistor spark plug caps and resistor HT leads are all avoided.

A classic scooter engine utilises what is by today's standards a relatively low-tech ignition system. This can mean a reduced spark from a modern resistor type spark plug, in particular if it is used with a resistor spark plug cap or resistor type HT leads may not adequately ignite all the petrol / air mixture in the engines cylinder. This will obviously create performance problems. Therefore it's advisable not to use the "R" type plugs as these may see your scooter sacrifice performance. There may also be other long term detrimental implications for your scooter as will be further discussed.



The image on the left shows the internal resistor fitted in resistor type spark plug caps. The resistance is typically anywhere between 3,000 to 5,000 ohms. The resistor reduces the voltage to the center electrode of the spark plug and so significantly reduces the spark in your scooter engines cylinder. This type of cap should not be used unless electronic instrumentation is being used, otherwise it offers no advantage to a classic scooter.

Most sales people at Super Cheap and other car parts shops are not qualified mechanics, neither do they usually ride or maintain a classic scooter and so it's fair enough they may not know what spark plug you really need, so you need to know!

A sales person with the very best of intentions may misguidedly suggest you buy what they believe is an "equivalent" spark plug for your classic scooter. These may have a similar part number to the spark plug you should be using, but with an additional letter "R" or "P" in the part number. As already discussed be wary as the "R" denotes a spark plug with the invisible internal resistance. Resistor type spark plug leads are discussed later on page 6 of this guide.

It's important to know whereas an 'R' Type plug will usually allow a scooter's ignition system to create a spark (albeit with a lower voltage), if the plug is contaminated just a little (even with fuel) the resistor in the plug cap may prevent the plug from firing as it should, hence the scooters engine may not start and even if it does the engine can run roughly.

'P' TYPE SPARK PLUGS

Even worse are the "P" type plugs, which look almost the same as the standard spark plug and have the same thread diameter and length, but on closer inspection have a longer (projected) firing tip, which lengthens the amount of plug protruding into your engine cylinder. Whereas an "R" type spark plug may create poor performance and perhaps engine damage after prolonged use, the "P" type spark plugs will very quickly put a hole in the top of your engines piston. The selection of the correct plug for your scooter is therefore of the utmost importance.

Take care when selecting the 'reach' of your spark plug, do not use the "P" designated plugs. If the plug is too long additional plug threads and the spark plug tip protrude too far into the cylinder. The usual consequence of this is the top of the piston smashes into the spark plug. Even if this does not occur, the additional threads protruding into the cylinder will become filled with baked in carbon deposits. Then when you try and remove the contaminated spark plug it will strip the threads right out of the cylinder head.



As can be seen from the two photographs above, the protruding tip type spark plug has much more of the ceramic insulator protruding below the threads. Also the area below the plug threads and the central live electrode are both longer than on a standard plug.

NGK - SPARK PLUG DESIGNATIONS (UK & AUSTRALIA)

First letter (eg: B) 14mm (this is the standard spark plug thread diameter)

Second letter 'E' Long reach plug

'H' Short reach plug

'R' Resistor plug for modern or electronic ignitions only

'P' Projected firing tip, more plug protruding into cylinder

Third letter (If applicable)

'S' High performance 'super' plug with copper electrode rather than the standard nickel/iron type.

SPARK PLUG HEAT RANGES

A 'hot' rated spark plug does not make your engine run hotter, neither does a 'cold' plug make your engine run colder, it is the engine, not the spark plug that is responsible for creating the heat. What the plug 'heat' rating actually refers to is that under the same operating conditions and engine temperatures the plug tip will run hotter or colder. This is important because for an engine to operate efficiently it must reach a temperature where any accumulated carbon or combustion deposits are burned off the end of the spark plug, this is known as the "self-cleaning temperature" and which is amazingly around 450 degrees Centigrade, temperatures below this will soon "foul" the plug. This is why a range of spark plugs have been designed to suit most riding conditions and the associated engine temperatures; for example for short rides around town the engine may not have sufficient time to heat up to the plugs 'self cleaning temperature' therefore plugs that become hot quickly are recommended. On the other hand, for long trips out on the open road, the engine has time to heat up to the self cleaning temperature, so cold running plugs are recommended. Hot plugs have a longer insulator nose which therefore has a greater surface area surrounded by ignited gases to absorb heat and so it will reach higher temperatures faster than a plug with a shorter insulator nose.

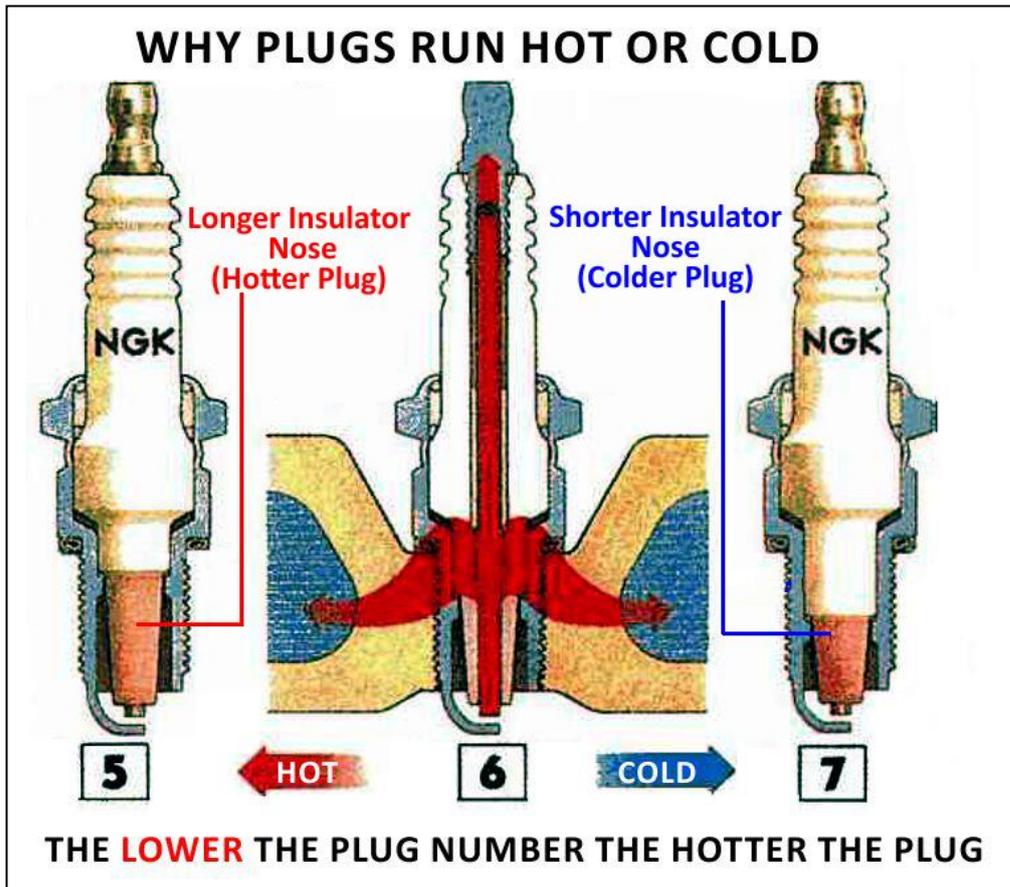
COLD >>>>>> HOT

CHAMPION

N2 - N3 - N4 - N5

NGK

B9 - B8 - B7- B6



Hot plugs have a longer insulator nose with more area to hold the heat

Spark Plugs running too hot or cold

Be sure to select the appropriate 'heat' range for your scooter riding, because if you select a cold plug and ride around town, the plug temperature may not get hot enough and so will not reach it's 'self-cleaning temperature', this could mean a dirty plug with carbon deposits on the tip. This may reduce the size and frequency of the sparks in your engine and create misfiring, poor performance, poor fuel consumption and bad starting.

If you select a 'hot' plug and do a lot of open road riding the plug temperature may become too hot, so hot it can ignite the petrol in your engine cylinder without the plug actually "firing" (sparking) and so creating what is known as pre-ignition. This is bad and the heat generated can be so high it may 'burn out' the plug and in severe cases melt the spark plug electrode. A hot plug won't however as sometimes believed burn a hole in the top of your piston, incorrect fuel mixture or ignition timing is usually responsible for this.

SPARK PLUG ELECTRODE COLOUR AND CONDITION

It's good to know how to "read" spark plugs and understand what the appearance of the tip is revealing about engine performance. Appearance mainly depends on the fuel mix and the operating temperature of the spark plug. To keep it simple we will say there are three basic appearances for spark plugs: best, oiled and fouled. The operating range between fouling and best spark plug temperature is called the "self-cleaning temperature", or the temperature at which carbon or combustion deposits are burned off the end of the plug. Carbon fouling will occur when the plug operates at less than 450°C, over heating at 800°C plus. The colour and condition of the plug tip tell a lot about how the engine is operating. In the less politically correct era of the 1960's it was often said after 50 miles the colour of the plug electrode should be that of "*a dusky maiden's breast*". Another way of describing is the approximate colour of milk chocolate. See the diagrams below showing the three most frequently found plug conditions.

1 - Best



2 - Oiled



3 - Fouled



1 - Best

Clean and the colour of a dusky maiden's breast (just right) Looks like your scooter is running just the way it was intended to.

2 - Oiled

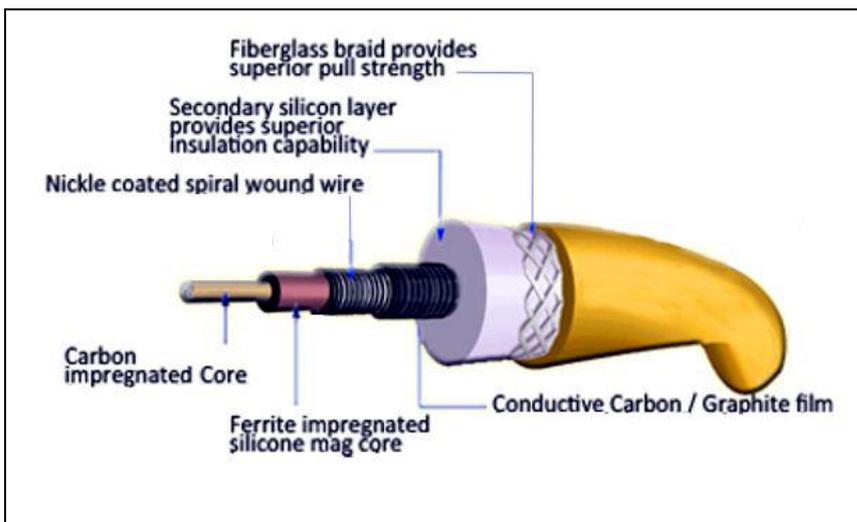
The black "oily" spark plug is public enemy number one of the two-stroke scooterist and is a main reason for bad starting. Is your air / fuel mixture too rich, choke jammed on? Perhaps far too much oil in your two stroke mix? Fix these issues and try a hotter plug.

3 - Fouled

Fouled with carbon or other deposits is another reason for bad starting, misfiring, rough idling & poor performance. Are you using the right type and quantity of oil in your two stroke mix?

SPARK PLUG LEADS

Resistor type spark plug leads, just like resistor plugs and plug caps are used to suppress radio frequency noise, which may interfere with car radios, GPS and electronic instrumentation. Resistor spark plug leads are not intended for use in motorcycle type ignition systems. Motorcycle manufacturers usually put the resistor in the spark plug caps and use leads made of copper or stainless steel wire. Wire is highly conductive and offers little electrical resistance. Resistor leads for modern cars have internal resistance, so a resistor is not required in the spark plug cap. The 'wire' in modern car HT leads is not really wire at all, it's actually carbon, silicon, graphite, fiberglass and sometimes a small amount of wire. This type of HT lead is difficult to make a good electrical connections with, so don't try and fit a screw on type spark plug cap, for this type of lead they are usually hollow and crimped on. In fact don't use this type of lead at all, use only a (HT) lead wire with a core of metal wire. Using a resistor spark plugs, resistor spark plug caps and carbon resistor leads can create a resistance of 100, 000 ohms or greater at the spark plug terminal, this will significantly reduce the spark at the tip of the plug.



The modern type of spark plug (HT) lead shown on the left does not have a core made of solid wire, it also has internal resistance and may be great for modern cars, but is unsuitable for use in a classic motorcycle and scooter ignition system.

On the right is the good old fashioned wire cored spark plug (HT) lead. It can be seen the only thing inside the lead apart from insulation is wire. The screw in spark plug cap will make a good connection with the wire, but would only damage the combination of carbon, ferrite & silicon in the modern type HT lead shown in the image above.



Whereas a resistor spark plug cap alone is OK, the combination of a resistor cap with a resistor plug and a resistor type lead will seriously reduce the spark at the tip of the plug.

SPARK PLUG TYPES (LAMBRETTA)

SERIES I, II, III, GP, J AND LUNA RANGE

Champion N4 or NGK B7ES

These are slightly “hot” running plugs suitable for normal day to day street riding you can also use the Denso type W22 ES-U

Champion N3 or NGK B8ES

These are cooler running plugs suitable for day to day street riding with a moderately tuned up scooter engine

Champion N2 or NGK B9ES

These are one of the coldest running plugs best suited for highly tuned scooters or those performing a lot of long journey freeway type riding.

LD AND D RANGE

Champion L86 or NGK B6HS

SPARK PLUG TYPES (VESPA)

150 SPRINT & SPORTIQUE, SPECIAL 50, PK 50, 100 & 125 PRIMAVERA 125, 150 SUPER & BAJAJ

Champion L86 or NGK B6HS

These plugs are suitable for normal day to day street, rather than motorway riding

90 & 90SS, PRIMAVERA 125

Champion L81 or NGK B7HS

These hotter running plugs are for long runs and/or motorway riding

RALLY 180 & 200, GS 160, SS 180, PK 80E & 80S, SS180

Champion N5C or NGK B6ES

These plugs are suitable for normal day to day street, rather than motorway riding

FOR THE NEWER CLASSIC STYLED VESPAS

PX 200

Champion N4C or NGK B7ES

PX 200 (E Disc)

Champion N5C or NGK B6ES (This hottest running plug is recommended in particular around town)

PX 125 (electric start)

Champion RL4J or NGK BR7HS (The only scooter in this guide using a resistor plug as recommended by Vespa for this modern scooter)

SPARK PLUG GAPS

A new spark plug straight out of the box nearly always will have the gap set far too wide and if used without adjustment the high-voltage may not “arc” (jump) across from the central electrode to the external electrode so may cause misfiring and poor starting. Also remember the gap of any spark plug will increase slightly over time due to normal wear. The effect is always the same, some of the fuel remains unburnt in the cylinder, resulting in power loss, poor idling and bad starting. On the other hand if the gap is too small, the spark may be inadequate to ignite a lean fuel-air mixture, also causing misfiring, poor performance and bad starting. Depending on the type of feeler gauges you are using the gap will need to be set in either an Imperial or Metric measurement as follows:

Imperial – From 0.020 to 0.025 of an inch (*or as my Dad used to say 20 to 25 thou*)

Metric – From 0.5 – 0.6 of a millimeter or around “half a mill”, (*no my Dad did not say it that way, as in England we had never heard of “Metric” in the 1960’s*).

PLUG MAINTENANCE

The spark plug gap and colour should be checked every 1000 miles (1610 kms). It’s always a good idea to make sure the upper porcelain insulator part of the plug (the white bit) is free from dirt and grease, otherwise the voltage to your plug cap may “track” through the grease and grime down the plugs porcelain and so no, or a reduced spark may occur at the plug tip.

PLUG CAPS

Remember whenever changing your plug cap, unless you are using electronic instrumentation make sure you don’t get one with an inbuilt resistor. This will have the same effect as the ‘R’ type plug & could give you performance problems & increase fuel consumption, that’s if you ever get your engine started. Always ask for a “zero ohm” plug cap, buy two and keep one as a spare.

CHANGING YOUR SPARK PLUG

Always try to change your spark plug when the engine is cold. This is because metals expand at different rates when heated. The thread on a spark plug is usually made of steel, whereas the cylinder head on scooters is usually made of an aluminum alloy. If you change your spark plug when the engine is hot it has expanded, so removing it from the softer aluminum cylinder head may strip or damage the cylinder head threads. Also the tightening force you apply when screwing in the plug will change, so when the engine cools you may need to nip up the spark plug once again.

Also remember to set the gap before putting in a new spark plug, the manufacturer usually sets the gap far too wide, it’s a case of gently tapping the end of the plug on a hard surface to reduce the gap, until it is just right, which is (0.020 – 0.025” or 0.5 - 0.6 mm) for standard Lambretta Series III engines.



←The spark jumps the gap between the electrodes

A LAST WORD

Hopefully this guide may assist readers to have a better idea of which spark plugs, spark plug caps and spark plug leads to buy and use, how to set the plug gap and how important a correctly selected, fitted and working spark plug is to the performance, fuel consumption, idling, starting and longevity of a classic scooter engine.

It is worth remembering the petrol to oil ratio of your fuel is not only about lubricating the engine, it's also about the ratio of petrol, oil and air in your engine cylinder. Adding just a little bit of extra oil to your fuel mix can do more harm than good. This is because adding the extra oil does not protect your scooter by providing extra lubrication as is sometimes believed. More oil means less petrol, which in turn means a leaner petrol to air ratio in your scooter engines cylinder.

A too lean air / petrol mix causes the spark plug tip and cylinder temperature to increase rapidly, which can result in pre-ignition and other problems that are likely to quickly cause serious damage to the spark plug and more importantly possibly the engine, at worst you may end up with a piston looking like the one below. Very rich or lean mixtures also require a much larger spark to ignite the petrol, air and oil fuel mixture and so make engines prone to poor starting and poor performance.



Engine care and maintenance are important and a stitch in time may save nine.

Happy Scootering.....

Regards

Steve Bardsley