

# Pioneers of copper core spark plugs and still the leaders in spark plug technology.



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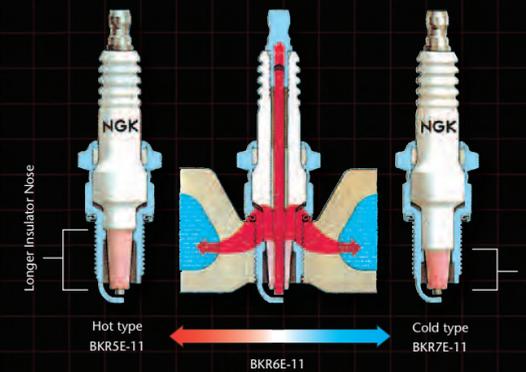
## Understanding heat range & heat dissipation

Spark plugs do not generate heat. They make good use of the heat produced by combustion to elevate the temperature of the insulator nose, keeping it free of carbon deposits. The optimum temperature range of the firing end is shown in the chart opposite. As conditions vary considerably from engine to engine a spark plug must be selected that can get up to temperature quickly but not become overheated under high loads. The 'heat range' of a spark plug is a measure of its ability to dissipate, thereby controlling this heat energy. Most of this energy is transferred from the combustion chamber to the cylinder head via the threaded portion and gasket/seating area.

We need to keep the temperature at the firing end of the spark plug within a certain region to prevent problems. Engine types differ enormously in their performance characteristics therefore we need to choose a plug with a suitable 'heat range' to match the engine and its intended use.

This complex selection process is carried out by NGK engineers working with the vehicle manufacturer.

## Heat rating and heat flow path of spark plugs



## Checking the firing end appearance

<b>Firing end temperature °C</b>  <b>Overheating area</b>  <b>870°</b>	 	<b>Overheating</b> The insulator is white and sometimes blistered. If the insulator temperature is over 870°C pre-ignition may occur. Engine power will be reduced and the piston may be damaged.	<b>Causes</b> <ul style="list-style-type: none"> <li>Over advanced ignition timing</li> <li>Too lean a fuel mixture</li> <li>Blocked injectors</li> <li>Insufficient cooling</li> <li>Excessive deposits in the combustion chamber</li> </ul>
<b>Optimum temperature area</b>  <b>450°</b>	 	<b>Good condition</b> The insulator is brown or light grey.	Even if the spark plug is used under good conditions, deposits will accumulate. Regular inspection and replacement is advisable.
<b>Fouling area</b>  <b>Idle Temp { 250° 150°</b>	 	<b>Fouling</b> Carbon accumulates on the insulator nose forming a leakage path to earth. The engine misfires resulting in bad starting and poor acceleration. Particularly common with unleaded fuel.	<b>Causes</b> <ul style="list-style-type: none"> <li>Too rich a fuel mixture</li> <li>Excessive use of choke</li> <li>Prolonged slow speed driving or idling</li> <li>Blocked air filter</li> <li>Spark plug heat range too cold</li> </ul>

## Torque tightening chart

Thread Ø	FOR FLAT SEAT TYPE (WITH GASKET)					TAPER SEAT TYPE	
	18mm	14mm	12mm	10mm	8mm	18mm	14mm
Cast iron head	35-45Nm (3.5-4.5kgm) (25.3-32.5lbs ft)	25-35Nm (2.5-3.5kgm) (18.0-25.3lbs ft)	15-25Nm (1.5-2.5kgm) (10.8-18.0lbs ft)	10-15Nm (1.0-1.5kgm) (7.2-10.8lbs ft)		20-30Nm (2.0-3.0kgm) (14.5-21.6lbs ft)	15-25Nm (1.5-2.5kgm) (10.8-18.0lbs ft)
Aluminium head	35-40Nm (3.5-4.0kgm) (25.3-28.9lbs ft)	25-30Nm (2.5-3.0kgm) (18.0-21.6lbs ft)	15-20Nm (1.5-2.0kgm) (10.8-14.5lbs ft)	10-12Nm (1.0-1.2kgm) (7.2-8.7lbs ft)	8-10Nm (0.8-1.0kgm) (5.8-7.2lbs ft)	20-30Nm (2.0-3.0kgm) (14.5-21.6lbs ft)	10-20Nm (1.0-2.0kgm) (7.2-14.5lbs ft)

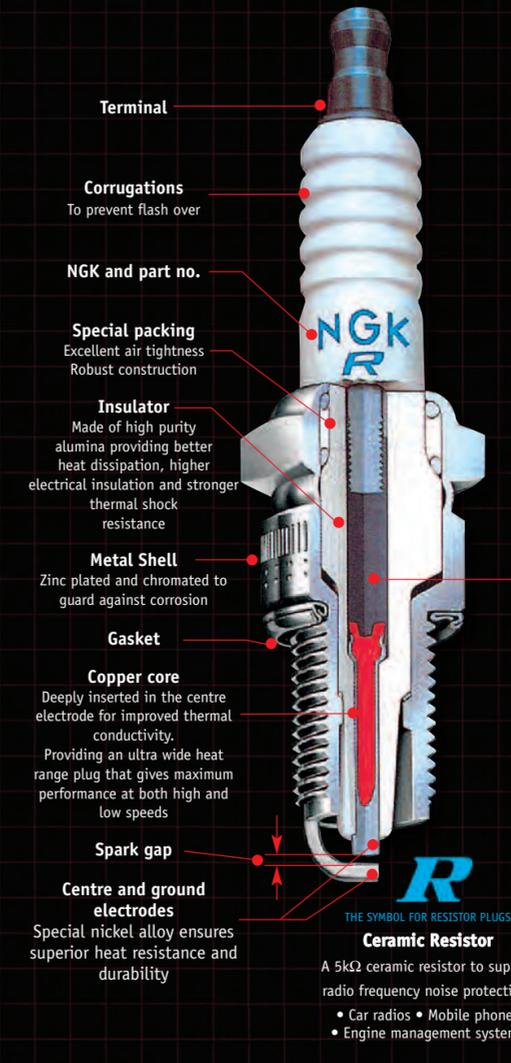
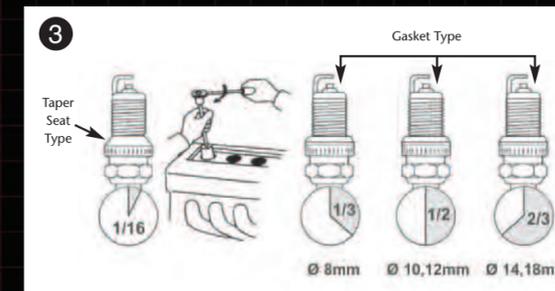
## Recommended installation procedure

Spark plugs must be secured to the correct tightening torque. A plug left too loose may overheat and suffer vibration damage. One that is too tight may suffer from shell distortion, cracking of the insulator or shell separation upon subsequent renewal.

Refer to current NGK catalogue for correct spark plug selection.

- Check condition and cleanliness of threads in cylinder head
- Ensure plug is gapped according to vehicle manufacturers specification
- Install new spark plug by hand until it seats. A length of rubber tubing pushed over the insulator can be a useful aid for plug installation where access is difficult
- Tighten to specified torque setting as shown in the Torque tightening chart.
- If torque wrench is unavailable fig.3 below will serve as an angular guide for tightening new spark plugs
- Reused gasket type spark plugs require only 1/12 turn
- Always use the correct tools for removal/installation to prevent damage to the spark plug or engine

Inspect spark plug cover and renew if necessary



## How to get the perfect match for your engine

NGK work closely with engine manufacturers the world over to develop spark plugs optimised for their specific engines. To ensure you get the perfect match for your application please consult an NGK Spark plug catalogue or use the part finder facility on our website at [www.ngkntk.co.uk](http://www.ngkntk.co.uk).

If you require further assistance, please contact NGK Technical Services Department.

It is essential to use the correct spark plug to optimise performance and economy. Use of the wrong spark plug could damage your engine.

# Spark Plugs

Never settle for second best, always insist on NGK, the world's No.1 OE fitment.





# NGK. The world's No.1 spark plug is the perfect match for every engine.

## Standard

e.g. BKR6ES  
BPR6ES

Parallel face nickel alloy electrodes  
typical centre electrode diameter  
2.5mm, gap setting 0.7-.08mm



## Multi Electrode

e.g. BKR6EKC  
DCPR8EKC  
CR9EK

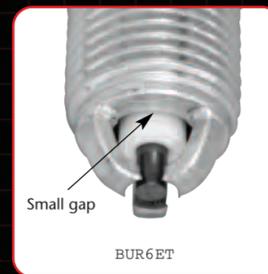
Two ground electrodes allow  
sacrifice of more material before  
gap size becomes too large  
therefore service mileage is  
increased.



## Supplementary Gap

e.g. BUR6ET  
BKUR6ET

Small gap between metal shell  
and insulator nose allow carbon  
to be burnt off by spark discharge  
and restricts combustion gas  
reaching insulator root.



## Fine Wire Types

Smaller diameter centre electrodes allow a reduction  
in voltage requirement, better gas flow around spark  
position, less heat absorbing 'quench effect' and  
more consistent spark position. Special precious metal  
alloys employed at the electrode tips prevent high  
rates of wear.

## Iridium & Iridium IX

e.g. BKR6EIX  
IFRSN10  
IMR9C-9H  
ITR6F13  
LZFR6AI

Iridium alloy chip allows reduction  
in centre electrode diameter as small  
as 0.4mm. This offers reduction in  
required voltage, a consistent spark  
position, reduction of quench effect  
more complete combustion and  
lower emissions. Often used in  
conjunction with platinum chip  
on ground electrode.

Used in high stress, high performance  
engines.

Some types, including all Iridium IX  
plugs also have a taper cut ground  
electrode to improve ignition quality  
further.



## Double Fine Electrode

e.g. DIMR8B10

Similar to other Iridium types  
but with special projected  
electrode welded to ground  
electrode. Fastest, least  
restricted flame kernel growth  
and consistent spark position.  
Typical use - high performance  
off road racing motorcycle.



## Competition & Racing Types

e.g. B7ECS  
R7435-9  
R7436-9  
R0045J-10 - semi surface

Racing spark plugs are generally  
constructed with higher heat ranges  
due to the production of more  
thermal energy from racing and  
performance modified engines.

Different designs offer varying  
projection into combustion  
chamber to match engine design  
and performance characteristics.

Ground electrode designs vary to  
offer better engine flexibility or  
resistance to damage by high levels  
of combustion vibration and high  
temperatures.

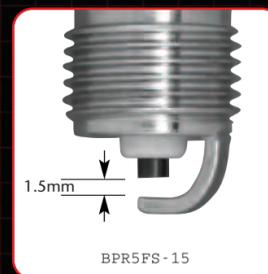
Semi surface design plugs similar to  
the true surface discharge types  
shown below offers the most robust  
characteristics only used in the most  
extreme conditions.



## Wide Gap Types

e.g. BPR5FS-15

Wide gap plugs offer reduction  
in emissions but require suitable  
ignition coils to provide sufficient  
voltage.



## Multi Electrode

e.g. BCPR6ET  
BKR6ETA-10

Three ground electrodes provide  
large surface area for long service  
life. These plugs often combine  
other special features mentioned  
elsewhere in this leaflet.



## Semi Surface Types

e.g. BKR5EKU  
BKR6EQUP

Spark always discharges across  
insulator burning away carbon  
deposits thereby offering excellent  
resistance to fouling. This mechanism  
also allows the use of large spark gap.



## Single Platinum & Platinum VX

e.g. BKR6EVX  
LFR5AP-11  
TR6AP-13

Platinum alloy chip (typically  
0.8mm diameter) is laser welded  
to centre electrode. VX types also  
have taper cut ground electrode  
to further improve ignition quality.



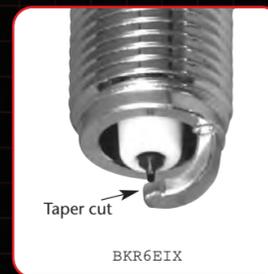
## Hybrid Types

e.g. PZFR5N-11T

Excellent ignition quality offered by  
platinum fine wire and single main  
ground electrode design but should  
excessive carbon become deposited on  
the insulator nose additional auxiliary  
side electrodes allow spark to discharge  
to shell. This action suppresses drop in  
overall insulator resistance.

- Spark is not 'lost'
- Unburnt fuel cannot reach catalytic converter

Extended shell design reduces ground  
electrode temperature.



## Rotary Engine Types

e.g. BUR9EQP  
RE8C-L  
RE9B-T

Special conditions in rotary engines  
often dictate unusual features in  
spark plugs which may include the  
following:

- High heat range plugs
- Different heat range in leading and trailing plugs
- Special protection of insulator nose
- Different thread reach for leading and trailing types
- Specific shell dimensions



## Surface Discharge Type

e.g. BUZHW

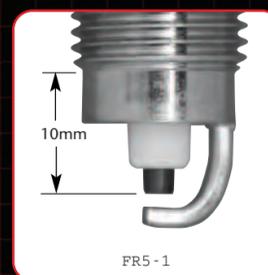
True surface discharge design has  
no given heat rating as the structure  
of the plug prevents almost all rises  
in electrode temperature. Wall of  
insulator is in complete contact with  
metal shell to dissipate heat quickly.  
Used in some two stroke marine  
engines with fast rise short duration  
CDI ignition systems.



## Extra Projected types

e.g. FR5-1  
ZFR5E-11  
ZFR5F

Spark position projected much  
further into combustion chamber  
providing stable combustion when  
using leaner air/fuel mixtures. Only  
use where specified.



## Intermittent Gap

e.g. BKR6EK

Spark discharge at the intermittent  
gaps can burn away carbon  
deposits reducing possibility of  
mis-sparking.



## V-Grooved Types

e.g. BKR6E  
BKR6EZ

90° groove cut in centre electrode  
forces spark to occur at the periphery  
of the electrode resulting in

- less material to obstruct burn - faster flame kernel growth
- less heat energy absorbed by electrode mass - reduced quenching effect
- enhanced the potential gradient - less voltage required to create spark
- no loss of service life



## Double Platinum

e.g. BKR6EP-11  
PFR6N-11  
PTR5A-10

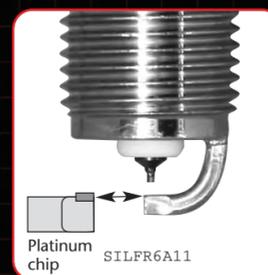
In addition to the centre electrode  
a platinum alloy chip is platinum  
alloy chip welded to ground  
electrode to enhance service life  
still further especially with dual  
polarity ignition systems.



## SPE type

e.g. SILFR6A11

To improve the ignitability of  
conventional iridium plugs, a  
special angular Platinum chip is  
welded to the leading edge of  
the external electrode. The centre  
electrode is therefore less shrouded  
by the ground electrode.



To find the perfect match for your engine, see our latest spark plug catalogue or use the part finder facility on our website at

[www.ngkntk.co.uk](http://www.ngkntk.co.uk)