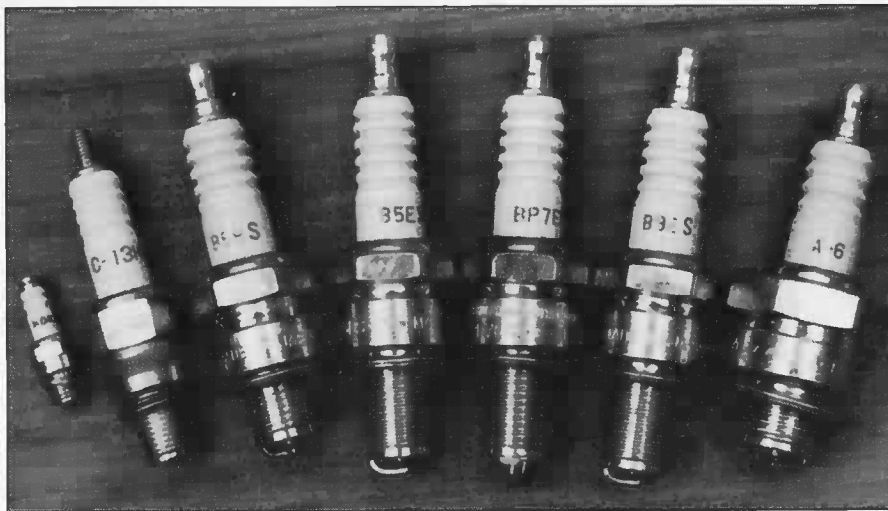


PRODUCT REVIEW



SPARK PLUGS

□ Have you ever stopped to consider what a spark plug does? As well as provide a spark (we hope), it must seal internally and externally against pressures of up to 700lb/in², must withstand temperatures of up to 2,500°C (4,500°F), must be capable of accepting and insulating surges of very high voltage electricity, be tough enough to absorb mechanical vibration without breaking, and resist chemical corrosion on its working end. To return briefly to the temperature requirements, it is possible that on a winter day, one end of the plug will be frozen while the other is involved in an explosion!

Those are just the operating conditions, for as well as being able to stand up to them, a plug must also be of the right type to suit any given engine's combustion characteristics. The wrong plug can cause a lot of damage to an engine, as well as adding to air pollution by inefficient ignition of the air/petrol mixture, and overloading the ignition system. So, apart from being a nuisance when the engine won't fire, a wrong or worn plug can give rise to all kinds of side effects and it is worth making sure that you have the correct one fitted, and that it is fully effective.

In compiling this review, I attempted to contact as many of the old names as I could. Of the 'classic' makers, only Champion could offer any help. KLG and Lodge, united under the Smiths Industries banner, no longer make spark plugs, though they do make and export machines which make them (and all the expertise that goes with it). AC Delco appear to be concentrating on the car market, and the simpler end of it at that, for their technical literature was restricted to a point of sale leaflet for accessory shops.

NGK has made great inroads into the

motorcycle spark plug market in recent years. Like most Japanese factories, they appear keen to explain their products, and the technical manual provided by Martyn Ashwood (the classic racer who is also NGK's technical consultant) is the basis for much of the information offered here.

Nippon Denso is another Japanese company keen to expand in the motorcycle market. ND plugs are handled here by Andover Norton, and not surprisingly, the importers have compiled a very useful application chart listing virtually every post war BSA, Norton and Triumph. They also have a cross reference chart translating Champion, Bosch and NGK to ND.

Bosch make an extremely comprehensive range of plugs, and have a good reputation. Their plug application list has a useful cross reference chart, which includes KLG and Lodge equivalents, as well as lesser known makers such as Eyquem and Iskra.

What is made perfectly clear by a study of all these companies' literature is that the days when a plug was a plug are long gone. Not only has technology improved and increased the types of plug available, marketing requirements have caused manufacturers to concentrate on a particular type of plug, trumpeting its virtues. Thus Champion feature 'Gold Palladium' tips heavily, and ND stress the benefits of the 'U-groove' electrode.

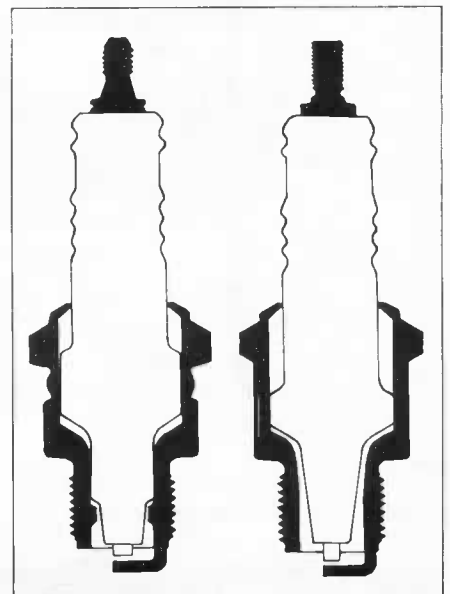
However, underneath these apparent differences, all spark plugs work on the same principles and a general explanation of some of the more commonly used (and misunderstood) terms relating to them stands good for all manufacturers. To a certain extent a plug is still a plug, even if it can now be gilded or even 'Non-U'.

HEAT RANGE

A spark plug's heat range is quite simply the temperature range in which the plug works well. If a plug intended for a highly tuned engine is used in a plodder, the end of the plug will become carboned up since insufficient heat will be generated for the tip to remain clear. Contrariwise, if a plug intended for a plodder is used in a highly tuned engine, the tip will become overheated, possibly leading to pre-ignition (pinking) and all the damage which that can cause.

The terms often bandied about in this context (and just as often misused) are 'hot' and 'cold'. These refer to the type of plug, not the type of engine. In fact it is a converse relationship, for a hot plug is designed to run hot at the tip to maintain sufficient temperature to burn off oil and carbon deposits. In other words, it is for an engine in a low state of tune. A cold plug is designed to dissipate heat quickly, to maintain a reasonable working temperature in a more highly tuned engine.

It is often possible to tell if a plug is hot or cold just by looking at the insulator tip surrounding the electrode. A hot type has a longer insulator, which provides a longer heat flow path and a wider surface area to receive more heat. A cold type will have a short insulator – a small surface area and a short heat



The Champion L78 (left) is a cold plug, with a short heat flow path. The L90 (right) is a hot plug, and the heat flow path is correspondingly longer.

flow path being necessary.

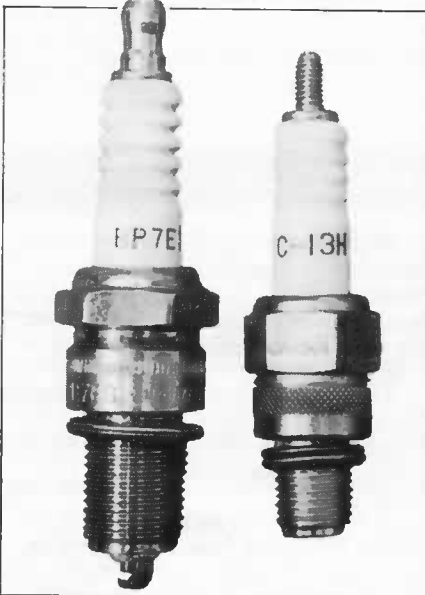
The plug's heat range is indicated in the identifying number. This is explained in detail later, but it is just worth noting here that NGK and ND use a low

number to indicate a hot plug, the number rising as the plug gets colder, whereas Champion use a low number to indicate a cold plug, the number rising as the plug gets hotter. Bosch have two methods of designation. The old range starts with a hot plug at 25 and gets colder by working towards 400. The new range is at its hottest with 13 and works down, through zero to 06.

SPECIAL TYPES

In the effort to achieve the best of all possible worlds, spark plug manufacturers have developed new types of plugs for which all sorts of miraculous benefits are claimed. Some of these are examined here, in relation to their use on old motorcycles.

The projected insulator (also known as Projected Core Nose or Turbo action) type has, as its name suggests, an insulated tip which projects further than normal into the combustion chamber. Advantages claimed for this are better fouling protection and less likelihood of pre-ignition. While the long tip is easily heated at low rpm, it is also (the makers claim) easily cooled by incoming mixture at higher revs. This does appear to increase the temperature range usefully but this type of plug is not considered suitable for use in engines with rich mixtures or low rev ranges which, in all



The insulator nose on NGK's BP7ES (left) is projected into the combustion chamber. C-13H (right) is a racing plug – note the 'invisible' insulator tip.

honesty, rules out most old motorcycle engines. There could also be a problem of clearance with the extended tip (I speak from experience, having once tried a plug with a fractionally longer tip in

my Enfield. I was lucky to get away with stripping the heads to remove the debris).

The best known special type must be the one which uses a precious metal alloy in the centre electrode. Although the marketing of this seems to have been dominated by Champion and 'Gold Palladium', NGK, Bosch and ND offer precious metal electrodes.

The major advantage offered by this type is that the electrode can be much thinner, and the thinner the electrode, the smaller the voltage required to fire the plug. It also allows a smaller gap to be used (again decreasing the required voltage) without incurring the risk of misfiring encountered when using a conventional plug with a small gap. Despite the fineness of the electrode, plug life is generally as long as a conventional plug.

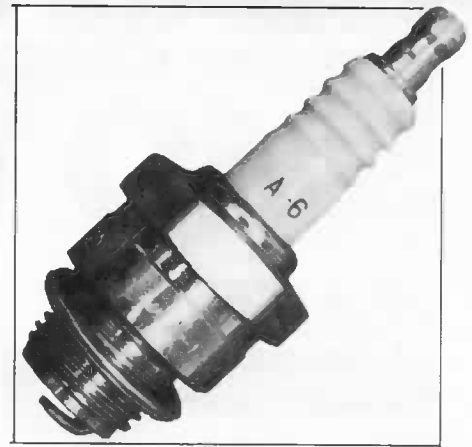
This type would seem to offer a great deal to classic motorcyclists, especially as many old bikes have rather marginal ignition systems and a decrease in the required voltage is to be welcomed. The drawback, however, is that precious metal plugs cost a great deal more than conventional ones (approximately two and a half times more).

Incidentally, a little known fact is that the required voltage is lower if a *negative* current is running through the plug than if a *positive* one is. Could this explain the apparent difference in the type of spark generated by a magneto and a battery and coil? A colleague was informed that a magneto offered a better kind of spark than a coil, it being something to do with the direction of travel of the spark (from the centre outwards or the ground electrode inwards).

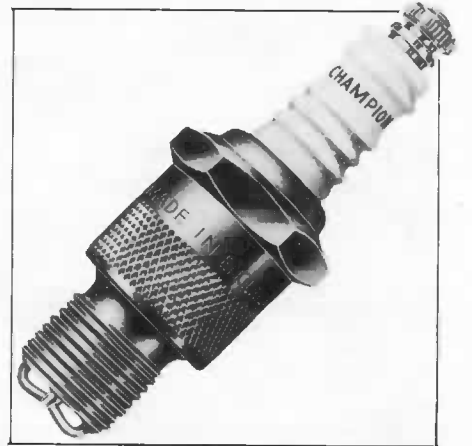
The other special types do not really concern us here, as they are of little practical use on a conventional motorcycle engine, having been developed for specific applications. However, owners of the Suzuki RE5 and the DKW rotary may be interested in the dual ground electrode type, specially developed for use in the Wankel engine, where greater heat is generated resulting in heavier wear on the electrodes. There are also triple ground electrode types.

Racing plugs are in effect very cold plugs, with added protection against the mechanical shock generated by very high compressions. As there are no hard and fast rules that can be applied to racing engines, anyone needing advice on which type to use would do better to consult the factory or importer directly.

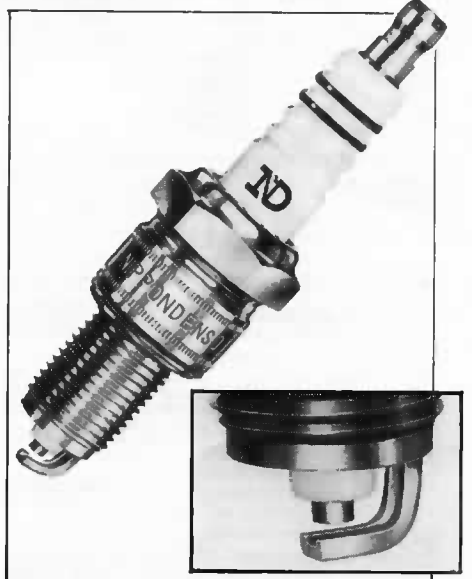
Champion were also kind enough to compile a useful table showing the (now superseded) popular plugs of the '40s and '50s and their current equivalents, so if you have the original manual which specifies one of the following discontinued lines, you can now trace its modern replacement.



NGK's A6 is a medium heat range 18mm short reach plug, suitable for older bikes.



This is a 7COML, 18mm $\frac{5}{8}$ reach hot plug, again suitable for some veteran machines.



Nippon Denso claim wonderful things for their U-groove. The electrode is said to allow the spark to 'grow' better than a conventional one. It could also carbon up.

PRODUCT REVIEW

Deleted plugs Current equivalent

14mm	
L10	L90
L10S, L7	L86
L11S, L5	L81
18mm	
16	K9
7	K17
7COML	K17
14mm long reach	
NA10	N3
NA8	N5
N8B	N8

IDENTIFICATION

NGK

The following symbols are explained in the order in which they appear on the plugs. An example would be BP6ES - work out for yourself what type it is from the lists:

First letter:

- A 18mm thread
- B 14mm thread
- C 10mm thread
- D 12mm thread
- F 7/16in - 18
- G PF 7/16in - 14

Second (and also third, if applicable) letter:

- B 20.6mm hexagon
- C 16mm hexagon
- G 23.8mm hexagon
- L Compact type 1
- M Compact type 2
- P projected insulator nose
- R internal resistor
- S shielded
- U surface discharge (for extremely high comp. motors)

Heat range number:

- 2 ... hottest
- 14 ... coldest

Ordinary plugs range between 2 and 8; racing plugs between 9 and 14.

First suffix:

- L 11.2mm thread reach
- H 12.7mm (1/2in) reach
- E 19mm (3/4in) reach
- F conical seat (no gasket)

If there is none, it indicates the following

Thread reach	Thread diameter
12mm	18mm
9.5mm	14mm
22.5mm	PF 7/16in - 14
16mm	7/16in - 18

Thread diameter can be determined from the first prefix.

Second suffix:

- A special plug
- B special Honda plug
- C competition
- GV ... racing plug, precious metal electrode

- N racing plug nickel electrode
- P racing plug platinum electrode
- R shielded resistor
- S copper core
- V centre electrode precious metal
- W tungsten electrode
- X series gap
- Y V-grooved electrode
- K 2 ground electrodes
- M 2 ground electrodes
- T 3 ground electrodes
- Q 4 ground electrodes.

If there is a number following the second suffix, it indicates a wide gap type, the number being the gap in mm (eg. 11 = 1.1mm gap).

ND

This is a similar system to NGK's. An example is W16EX-U.

First prefix:

- M ... 18mm thread - 25.4mm hex
- L ... 18mm thread - 22mm hex

- MA 18mm thread - 20.6mm hex taper seat
- T 14mm thread - 16mm hex taper seat
- W 14mm thread - 20.6mm hex
- WA 14mm thread - 16mm hex taper seat
- X 12mm thread - 18mm hex
- U 10mm thread - 16mm hex

Heat range number:

- 4 ... hot
- 37 ... cold

First suffix:

- L 11.2mm (7/16in) thread reach
- F 12.7mm (1/2in) thread reach
- E 19mm (3/4in) thread reach

If there is none, it indicates -

- 14mm thread 9.5mm (3/8in) reach
- 18mm thread 12mm reach

Second suffix:

- A 2 ground electrodes
- B 3 ground electrodes
- C competition
- D 4 ground electrodes
- M short
- N racing, nickel electrode
- Pt racing, platinum electrode
- P projected nose
- R internal resistor
- S standard
- T 2 ground electrodes
- X extra projected nose

Third suffix:

- G gold palladium electrode
- U U-grooved ground electrode
- L special

CHAMPION

First letter:

- U auxiliary gap
- R internal resistor
- Q internal resistor

Second letter:

- Z 10mm dia - 12.5mm (1/2in) reach
- P 12mm dia - 12.5mm (1/2in) reach
- J 14mm dia - 9.5mm (.375in) reach
- L 14mm dia - 12mm (.472in) reach
- N 14mm dia - 19mm (3/4in) reach
- K 18mm dia - 11.3mm (.445in) reach

Heat range number:

- 1 ... cold
- 25 ... hot
- 51 to 75 are racing types.

Third letter:

- G ... gold palladium

- R retracted gap
- Y projected nose
- J short ground electrode
- LM lawn mower
- CM ... moped
- P platinum electrode

BOSCH

First letter:

- D 18mm thread, taper seat
- F 14mm thread, 16mm hex
- H 14mm thread, taper seat
- M 18mm thread
- W ... 14mm thread

Second letter:

- B internal resistor, shielded, connection for 7mm ht lead
- C internal resistor, shielded, connection for 5mm ht lead
- E surface discharge
- R internal resistor
- S mini plug

Number (new plugs):

- 13 ... hot
- 2 ... cold
- (goes down to 0.6, very cold)

Number (old plugs):

- 25 hot
- 400 ... cold

First suffix:

- A 12.7mm thread reach (11.1mm taper seat)
- B 12.7mm thread reach, projected nose (11.1mm taper seat)
- C 19mm thread reach
- D 19mm thread reach, projected nose (17.5mm taper seat)
- E 9.5mm thread reach
- F 9.5mm thread reach, projected nose
- G ... 11.2mm thread reach
- H 19mm thread reach

Second suffix:

- standard
- C copper core (Super Plug)
- P platinum electrodes
- S silver electrodes

Third suffix (special plugs):

- X ... 1.1mm gap
- Y ... 1.5mm gap
- O abnormal dimensions
- 1, 2, 3, 5, 7 etc colder than normal
- 2, 4, 6, 8, etc hotter than normal

VINTAGE AND VETERAN



A pair of 18mm short reach plugs. On the left a cold one, on the right a hot.

It is worth noting that all the above manufacturers still make 18mm plugs, though these are commonly intended for horticultural or agricultural machinery. As most old engines will require hot or hottish plugs, owners should be able to find something suitable in the catalogues. To give you a flying start, suitable Champion plugs are: K9 (cold, 1/2in reach), K17 (hot, 1/2in), 7COML (hot, 3/8in).

If your motorcycle shop will not or cannot get any of these for you, try an agricultural or garden machinery stockist. If they have none available, they will probably be able to get some. I have heard, however, that some will only supply complete boxes. As many old machines seem to need frequent plug changes, this could be a good investment!