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

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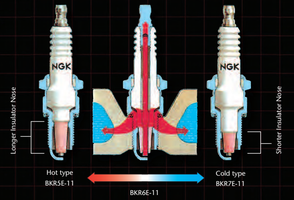
Understanding heat range & heat dissipation

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

Firing end temperature °C			
Overheating area	 	**Overheating** 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.	**Causes** ■ Over advanced ignition timing ■ Too lean a fuel mixture ■ Blocked injectors ■ Insufficient cooling ■ Excessive deposits in the combustion chamber
870°			
Optimum temperature area	 	**Good condition** 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.
450°			
Fouling area Idle Temp { 250° 150°	 	**Fouling** 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.	**Causes** ■ Too rich a fuel mixture ■ Excessive use of choke ■ Prolonged slow speed driving or idling ■ Blocked air filter ■ Spark plug heat range too cold

Torque tightening chart

	FOR FLAT SEAT TYPE (WITH GASKET)					TAPER SEAT TYPE	
Thread Ø	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)

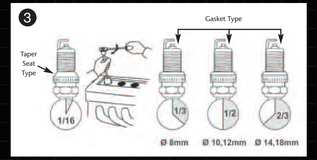
Recommended installation procedure

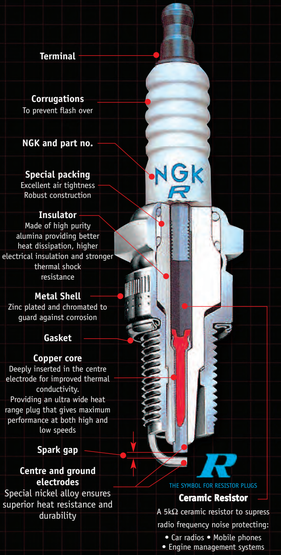
Spark plugs must be secured to the correct tightening torque. A plug left too loose may overheat and suffer vibration damage. One that is too tight may suffer from shell distortion, cracking of the insulator or shell separation upon subsequent renewal.

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

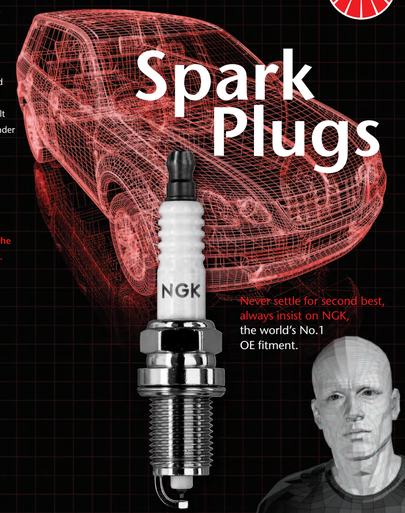
NGK work closely with engine manufacturers the world over to develop spark plugs optimised for their specific engines. To ensure you get the perfect match for your application please consult an NGK Spark plug catalogue or use the part finder facility on our website at www.ngkntk.co.uk.

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.

POCKET GUIDE

Spark Plugs



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

THE WORLD'S NO.1 OE FITMENT SPARK PLUG

Alfa Romeo Aston Martin Audi Bentley BMW Caterham Cars Chevrolet Citroen Daewoo Daihatsu DaimlerChrysler Ferrari Fiat Ford General Motors Honda Hyundai Isuzu Jaguar Jeep Kia Lancia Land Rover Lexus Lotus Maserati Mazda Mercedes Mini Mitsubishi Nissan Perodua Peugeot Proton Renault Rolls-Royce Saab Seat Skoda Smart Suzuki Subaru Toyota Vauxhall Volvo VW

Technical Perfection from the people who know. NGK

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

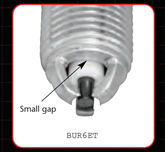
e.g. BKR6EKC
DCPR8EKC
CR9EK

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
IFR5N10
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.

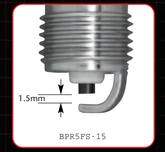
Ground electrode designs vary to offer better engine flexibility or resistance to damage by high levels of combustion vibration and high temperatures.

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.

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.

Some examples have an extended shell design to enhance ground electrode performance and protect insulator nose.

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.

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.

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.

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