

Aftermarket spark plug directory for BMW Motorrad engines

All BMW motorcycles, model-year 1999 onward

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UKGSer profile: <http://www.ukgser.com/forums/member.php?1044494-Nick-V>

Introduction and rationale

BMW R-series motorcycles dating to approximately 2000 are equipped with standard, commonly-available spark plugs, typically supplied either by Bosch or NGK.

However, dating from approximately 2000, a trend began whereby BMW motorcycles began to be equipped with increasingly specialized spark plugs (usually but not always manufactured by NGK) which are typically only available through the dealer network and not through aftermarket channels.

Where applicable, this document illustrates the specialized features of the spark plugs in use on BMW Motorrad engines manufactured from 1999 onward, and describes, where applicable, which standard spark plugs in use may be replaced with commonly-available spark plugs of various makes and types.

The advantages of this approach are as follows:

- Reduced cost in terms of spark plug replacement (typically 40% or less of BMW genuine-part replacement cost).
- Ability to use a variety of standard nickel-electrode, platinum- or iridium-electrode, or racing spark plugs from a variety of manufacturers.

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Equipment List

- Suitable 14mm, 16mm or 18mm spark plug wrench (as appropriate).

Consumables List

- Appropriate type and quantity of replacement spark plugs.
- Appropriate anti-sieze compound for use on spark plug threads (high-quality copper grease such as Würth is recommended).

Note: NGK spark plugs with a *VX* suffix use platinum-coated centre electrodes. This type has been replaced by the *IX* suffix, which use iridium-coated centre electrodes. Where a vendor has not moved stock of a particular spark plug type for some time, *VX*-suffix plugs may still be available.

Selecting a suitable spark plug type

Heat ranges

If the motorcycle is used mostly in urban situations, it is recommended that the factory-specified heat range be retained.

If the motorcycle is used mostly for high-speed and/or high-load running, and/or is running on a lean or over-lean fuel mixture (fuel mixture λ of 14.8:1 or more), a sensible precaution is to use plugs which are one heat range colder than standard. This will help reduce combustion-chamber overheating and mixture pre-ignition and detonation ('pinging'), especially on engine-management systems do not feature knock sensors (such as BMS-X).

Caution: It is strongly recommended that fuel-octane recommendations specified by BMW be adhered to at all times. Using spark plugs with a colder heat range is not a guarantee against overheating or engine damage due to sub-standard fuel.

Using plugs which are one or more heat ranges hotter than standard is usually not recommended.

This tactic is sometimes used in cases where piston-ring/cylinder-wall wear and/or valve guide wear has reduced the engine's ability to clear engine oil from the combustion chambers, and oil deposits accumulate on the spark plug electrodes, causing hard starting. The hotter spark plug maintains electrode conductivity by 'burning' oil deposits off the plug electrodes. However, if the engine's condition has deteriorated to this extent, isolating and permanently rectifying the actual fault is the only practical long-term solution.

Resistor-equipped spark plugs

It is essential that fuel-injected BMW Motorrad engines be equipped only with resistor-type spark plugs. Most motorcycles of these vintages are not equipped with a resistor substitute (for instance, high-resistance spark plug leads), and failure to use resistor-equipped spark plugs may result in excessive radio noise being generated. In a worst-case scenario, this could result in fuel-injection system and/or secondary electronic-system malfunctions.

Electrode types

1. Nickel steel (conventional firing end)

The main advantage of this type of spark plug is low initial and replacement cost. Nickel steel electrodes represent an acceptable trade-off by offering fairly long life coupled with the reduced cost of high-volume production (the overwhelming majority of spark plugs manufactured today use nickel-steel electrodes). A typical example is the NGK CR8E (below).



1. Nickel steel (multiple earth electrodes)

A common nickel-steel firing end derivative employs two, three or four earth electrodes. This layout offers the theoretical advantage of longer plug life compared to single-electrode (assuming that all firing-end air gaps are set equally). This is because a spark can only arc across one of the air gaps at any given moment. Assuming that all earth gaps see equal use, this has the theoretical potential to double (in the case of two earth electrodes), triple (three earth electrodes) or quadruple (four earth electrodes) spark plug life.

A typical example is the NGK CR8EK (below).



2. Rare earth metal (typically Platinum or Iridium)

This layout offers the advantages of longer plug life and increased spark performance compared to any nickel-steel plug type, albeit at increased cost.

For longer-term use, rare earth metal spark plugs are actually more economical because for an average of 50% greater cost, they offer anything up to 300% longer life.

The centre electrode tip has a much smaller diameter than nickel-steel types (typically 0.6mm for NGK and 0.4mm for Denso) and may be accompanied by a tapered earth electrode. The reduced-diameter centre electrode encourages a greater release of electrical energy, resulting in more efficient mixture ignition and reduced potential for misfires. The greatly increased centre electrode wear this would otherwise result in is offset by a very thin surface coating of highly temperature-resistant rare earth metal (typically platinum or iridium, although niobium and palladium as well as gold/palladium combinations have also been used).

Typical examples are the NGK CR8EVX (platinum) and CR8EIX (iridium) (below).



As of 2014, spark plugs utilizing platinum-coated centre electrodes have largely been supplanted by identical-appearing spark plugs which utilize an iridium coating. These offer slightly longer life than equivalent platinum spark plugs, but in most if not all cases, an iridium-equipped firing end looks identical to a platinum-equipped firing end.

For cost reasons, each manufacturer has a different policy regarding use of exotic metals in its spark plugs. Denso terminated the use of platinum in favour of iridium some years ago. NGK have recently followed suit. In contrast, the majority of current high-performance Bosch plugs use either platinum or a platinum/iridium blend.

Use of racing spark plugs

For road-going motorcycles, *bona fide* racing spark plugs offer no tangible advantages over a high-quality platinum or iridium plug.

Racing spark plugs are almost always hand-made in extremely low volumes by a dedicated sub-division of the manufacturer. As a result, they are highly expensive (anywhere up to six times the cost of equivalent iridium plugs). Their main advantages are very careful quality control at every stage of the manufacturing process, thereby reducing the risks of plug-related misfires and failures (either of which may have catastrophic effects on a race win or result during a relatively short-duration motorsport event) as well as ensuring consistent results from plug to plug. Firing-end designs are specifically tailored to the demands imposed by unusually high engine speeds and/or unusually high compression ratios (which may result in lack of clearance between piston crown and cylinder head) and/or unusually high compression pressures.

An example is the NGK R0045Q-10, which uses a semi-surface discharge firing end (below).



Spark plug applications by BMW engine

Tip: Where the design of the spark plug lead or direct-fire ignition coil requires a solid terminal nut, equivalent spark plugs with threaded terminals can be substituted if they are equipped with screw-on terminal nuts.

C1 (Rotax 124 cm³ and 176 cm³ singles)

Standard spark plug	Can be replaced by
NGK CR8EB	NGK (conventional): CR8E CR8EB CR8EK CR8EKB NGK (platinum / iridium): CR8EVX CR8EIX Denso (iridium): IU24

G450X (449 cm³)

Standard spark plug	Can be replaced by
NGK CR9EKB	NGK (conventional): CR9E CR9EB CR9EK CR9EKB NGK (platinum / iridium): CR9EVX CR9EIX NGK (racing): R0373A-* ¹ R0045G-* ¹ R0045J-* ¹ R0045Q-* ¹ Denso (iridium): IU27

G-series and F-series (Rotax 652 cm³ single)

Standard spark plug	Can be replaced by
<i>F650 Funduro 1999:</i> NGK BCPR7ET	NGK (conventional): BCPR7ES, BCPR8ES NGK (platinum / iridium): BCPR7EIX, BCPR8EIX
<i>F650 Funduro 2000 - 2003:</i> NGK DR8EA	NGK (conventional): DR8EA, DR9EA NGK (platinum / iridium): DR8EIX, DR9EIX NGK (racing):

¹ The asterisk (*) denotes the heat range of the given spark plug. Depending on type, NGK racing spark plugs are typically available in heat ranges 7 to 11.

<p><i>F650GS / Dakar 2000 - 2003:</i> NGK DR8EA</p>	<p>R2349-^{*2} R2525-^{*2}</p> <p>NGK (conventional): DR8EA, DR9EA NGK (platinum / iridium): DR8EIX, DR9EIX NGK (racing): R2349-^{*2} R2525-^{*2}</p>
<p><i>F650GS / Dakar 2003 - 2006:</i> NGK DR8EB</p>	<p>NGK (conventional): DR8EA, DR9EA DR8EB, DR9EB NGK (platinum / iridium): DR8EIX, DR9EIX NGK (racing): R2349-^{*2} R2525-^{*2}</p>
<p><i>F650GS / Dakar 2007 – 2010 / G650GS / Sertão:</i> NGK DCPR8E</p>	<p>NGK (conventional): DCPR8E, DCPR9E NGK (platinum / iridium): DCPR8EVX, DCPR8EIX DCPR9EVX, DCPR9EIX NGK (racing): R2349-^{*2} R2525-^{*2}</p>
<p><i>G650X series (Xchallenge, Xcountry, Xmoto):</i> NGK DR8EB</p>	<p>NGK (conventional): DR8EA, DR9EA DR8EB, DR9EB NGK (platinum / iridium): DR8EIX, DR9EIX NGK (racing): R2349-^{*2} R2525-^{*2}</p>

C600 Sport and C650GT (647 cm³ inline twin)

Standard spark plug	Can be replaced by
NGK LMAR8D-J	<p>NGK (conventional): LMAR9D-J (<i>BMW S1000RR and HP4 application</i>) LMAR9E-J (<i>Yamaha R1 application</i>) LMAR8C-9 LMAR8G NGK (iridium): LMAR8AI-8 (<i>BMW K1600GT/GTL application</i>) LMAR9AI-8 (<i>KTM 350 SX-F application</i>) LMAR9AI-10 (<i>KTM Freeride 350 application</i>) SILMAR9A9S (<i>Honda CRF 450R application</i>)</p>

² The asterisk (*) denotes the heat range of the given spark plug. Depending on type, NGK racing spark plugs are typically available in heat ranges 7 to 11.

F-series (Rotax 798 cm³ inline twin)

Standard spark plug	Can be replaced by
<i>F650GS, F700GS and all F800-series:</i> NGK DCPR8E	NGK (conventional): DCPR8E, DCPR9E NGK (platinum / iridium): DCPR8EVX, DCPR8EIX DCPR9EVX, DCPR9EIX NGK (racing): R2349- ^{*3} R2525- ^{*3}

OHV R-series (AKA 'Oilhead': 848 cm³ [R850], 1 085 cm³ [R1100], 1 130 cm³ [R1150], 1 170 cm³ [R1200C])

Standard spark plug	Can be replaced by
<i>All R850, R1100 (except R1100S), R1150 and R1200C (single-spark ignition):</i> Bosch FR6DDC	Bosch: FR6DDC, FR6KDC, FR7KDC, FR78
<i>All R1100, R1150 and R1200C (single-spark ignition):</i> NGK BKR7EKC	NGK (conventional): BKR7EKC BKR7E BKR7E-E BKR7EKU BKR7EQUP BKR7EKC-N NGK (platinum / iridium): BKR7EIX, BKR8EIX, BKR9EIX NGK (racing): R6888A- ^{*3} R7433- ^{*3} R7434- ^{*3}
<i>All R1100, R1150 and R1200C (dual-spark ignition):</i> Primary: NGK BKR7EKC Secondary: NGK DCPR8EKC or Bosch YR6LDE	Primary (NGK conventional): BKR7EKC BKR7E BKR7E-E BKR7EKU BKR7EQUP BKR7EKC-N Primary (NGK platinum / iridium): BKR7EIX, BKR8EIX, BKR9EIX Secondary (NGK conventional): DCPR8E, DCPR9E Secondary (NGK platinum / iridium): DCPR8EVX, DCPR8EIX DCPR9EVX, DCPR9EIX Primary (NGK racing): R6888A- ^{*3} R7433- ^{*3} R7434- ^{*3} Secondary (NGK racing): R2349- ^{*3} R2525- ^{*3}

³ The asterisk (*) denotes the heat range of the given spark plug. Depending on type, NGK racing spark plugs are typically available in heat ranges 7 to 11.

OHV R-series (AKA 'Hexhead', 1 170 cm³)

Standard spark plug	Can be replaced by
Bosch YR5LDE NGK DCPR8EKC	NGK (conventional): DCPR8E, DCPR9E NGK (platinum / iridium): DCPR8EVX, DCPR8EIX DCPR9EVX, DCPR9EIX NGK (racing): R2349- ^{*4} R2525- ^{*4}

DOHC R-series (AKA 'Camhead', 1 170 cm³)

Standard spark plug	Can be replaced by
NGK MAR8B-JDS	NGK (conventional): CR8E, CR9E CR8EB, CR9EB CR8EK, CR9EK CR8EKB, CR9EKB NGK (platinum / iridium): CR8EVX, CR9EVX CR8EIX, CR9EIX NGK (racing): R0373A- ^{*4} R0045G- ^{*4} R0045J- ^{*4} R0045Q- ^{*4} Denso (iridium): IU24, IU27

Liquid-cooled DOHC R-series (1 170 cm³)

Standard spark plug	Can be replaced by
NGK LMAR8D-J	NGK (conventional): LMAR9D-J (<i>BMW S1000RR and HP4 application</i>) LMAR9E-J (<i>Yamaha R1 application</i>) LMAR8C-9 LMAR8G NGK (iridium): LMAR8AI-8 (<i>BMW K1600GT/GTL application</i>) LMAR9AI-8 (<i>KTM 350 SX-F application</i>) LMAR9AI-10 (<i>KTM Freeride 350 application</i>) SILMAR9A9S (<i>Honda CRF 450R application</i>) SILMAR10A9S (<i>recommended for racing applications only</i>)

⁴ The asterisk (*) denotes the heat range of the given spark plug. Depending on type, NGK racing spark plugs are typically available in heat ranges 7 to 11.

K-series, Gen. 2 (AKA 'Flying Brick', 1 171 cm³)

Standard spark plug	Can be replaced by
<i>K1200RS, K1200LT (1997 – 1998):</i> NGK BKR6EK	NGK (conventional): BKR6E BKR6EK BKR6EKC BKR6EKE BKR6EKU BKR6EKUB BKR6EKUE BKR6EP-8 BKR6EGP NGK (iridium): BKR6EIX, BKR7EIX, BKR8EIX NGK (racing): R6888A- ^{*5} R7433- ^{*5} R7434- ^{*5}
<i>K1200RS, K1200GT, K1200LT (1998 – 2003):</i> NGK DCPR7E	NGK (conventional): DCPR7E, DCPR8E, DCPR9E NGK (platinum / iridium): DCPR7EVX, DCPR8EVX, DCPR9EVX DCPR7EIX, DCPR8EIX, DCPR9EIX NGK (racing): R2349- ^{*5} R2525- ^{*5}

K-series, Gen 3 (AKA 'Slant-four', 1 157 cm³ and 1 293 cm³)

Standard spark plug	Can be replaced by
<i>Early specification: Bosch YR5DDE</i> <i>Revised specification: NGK KR9CI</i>	NGK (conventional): DCPR9E NGK (platinum / iridium): DCPR9EVX DCPR9EIX NGK (racing): R2349- ^{*5} R2525- ^{*5} Denso (iridium): IXU27

K-series (AKA 'Slant-six', 1 649 cm³)

Standard spark plug	Can be replaced by
NGK LMAR8AI-8	NGK (conventional): LMAR8AI-8 LMAR9AI-8

S-series and HP4 (999 cm³)

Standard spark plug	Can be replaced by
NGK LMAR9D-J	NGK (conventional):

⁵ The asterisk (*) denotes the heat range of the given spark plug. Depending on type, NGK racing spark plugs are typically available in heat ranges 7 to 11.

	LMAR9D-J LMAR9E-J (<i>Yamaha R1 application</i>) NGK (iridium): LMAR9AI-8 (<i>KTM 350 SX-F application</i>) SILMAR9A9S (<i>Honda CRF 450R application</i>) SILMAR10A9S (<i>recommended for racing applications only</i>)
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Recommended spark plug replacement intervals

Caution: BMW ignition systems incorporating direct-fire (AKA 'stick-coil') ignition coils require a special tool in order to remove the coils.
Do not attempt to remove this type of ignition coil by improvised means, as this may result in severe damage to the ignition coil.

It is recommended that regular nickel-steel spark plugs incorporating a single earth electrode be replaced at intervals of:

- 15 000 Km maximum (engines revving to a maximum of 8 500 RPM and/or with a maximum compression ratio of 12.0:1).
- 10 000 Km maximum (engines revving beyond 8 500 RPM and/or with a compression ratio of greater than 12.0:1).

Regular nickel-steel spark plugs incorporating two or more earth electrodes may be replaced at intervals of:

- 20 000 Km maximum (engines revving to a maximum of 8 500 RPM and/or with a maximum compression ratio of 12.0:1).
- 15 000 Km maximum (engines revving beyond 8 500 RPM and/or with a compression ratio of greater than 12.0:1).

As a general rule, platinum- and iridium-tipped plugs may be replaced at intervals of:

- 60 000 Km maximum (engines revving to a maximum of 8 500 RPM and/or with a maximum compression ratio of 12.0:1).
- 40 000 Km maximum (engines revving beyond 8 500 RPM and/or with a compression ratio of greater than 12.0:1).