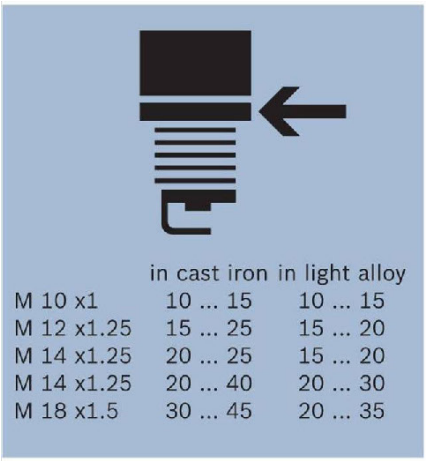
BOSCH

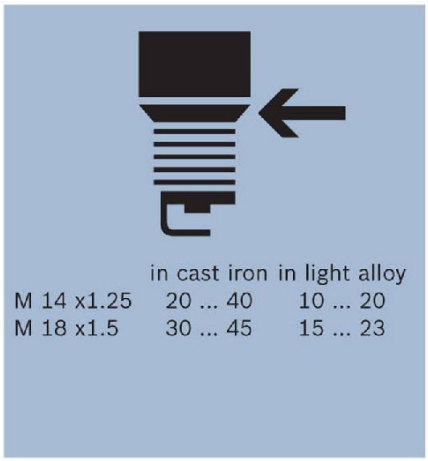
Spark Plugs

Information Pack

Technical Information
Quick Tips

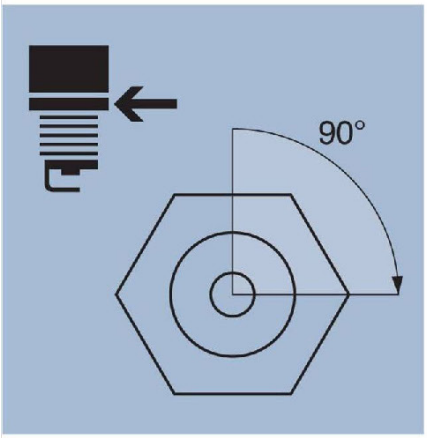


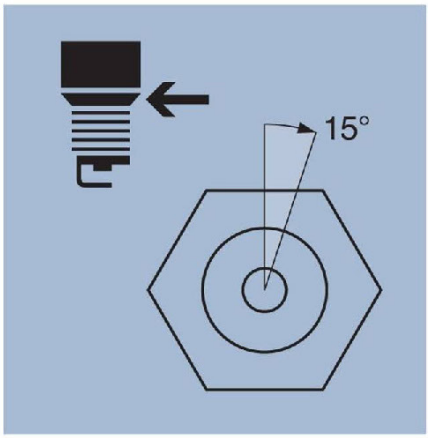
	in cast iron	in light alloy
M 10 x1	10 ... 15	10 ... 15
M 12 x1.25	15 ... 25	15 ... 20
M 14 x1.25	20 ... 25	15 ... 20
M 14 x1.25	20 ... 40	20 ... 30
M 18 x1.5	30 ... 45	20 ... 35



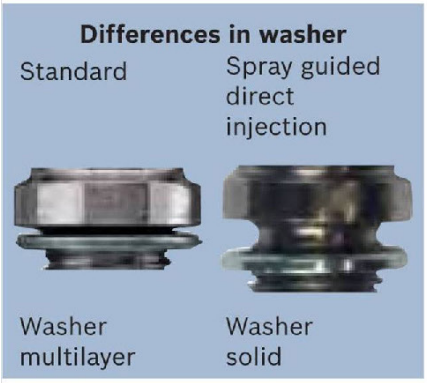
	in cast iron	in light alloy
M 14 x1.25	20 ... 40	10 ... 20
M 18 x1.5	30 ... 45	15 ... 23

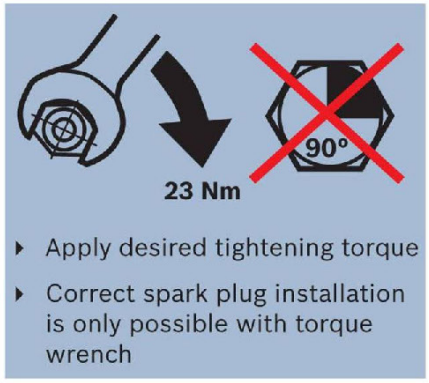
Correct installation of spark plugs with torque wrench:
Tightening torques (Nm)
10Nm = 1 kpm
Please note:
The specified tightening torques listed apply for dry, non greased and non oiled threads.





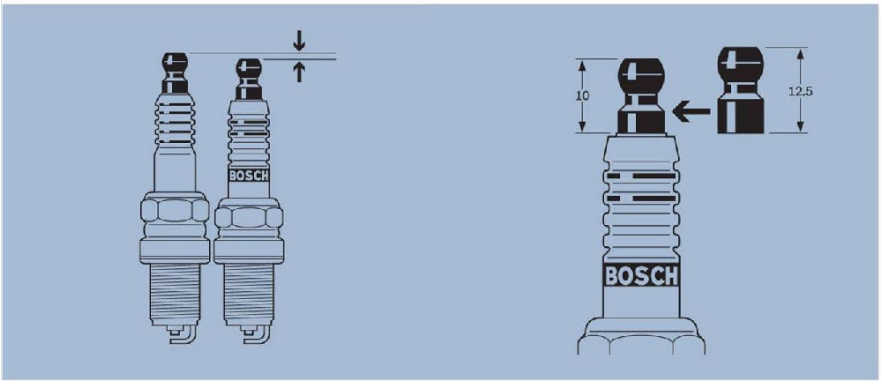
Correct installation of spark plugs without torque wrench:
Screw in the plug by hand until it is seated in the cylinder head. New spark plugs with flat seats are then screwed in by a further 90º (approx.) using the spark plug wrench. Spark plugs with conical seats are screwed in by a further 15º (approx.). Used spark plugs are screwed in by hand until seated and then screwed in by a further 15º (approx.).





Precise installation for spray-guided direct injection engines:
Incorrect positioning of the ground electrode in the cylinder head resulting from excessive torque can lead to:

- Poor starting.
- Misfiring.
- Damage to the motor and catalytic converter.



Spark plug connection nuts:
Spark plugs may be installed in the engine which differ in length from the Bosch spark plugs. In this case:

- Screw out old spark plugs.
- Compare to new Bosch spark plugs.
- If replacement spark plugs are longer than the original Bosch spark plugs, replace the terminal connection nut with a shorter equivalent as per the diagram to the left.

Technical Information
Alternative Fuels

LPG

When operating on LPG, the internal combustion pressures and temperatures are higher, this results in a higher voltage requirement for ionisation. With older contact ignition systems, a reduction in the spark plug gap compensates for this higher voltage requirement. LPG operation also causes less deposits and fouling, so the heat range selection can be one range colder than in petrol operation.

The correct spark plug will depend on whether the vehicle is run completely on LPG or is duel fuel.

Special attention should be paid to older contact ignition systems:

Where the vehicle is not listed in the LPG catalogue, follow the guidelines given on this page.

In high energy ignition systems, the recommendation generally remains unchanged between LPG and Petrol, however, your driving conditions and LPG/Petrol ratio may affect this.

Using Platinum Plus Spark Plugs in LPG

Platinum Plus spark plugs are also ideal for vehicles converted to LPG. Please refer to the PLG spark plug catalogue for specific vehicle applications where we have preformed the analysis to give you the recommended Double Platinum or Super Plus spark plugs.

However, if you decide to use Platinum Plus spark plugs in vehicles converted to PLG, please refer to the guidelines given on this page under the Dual Fuel heading.

LPG Only (Retrofit)

In older cars, the electrode gap needs to be set 0.1 – 0.2 mm smaller and the heat range should be one range colder. Misfiring due to carbon fouling is unlikely and the colder plug should increase service life.

Eg: WR8DC+ 0.8mm (petrol) to
WR7DC+ 0.7mm (LPG)

Dual Fuel

The spark plug is usually measured in petrol mode and you will need to make a compromise between the operation on both fuel types.

If you mainly use LPG, the electrode gap should be reduced by 0.1 – 0.2 mm and one colder heat range is to be selected.

Eg: WR8DC+ 0.8mm (petrol) to
WR7DC+ 0.7mm (LPG)

Please note:
Vehicles which run on petrol in stop/start traffic can misfire if using the LPG plug.
Electrode gap changes greater that 0.2 mm should be avoided.

Lead Replacement Fuel

LRP has taken the place of leaded petrol in most service stations around Australia. This fuel burns at a lower combustion temperature so self cleaning of the spark plug must be increased to burn off the chemical residue.

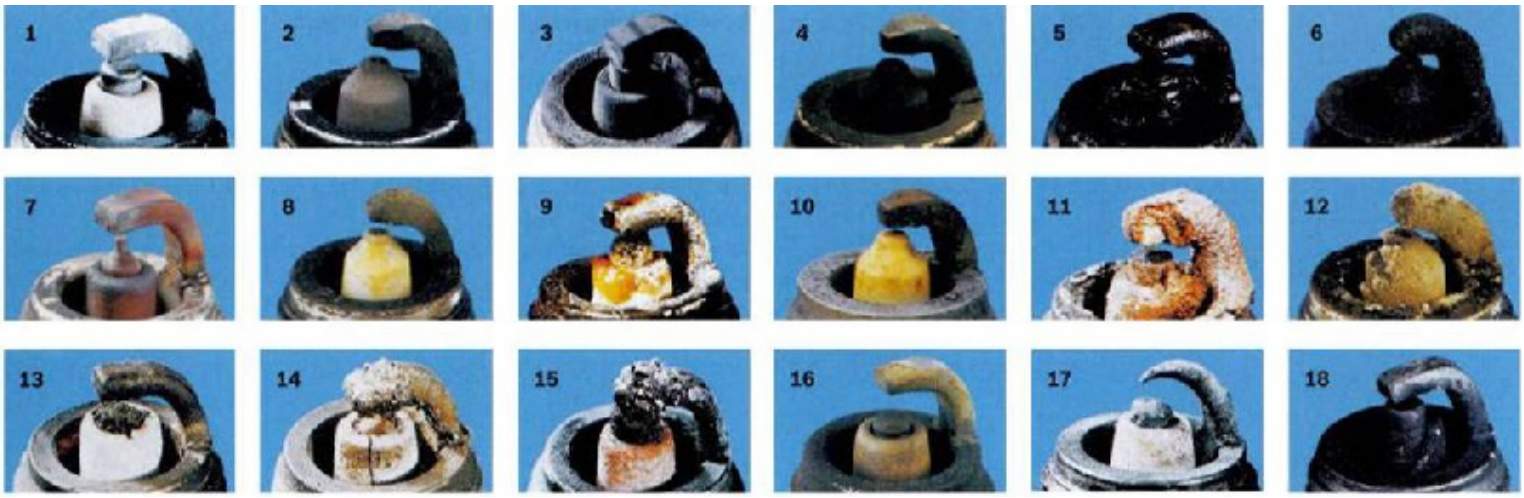
Ongoing testing in the Australian market shows that is may be beneficial in some vehicles to use a higher heat range spark plug than currently recommended.

i.e:
Ford Laser KA, KB, 1.3, 1.5L 1981-1985
Current recommendation: WR8DC+

If problems are experienced due to LRP, we suggest trying WR9DC+. If no problems have been experienced in the change from leaded petrol LRP or ULP then no changes should be made to the application.

However, if you have fouling (mainly in stop/start driving conditions) this change may be beneficial.

Technical Information
Spark Plug Faces



1 + 2 Normal

Insulator nose greyish-yellow to russet brown. Engine is in order. Heat range of plug correct. Mixture setting and ignition timing are correct: no misfiring, cold starting device functions correctly.
No deposits from fuel additives containing lead or from alloying constituents in the engine oil. No overheating.

3 + 4 Soot - carbon fouled

Insulator nose, electrodes and spark plug shell covered with velvet-like, dull black soot deposits.
Cause: Incorrect mixture setting (carburettor, fuel injection) mixture too rich, air filter very dirty, automatic choke not in order or manual choke pulled too long, mainly short distance driving, spark plug too cold, heat range code number too low.
Effect: Misfiring, poor cold-starting performance.
Remedy: Set mixture and cold-starting device correctly, check air filter.

5 + 6 Oil-fouled

Insulator nose electrodes and spark plug shell covered with shiny soot or carbon residue.
Cause: Too much oil in combustion chamber. Oil level too high, badly worn piston rings, cylinders or valve guides.
In two stroke gasoline engines, too much oil in mixture.
Effect: Misfiring, poor starting performance.
Remedy: Overhaul engine, correct fuel oil mixture, replace spark plugs.

7 + 8 Lead deposits

Insulator nose glazed brownish yellow, or may also tend towards green.
Cause:Fuel additives which contain lead. The glaze appears in the case of heavy engine loading after lengthy part-load operation.
Effect: Under heavy loading, deposits become electrically conductive and cause misfiring.
Remedy: Replace spark plugs.

9 + 10 Heavy lead deposits

Insulator nose is thickly-glazed brownish-yellow, or may also tend towards green.
Cause: Fuel additives which contain lead. The glaze appears in the case of heavy engine loading after lengthy part-load operation.
Effect: Under heavy loading, deposits become electrically conductive and cause misfiring.
Remedy: Replace spark plugs.

11 + 12 Heavy lead deposits

Heavy ash deposits from oil and fuel additives on the insulator nose, in the scavenging area and on the ground electrode. The structure of the ash is loose to cinder-like.
Cause: Alloying constituents, in particular from oil, can deposit this ash in the combustion chamber and on the spark-plug face.
Effect: Can lead to auto ignition with loss of power and engine damage.
Remedy: Repair engine. Replace spark plugs. Possibly use other oil.

13 Partially-melted centre electrode

Centre electrode partially melted, blistered, spongy insulator tip.
Cause: Overheating due to auto-ignition, Eg: due to over advanced ignition timing, combustion deposits in combustion chamber, defective valves, defective ignition distributor, inadequate fuel quality, heat range possibly too low.
Effect: Misfiring, loss of power (engine damage).
Remedy: Check engine, ignition and mixture formation. New spark plugs with correct heat range.

14 Centre electrode melted away

Centre electrode melted away, ground electrode also severely attacked.
Cause: Overheating due to auto-ignition. Eg: due to over-advanced ignition timing, combustion deposits in combustion chamber, defective valves, defective ignition distributor, inadequate fuel quality.
Effect: Misfiring, loss of power, possibly engine damage. Overheated centre electrode may result in insulator nose cracking.
Remedy: Check engine, ignition and mixture formation. Replace spark plugs.

15 Partially-melted electrode

Cauliflower-like appearance of the electrodes. Possibly deposition of foreign matter.
Cause: Overheating due to auto-ignition. Eg: due to over-advanced ignition timing, combustion deposits in combustion chamber, defective valves, defective ignition distributor, inadequate fuel quality.
Effect: Loss of power prior to complete failure. (engine damage).
Remedy: Check engine, ignition and mixture formation. Replace spark plugs.

16 Heavy wear on centre electrode

Cause: Recommended interval between spark plug changes not complied with.
Effect: Misfiring, particularly when accelerating. Ignition voltage no longer sufficient for large electrode gap.
Poor starting performance.
Remedy: Replace spark plugs.

17 Heavy wear on ground electrode

Cause: Aggressive fuel and oil additives. Unfavourable influence of gas turbulence in the combustion chamber, possibly caused by deposit detonation.
Effect: Misfiring particularly when accelerating (ignition voltage no longer sufficient for large electrode gap).
Poor starting performance.
Remedy: Replace spark plugs.

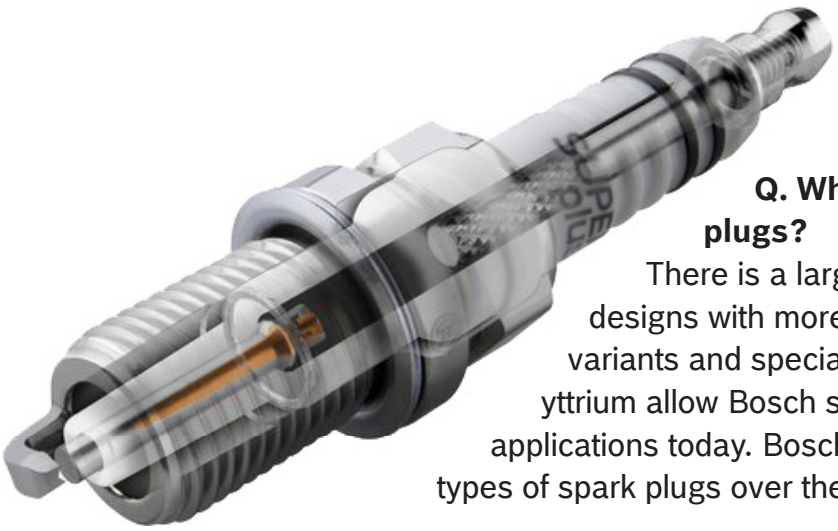
18 Cracking of insulator nose

Cause: Mechanical damage due to impact, dropping or pressure on the centre electrode resulting from incorrect handling. In marginal cases - especially after excessively long use - the insulator nose may crack due to deposits between the centre electrode and insulator nose, and due to corrosion of the centre electrode.
Effect: Misfiring, spark over at points not reliably supplied with fresh mixture.
Remedy: Replace spark plug.

Technical Information
FAQ

Q. What is the function of a spark plug and why is it a vital engine component?
The function of a spark plug is to introduce the ignition energy into the combustion chamber and to initiate combustion of the compressed air fuel mixture. It does this task by generating a spark between its electrodes which then generates the required heat to ignite a smooth burn of the air fuel mixture.
That spark plug is an important factor in determining optimal performance and reliable functioning of and engine. It must permit reliable cold starting, it must guarantee that there is no misfiring during acceleration, and it must withstand the engine being operated for hours on end at maximum power. These requirements apply throughout the entire service life of the spark plug.

For 105 years, Bosh spark plugs have been designed for optimal performance, reliable functioning and to withstand extreme operating conditions. Today the continuously developing spark plug is a key engine system component. It plays a major role in fuel economy, clean, efficient combustion and the reliable operation of engines and catalytic converters.



Q. What are the different types of spark plugs?
There is a large variety of different spark plug designs with more than 1,400 variations. Design variants and special materials such as platinum, silver and yttrium allow Bosch spark plugs to be used in a wide variety of applications today. Bosch has developed more than 20,000 different types of spark plugs over the last 105 years.

Q. Why do we need to change spark plugs?
During operation, the spark plug is subjected to both wear and fouling and should be replaces at regular intervals. In the course of its service life, the spark plug undergoes changes that increase the required ignition voltage. When the required voltage reaches a level that can no longer be compensated for by the voltage reserve the result of misfiring. These changes can be caused by:

- Electrode wear
- Engine wear
- Abnormal operating conditions (pre-ignition, detonation, high oil consumption)

Q. How often do I need to change my plugs?
As a rule, Bosch recommends that you follow the replacement interval listed in your vehicles owner's manual. However we highly recommend that you inspect (read) your spark plugs annually and replace as required, to insure optimum engine performance.

Technical Information
FAQ

Q. What is detonation?
Detonation or “knocking” is uncontrolled combustion with a very steep rise in pressure. It is caused by spontaneous ignition of the fuel mixture, which has not yet been reached by the ignition spark. As the high pressure waves hit the walls of the combustion chamber, their impact produces a metallic knocking sound.
Failure to recognise and deal with knocking will inevitably lead to serious engine damage.

Q. What is pre-ignition?
Pre-ignition is an uncontrolled ignition process in which the temperatures in the combustion chamber can rise to such an extent as to cause serious damage to the engine and the spark plug.
Full-throttle operation can generate localised hot spots and cause pre-ignition at the following locations:

- At the tip of the spark plug’s insulator nose
- On the exhaust valve
- On the protruding sections of the head gasket
- On the loose deposits (ash and carbon residue)

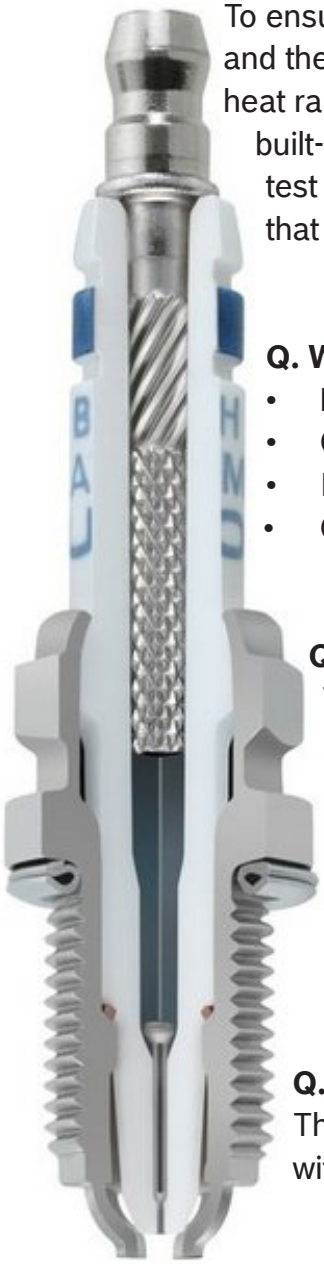
Pre-ignition of the air-fuel mixture can cause severe damage to an engine and this is one reason why the heat range of a spark plug is so important.

Q. What is heat range?
The spark plug’s heat range is an index of its capacity to dissipate thermal energy. The different characteristics of automotive engines regarding operating load, compression, engine speed, cooling and fuel make it impossible to run all engines with a standard spark plug.

The same spark plug may get very hot in one engine type, but may reach only a relatively low temperature in another. In the first case, the air-fuel mixture would ignite on the glowing parts of the spark plug projecting into the combustion chamber (pre-ignition) and, in the second case, the insulator tip would soon become so badly fouled by combustion deposits that misfiring would occur. To ensure that the plug runs between the desired temperatures, plugs with different heat capacities are developed.

The so called “heat” range, which is assigned to each spark plug, is used to characterise these dissipation capacities. A plug with a low heat range number (eg. 2-4) indicates a cold plug that quickly dissipates heat to the engine block and cooling system, while a high code (eg. 7-10) indicates a hot plug that retains heat. By properly selecting the heat range of the plug, it ensures that the plug will operate between the plug’s designed operating ranges of 500-900˚ Celsius. In this range, the spark plug will be self-cleaning, yet will not be hot enough to pre-ignite the air/fuel mixture.

Technical Information
FAQ



Q. How does Bosch test engines to determine heat range?

To ensure optimum performance in your car, Bosch has tested each vehicle model and the various engines using ionic current measurements techniques to determine heat range for the models listed in our catalogue. Using a special spark plug with a built-in thermocouple, Bosch engineers find the hottest cylinder engine and then test various spark plugs in that cylinder until the ideal plug is found. This ensures that you will always get the best performance possible.

Q. What advantages does Yttrium give a spark plug?

- Less electrode erosion
- Outstanding protection against corrosion
- Excellent ignition reliability
- Optimum performance throughout its service life.

Q. Do Yttrium spark plugs have a longer life?

The electrode with yttrium alloy shows significantly less wear than an electrode without yttrium increasing service life of the spark plug.

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Q. Why should you choose Bosch Super Plus Spark Plugs?

- Bosch Super Plus spark plugs have a new optimised design with yttrium allowing a pointed ground electrode to be produced.
- Bosch Super Plus spark plugs allow improved and more efficient performance.
- Bosch Super Plus spark plugs increase the protection of your catalytic converter reducing the risk of costly damage and more efficient combustion

Q. I want to use Bosch spark plugs, but have modified my engine by adding performance system, can I still use the plug listed in the catalogue for my vehicle?

No. Fitting standard plugs to modified engines can often result in engine damage. This is due to the plug being too hot for the modified engine. If the spark plug is too hot this can cause detonation in the combustion chamber. Bosch recommends seeking professional advice on heat range.

Technical Information
FAQ

Q. Do Bosch spark plugs meet original equipment requirements?
Yes! Bosch spark plugs meet or exceed warranty requirements of all vehicle and engine manufacturers, and when properly installed in accordance with the recommended application, will not adversely affect the emission control system of any vehicle.

Q. What about vehicle manufacturer warranties?
Consumers are sometimes told by an automobile dealer's service writer or mechanic that a brand of replacement spark plug cannot be used in the consumer's vehicle during the warranty period. The claim is made that use of the brand will "void the warranty"; with the statement or implication that only the original equipment brand of spark plugs may be used.

This of course tends to cast doubt on the quality of the replacement spark plug. That claim is not true. Under the Trade Practises Act 1974 (Cth), a manufacturer may not require the use of any brand of spark plug (or any other article). The use of a different brand of replacement spark plug will not void a new car warranty as long as it is genuine and of an appropriate quality.

Q. Does technology used in racing plugs find its way into Bosch spark plugs?
Yes! Racing provides a great development impetus and test bed for spark plug durability and performances. Bosch's state-of-the-art research and development centres use racetracks around the world as testing grounds to continually enhance the performance of spark plugs in the world's more sophisticated racing engines.Bosch invested the spark plug more than 105 years ago. With such a long history of spark plug development projects in close collaboration with the world's major vehicle manufacturers, Bosch remains on the world's leading suppliers of spark plugs. Bosch's on-going investment in research and development means continual testing in the harshest environment possible for a car: the race track.

Q. Are Bosch spark plugs pre-gapped at the factory?
Most Bosch spark plugs are factory pre-gapped for popular vehicle applications. The gap measurements are indicated either on the box or by part number located on the spark plug shell.
i. S suffix = 0.7 mm
ii. U suffix = 1.0 mm
iii. X suffix = 1.5 mm
Bosch Super Plus, Platinum Plus and resistor spark plugs also have factory-set gaps. For most plugs, the setting is shown on the plug packaging. These haps are correct for the most popular applications of these plugs. There are applications however, for which the gap setting has to be adjusted according to the vehicle manufacturers specification. To avoid damage to a spark plug in the process of adjusting the gap it is important to follow these guidelines:

- To widen the electrode gap, use a tool that only pulls back the ground electrode, without applying pressure to the centre electrode. The tool must not be wedged between the electrodes as that may cause damage to the insulator nose.
- To close the electrode gap, carefully tap the plug, electrode first, on a hard surface.

Technical Information
FAQ

Q. What are the advantages of air surface gap plugs (eg. FLR8LDCU+)

Extensive testing has been conducted in the laboratory and the field to validate the improved performance of air-surface gap plugs with multiple ground electrodes.

- The first test measured the energy transfer efficiency of the two-electrode plug compared to conventional and other premium plugs with a single ground electrode.
- This certified laboratory test measured the additional pressure generated by the spark discharge in a pressure chamber. Higher pressure equals a higher energy transfer by the spark. The test showed that the two electrode plugs transferred more energy to the air-fuel mixture resulting in improved driveability and lower emissions.
- As a spark plug wears, erosion and corrosion increases the gap between the centre and ground electrodes get larger. The larger the gap, the more voltage is required to produce a spark, until the capability of the ignition system is exceeded and the plug misfires. It was found that the multiple ground electrode and yttrium centre electrode plug reduces gap erosion, increasing voltage requirements over time.
- Tests for carbon fouling were stimulated in a cold cell by repeatedly cooling; starting and operating the engine without letting the spark plugs reach their self-cleaning temperature.
- This cycle does not let the spark plug reach its self-cleaning temperature and allows the formation of carbon deposits. The tests found that multiple ground electrode spark plugs had better cold restart reliability than conventional plugs.

Q. Why are there no more non-resistor spark plugs?

Since the early 80's, fuel injection systems have been designed by manufacturers to be fitted with resistor spark plugs. Fitting non-resistor plugs in a resistor application can:

- Affect sophisticated electronics
- Damage expensive components
- Create radio interference
- Affect overall performance
- Increase fuel consumption

Resistor spark plugs can be fitted in non-resistor applications. Bosch recommends fitting a resistor type spark plug for every application.

Q. How do I read a 'spark plug' OR does the Bosch part number have meaning to help " determine the specifications of the plug?

Reading spark plugs provides valuable information on spark plug and engine operating conditions.

Q. How should spark plugs be tightened for best performance?

Bosch recommends when installing spark plugs to use a torque wrench and the correct torque in Nm. as displayed in the picture below. If a torque wrench is not available, tighten the plug by hand until it is seated in the cylinder head. Spark plugs with tapered seats should be tightened an additional 15º.

Note: Avoid over tightening or under tightening as this might result in spark plug or engine damage.