

www.ngkntk.co.uk

## That's amore

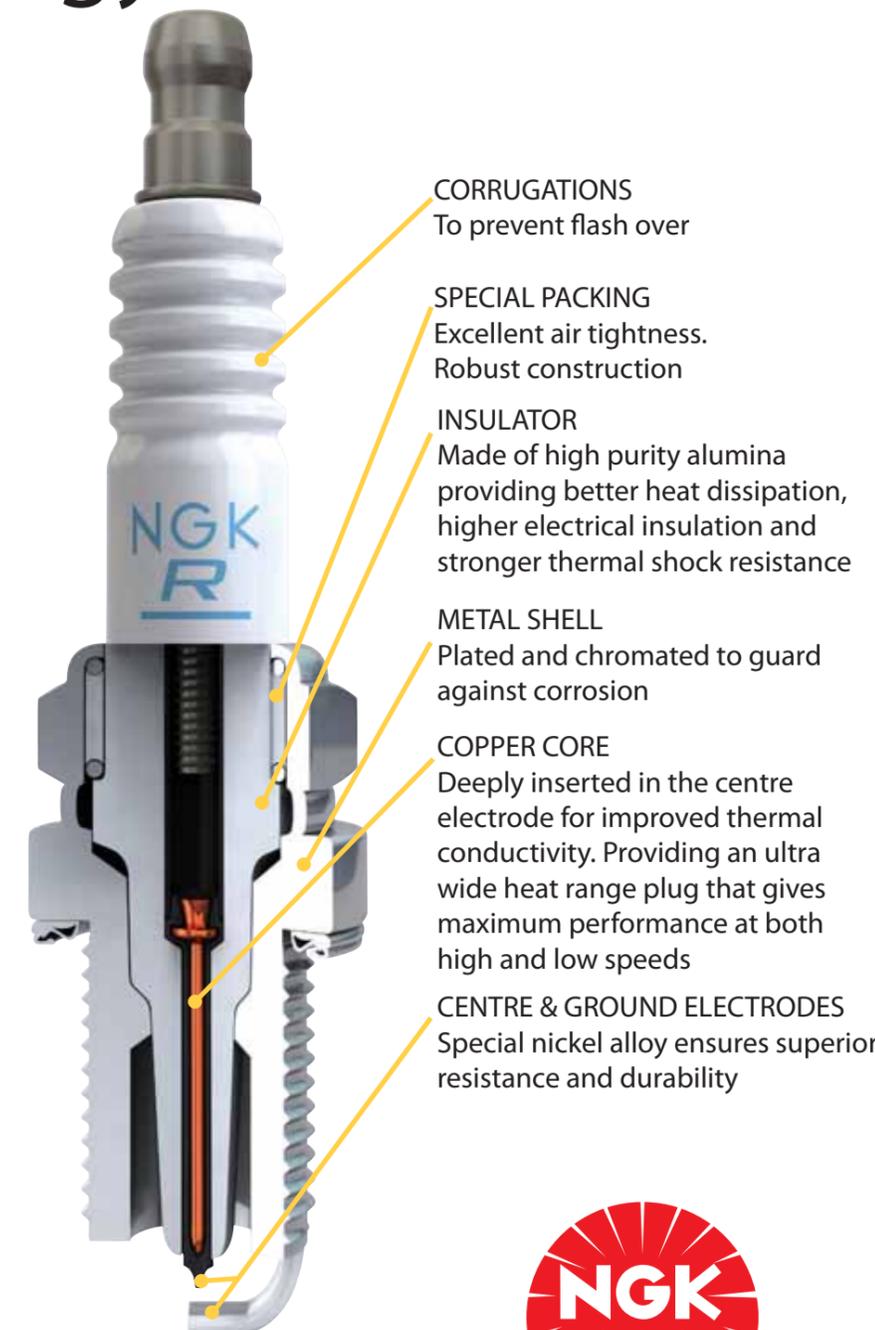
Motor technicians aren't easily swayed. Never have been. Never will be. They know what they like, who they can rely on. That's why NGK spark plugs are the No.1 choice of garage professionals the world over. And as engine technology becomes ever more advanced, NGK spark plugs are increasingly becoming the first choice for today's motor technician. And no doubt will be in the future too

NGK. At the heart of a successful service.



# Now look at what NGK's superior copper core technology delivers.

- Perfect Ignition
- Better cold weather starting
- Better engine performance
- More complete combustion
- Better emissions and cleaner exhaust
- Wider heat range over all driving conditions



**CORRUGATIONS**  
To prevent flash over

**SPECIAL PACKING**  
Excellent air tightness.  
Robust construction

**INSULATOR**  
Made of high purity alumina providing better heat dissipation, higher electrical insulation and stronger thermal shock resistance

**METAL SHELL**  
Plated and chromated to guard against corrosion

**COPPER CORE**  
Deeply inserted in the centre electrode for improved thermal conductivity. Providing an ultra wide heat range plug that gives maximum performance at both high and low speeds

**CENTRE & GROUND ELECTRODES**  
Special nickel alloy ensures superior resistance and durability

### Original Equipment suppliers to:

Alfa Romeo Aston Martin Audi Bentley BMW Chevrolet Chrysler Citroen Daewoo Daihatsu Ferrari Fiat Ford Honda Hyundai Isuzu Jaguar Jeep Kia Land Rover Lexus Lotus Maserati Maybach Mazda McLaren Mercedes Benz MG Mini Mitsubishi Nissan Perodua Peugeot Proton Renault Rolls Royce Saab Seat Skoda Smart Suzuki Subaru Toyota Vauxhall Volvo VW

www.ngkntk.co.uk

NGK. Pioneers of copper core spark plugs since 1958, and now undisputed leaders in spark plug technology.



www.ngkntk.co.uk

# SPARK PLUG DESIGN

## SPARK PLUG DESIGN

Every year the range of NGK spark plugs grows to accommodate the ever increasing demands of modern engines. Spark plug design must take into consideration many features of an engine including physical dimensions, combustion chamber shape, cooling abilities, fuel and ignition systems. Spark plugs play a vital role in producing the maximum power from an engine whilst keeping fuel consumption and emissions to a minimum. Choosing the correct spark plug type will help a vehicle manufacturer meet legislated emission targets and assists the motorist in getting the best from their engine.

Increases in the size and the requirement to improve the cooling of the inlet and exhaust valves have meant that the space available for the spark plug is severely restricted on some cylinder heads. A change in spark plug design, possibly the adoption of a taper seat and extended reach (threaded portion) or even the use of a smaller diameter is often the answer. Some engines require the use of two spark plugs per cylinder and again due to space restrictions these might be of different sizes.

Changes in fuelling systems and the fuel itself have meant some special features being adopted at the 'firing end' of the spark plug. Extra projected types push the spark position into the heart of the combustion chamber to promote better combustion of the fuel/air mixture, which is weaker than ever in an effort to improve economy. Modern engine manufacturers often require increased spark gaps to allow a longer spark duration, which again aids more efficient combustion.

To combat the 'cold fouling' effect that can occur in some engines using unleaded fuels specially arranged ground electrode arrangements are sometimes used. These can force the spark to discharge across the insulator and thus burn away any built up carbon that could cause poor starting or misfires. It is not uncommon to find two, three or four ground electrode arrangements in new vehicles. The use of precious metals on the tips of the spark plug electrodes is not uncommon especially on higher performance engines. Whilst these spark plugs do have increased service life they are often specified because of their superior ignition qualities.

Our engineering departments work very closely with the engine and vehicle manufacturers to produce the ideal spark plug type for each application. Any change in production is expensive for a manufacturer and therefore new spark plug types are only produced where necessary. NGK employ the very latest production technology to ensure that every aspect is catered for – performance, economy and value.

## HEAT RANGE AND HEAT DISSIPATION

Spark plugs do not produce heat in the combustion chamber. One of the functions of the spark plug is to dissipate some of the heat produced during combustion. This is mostly transferred into the cylinder head. The 'Heat Range' indicates the measure of the spark plug's ability to do this. A 'hot' spark plug is designed to maintain a sufficiently high temperature at the insulator nose to burn off carbon and oil deposits. A 'cold' spark plug is designed to allow a faster transfer of heat to the cylinder head thus preventing overheating and premature failure.

The heat range selection is obviously a complex task with many factors to take into account. NGK engineers therefore make specific recommendations for each engine and the use to which it is put.



Wide gap

BPR5ES-13



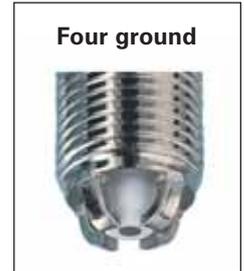
Twin ground

BKR6EK



Three ground

BCP6ET



Four ground

BKR6EQUP



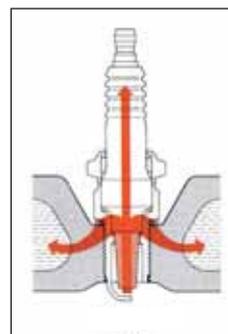
Extra projected and shielded

ZFR6E-11

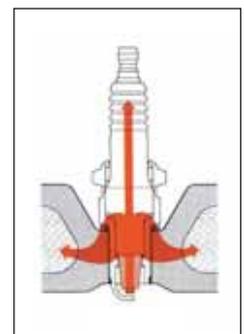


Precious metal

IZFR6B



HOT TYPE  
eg BR4ES



COLD TYPE  
eg BR10ES

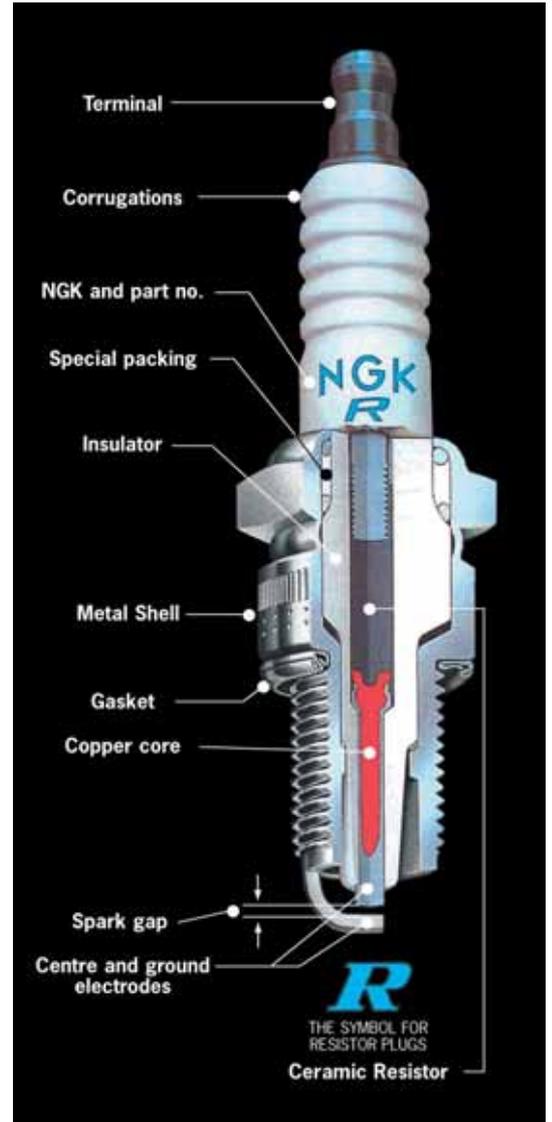
## WIDE HEAT RANGE

A wide range spark plug is more flexible and performs equally well in a hot or cold engine under stop and go city driving or fast motorway cruising. Engines that tend to run hot need cold type plugs. Those that run cold demand a hotter type. The specific plug for any engine is determined by the plug's heat range. That is the minimum and maximum temperatures between which the plug will offer optimum performance.

The heat range of NGK Spark Plugs is wider than ordinary plugs therefore they are suitable for both high speed and low speed driving. Compared with conventional plugs of the same pre-ignition rating they have more resistance to fouling. Compared to ordinary plugs with equal anti-fouling resistance, NGK Spark Plugs have a higher pre-ignition rating.

## NGK'S HEART OF COPPER

Copper wire used in place of the iron core in conventional plugs is the secret of NGK's Wide Heat Range. Copper's superior heat conductivity dissipates heat quicker. It cools the electrode tip and insulator tip which prevents hot spots that could cause pre-ignition. Increased heat resistance does not affect fouling resistance, which is primarily determined by the insulator nose length. The longer the nose, the more susceptible it is to heat and the more free from fouling. By raising the pre-ignition rating with the high conduction copper and leaving the insulator nose long, NGK produces the Wide Range Plug. One that meets the broad thermal requirements of engines under high and low RPM conditions. All the spark plugs in the Automotive Catalogue have a copper core.

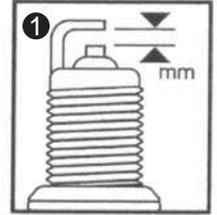


## FIRING END APPEARANCE

<p><b>Firing end temperature °C</b></p> <p><b>Overheating area</b></p> <p>870°</p>		<ul style="list-style-type: none"> <li>• <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.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Causes</b></li> <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>
<p><b>Optimum temperature area</b></p> <p>450°</p>		<ul style="list-style-type: none"> <li>• <b>Good condition</b> The insulator is brown or light grey.</li> </ul>	<p>Even if the spark plug is used under good conditions, deposits will accumulate. Regular inspection and replacement is advisable.</p>
<p><b>Fouling area</b></p> <p>Idle Temp { 250° 150°</p>		<ul style="list-style-type: none"> <li>• <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.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Causes</b></li> <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>

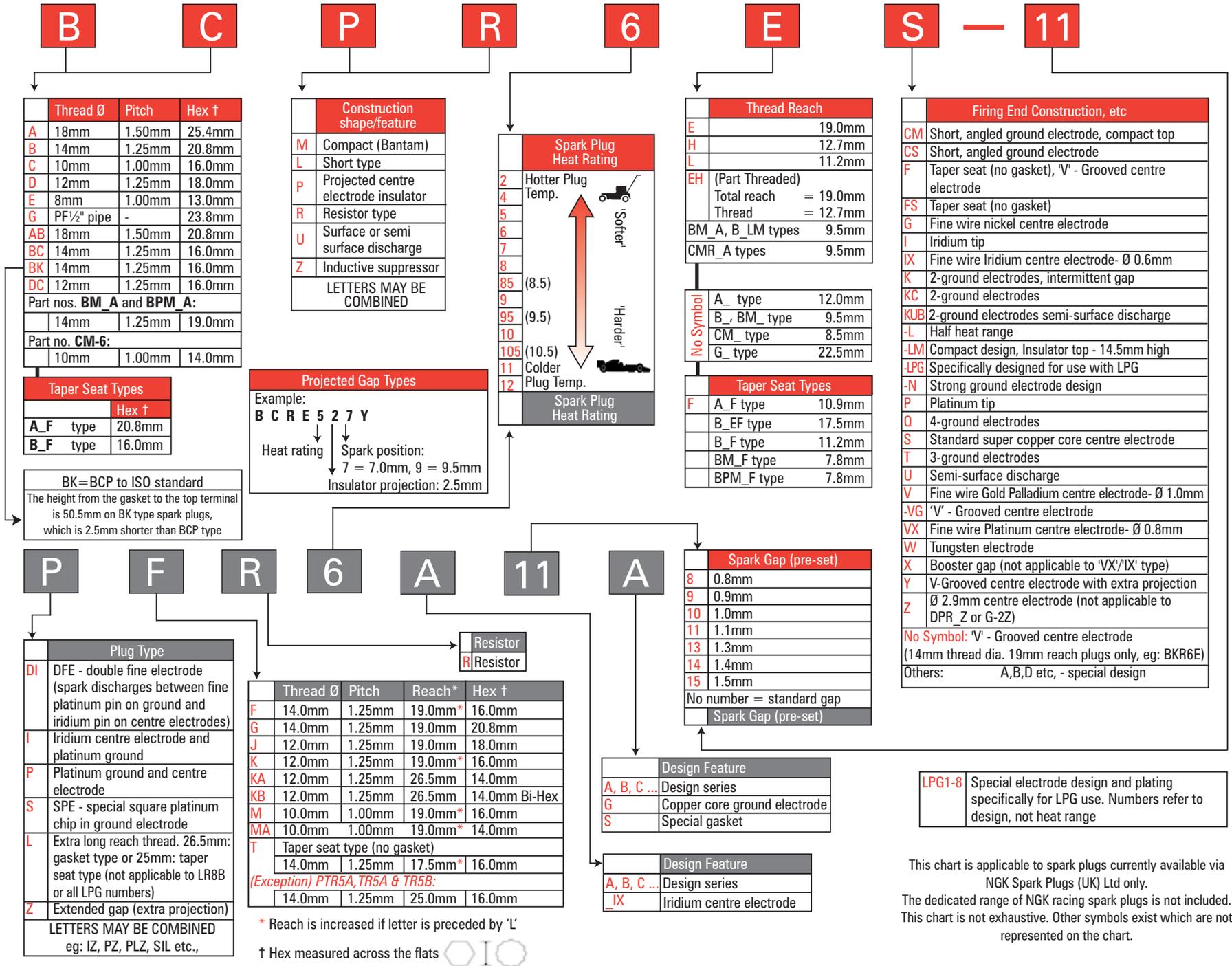
## SPARK PLUG INSTALLATION TIPS

- 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 (*fig 1*)
- Multi ground electrode and precious metal plugs should not be regapped - visual inspection only
- Install new spark plug *by hand* until it seats - (*fig 2*) 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 chart below (*fig 3*)
- If a torque wrench is unavailable then refer to vehicle/engine manufacturers installation instructions or the tightening angle advice which is displayed on current NGK packaging (excluding specialist race plugs). Note that this angle advice can differ between part numbers due to individual spark plug design (e.g. seating type, thread diameter and gasket material)
- It is important not to over or under tighten spark plugs during installation. Over-tightening can lead to distortion of the spark plug. Under-tightening can cause overheating due to poor heat dissipation. *In extreme cases incorrect tightening can cause spark plug breakage and/or engine damage*
- NGK does not recommend the application of lubricant to spark plug threads as the resultant reduction of frictional forces at the thread faces will render the torque charts inaccurate and over tightening could occur
- If a gasket type spark plug is re-installed, it should only require a further 1/12 of a turn after it has been seated
- Always carefully use the correct tools for removal/installation to prevent damage to the spark plug or engine
- Inspect spark plug cover and renew if necessary



③ Thread Ø	FOR FLAT SEAT TYPE (WITH GASKET)					TAPER SEAT TYPE	
	18mm	14mm	12mm	10mm	8mm	18mm	14mm
<b>Cast iron head</b>	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)
<b>Aluminium head</b>	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)

**Important:** Some spark plugs differ in gasket design or material, refer to tightening advice on specific spark plug packaging



This chart is applicable to spark plugs currently available via NGK Spark Plugs (UK) Ltd only. The dedicated range of NGK racing spark plugs is not included. This chart is not exhaustive. Other symbols exist which are not represented on the chart.