



IGNITION  
PARTS

# NGK Q&A

GLOW PLUGS:  
20 QUESTIONS  
& ANSWERS



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## 1. WHY ARE GLOW PLUGS FITTED?

DIESEL ENGINES have spontaneous ignition, which means that the injected fuel does not require a spark to ignite it. The high temperature, which occurs as a result of compressing intake air, is sufficient to ignite the fuel.

However, in cold conditions, more energy is required to help ignition at start because both the intake air and the engine itself are colder and compression and pumping losses are higher too. Therefore, in diesel engines, glow plugs are a key factor for every cold start. At low ambient temperatures they heat the combustion chamber sufficiently to allow stable combustion conditions for the injected fuel.

The 'glow pencil' (rod-like heating element) of the glow plug (which fits in the cylinder head) protrudes into the glow chamber or pre-combustion chamber. It is most effective when positioned on the edge of the mixing vortex. If it protrudes too far into the combustion chamber, it impedes the preparation and formation of an ignitable fuel/air mixture.

NGK glow plugs set the highest standards in diesel technology, always incorporating the latest technological advances. To ensure that this continues into the future, NGK invests a great deal of time, expertise and money in intensive research and development.

- 1 Fuel injector
- 2 Sheathed glow plug
- 3 Prechamber
- 4 Swirl chamber
- 5 Combustion chamber



Indirect-injection engine



Swirl chamber engine



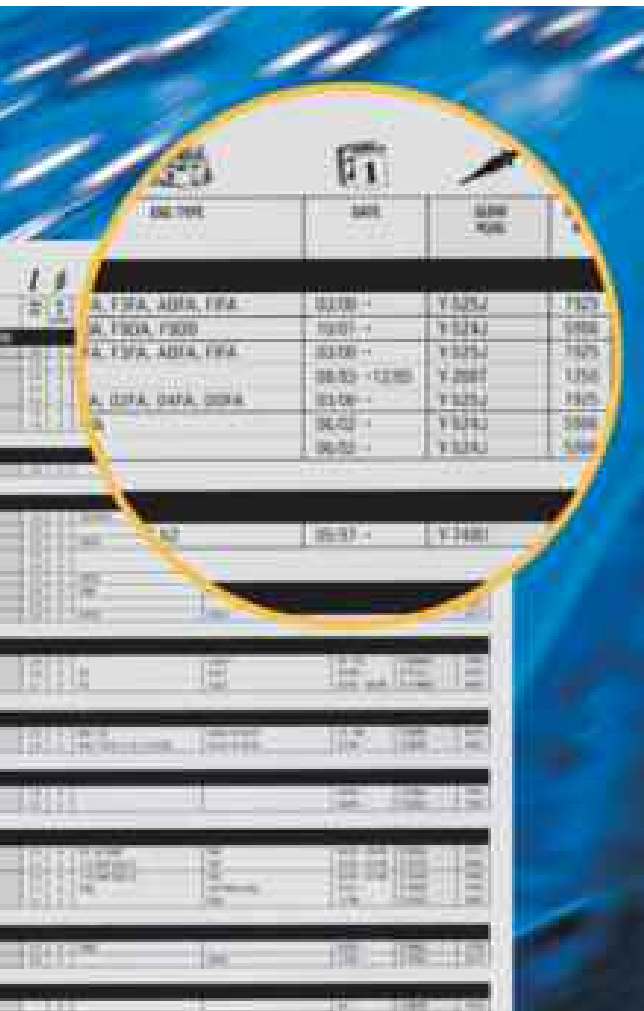
Direct-injection engine

## 2. WHAT ARE THE BENEFITS OF NGK GLOW PLUGS?

THE NGK BRAND is synonymous with quality across the board. NGK glow plugs:

- Start engines quickly and smoothly
- Offer an excellent post-glow function
- Have a long service life
- Offer the latest in high technology for today and tomorrow

NGK is constantly developing innovative concepts for the engines of the future. With NGK glow plugs, engines run quietly and smoothly. They are kinder on the environment too, thanks to the promotion of clean combustion and lower toxic emissions.



## 3. HOW DO I SELECT THE CORRECT GLOW PLUG?

SIMPLY TAKE A LOOK at the NGK catalogue, where our full list of diesel vehicle applications is provided, showing the correct glow plug for each engine.

This information is also available on our website. Go to [www.ngkntk.co.uk](http://www.ngkntk.co.uk) and select Part Finder.



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## 4. WHY DO GLOW PLUGS NEED TO PREHEAT?

BEFORE THE ENGINE IS STARTED, the components of the engine - the cylinder, pistons and valves for instance - are cold. They take heat out of the intake air. This effect is intensified if the intake air is also extremely cold; i.e. at low ambient temperatures.

However, in order to generate compression ignition successfully, diesel engines require the ambient temperature inside the combustion chamber to be warm enough. Glow plugs compensate for the heat loss caused by the cool components and cold air and ensure that temperatures are optimal before ignition. To do this, the plug is energised before the engine is started. The temperature of the heater tube rises rapidly to over 800°C, ensuring quick ignition and thus environmentally friendly combustion.

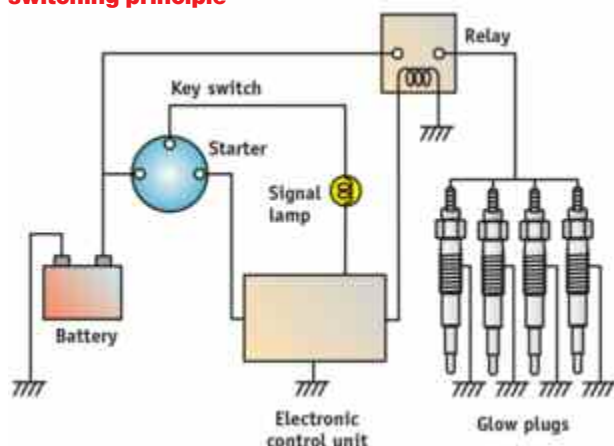
### Type of glow plug

Type of glow plug	with single coil	Standard	e.g. Y-103-2, Y-173	Preheating times
Sheathed type glow plug	with single coil	QGS glow plug	e.g. Y-103 V, Y-106 V	20-25 Sec. to 800°C
		QGS glow plug	e.g. Y-128 T, Y-204 T S1	15-17 Sec. to 800°C
Standard	with single coil	QGS glow plug	e.g. Y-112 M 1	13-14 Sec. to 800°C
		QGS glow plug	e.g. Y-107 R, Y-112 R 1	approx. 10 Sec. to 900°C
		QGS glow plug	e.g. Y-701 J, Y-515 J	approx. 6 Sec. to 900°C
				approx. 4 Sec. to 900°C

## 5. WHAT IS "POST-GLOW"?

POST-GLOW TAKES PLACE after ignition when the engine is running - possibly the first few hundred meters with SRM travelled by the car. It is required to prevent heat loss whilst the engine is warming up to its normal operating temperature.

### The post glow switching principle



Without it, there would be a considerably greater level of toxic emissions and white and blue smoke from the exhaust. The engine would not run smoothly either, displaying the characteristic cold-start knocking. Post-glow helps to keep the combustion chamber at a constant temperature until the engine reaches a reasonable operating temperature.

## 6. HOW DO I INTERPRET THE NGK CODE?

IF YOU THOUGHT If you thought all glow plugs were the same, you'd better think again: on closer inspection, you'll see that glow plugs come in a variety of guises and also differ in terms of properties and constituent materials. With the standard alpha-numerical code on the NGK glow plugs, you can classify every glow plug quickly and easily.

### Sheathed heated glow plugs



Y, YS: Body earth type  
YD: Insulated type

Thread size and number of coils:

1:10 mm Ø  
2:12 mm Ø  
3:10 mm Ø  
4:14 mm Ø  
5:10 mm Ø (Double coil)  
7:10 mm Ø (Double coil)  
8:18 mm Ø  
9:12 mm Ø (Double coil)

Note:

Y-109, Y-159 and Y-171 for Caterpillar have a thread size of 3/8" (= approx. 9,5 mm)

Battery voltage:

0-4: 12 V  
5-9: 24 V

Serial number

Temperature rise time:

V: Rapid glow plug  
T: Rapid glow plug (except YS-871T, it is a sheathed type glow plug)

R, M: QGS (also Y-117SS and Y-204SS)

J: SRM

K or no letter: Standard

B: Change

U: QGS

AS: AQGS

Special tube materials

Revisions number



Y: Sheathed type glow plug

E: 8 mm (QGS or SRM)

The two last figures build the serial number

### Ceramic glow plugs



C: Ceramic glow plug

Y: SRC

Z: QGS

X: QGS with double isolators

The last two figures build the serial number



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## 7. WHAT DIFFERENT TYPES OF GLOW PLUG DO NGK MANUFACTURE?

NGK MANUFACTURES suitable glow plugs for a wide variety of engines and ECUs. NGK glow plugs can be broadly classified into two groups which are outlined below.

### ■ Sheathed-type metal glow plugs

These glow plugs have a heating coil enclosed within a tube that is made of heat-resistant material.

### ■ Ceramic glow plugs:

The heating element of these glow plugs is completely encased in a ceramic material.

There are a number of further glow plug varieties which fall within these two main categories:

### Sheathed-type metal glow plugs

There are four types of sheathed metal glow plugs available:

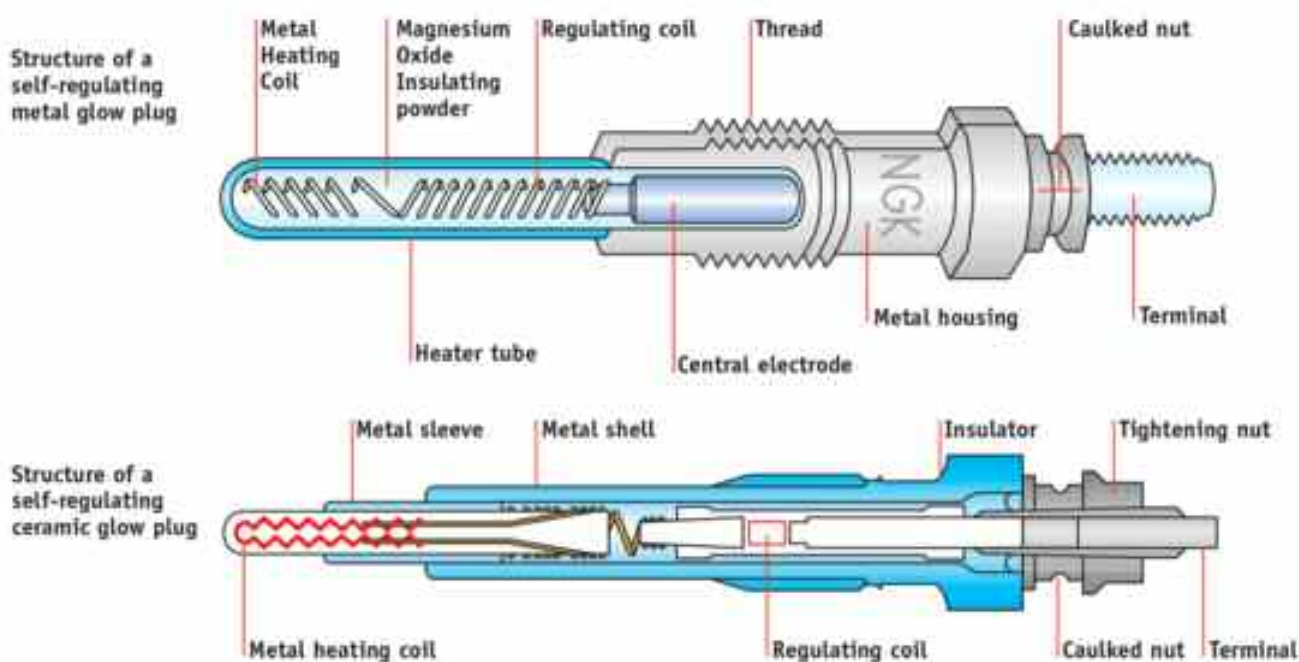
- Standard sheathed-type glow plugs
- Fast heat glow plugs
- QGS sheathed-type glow plugs
- Self-regulating sheathed-type glow plugs

### Ceramic glow plugs

There are two types of ceramic glow plug available:

- QGS glow plugs
- Self-regulating glow plugs

## 8. HOW IS A GLOW PLUG CONSTRUCTED?





## 9. WHAT IS A CERAMIC GLOW PLUG?

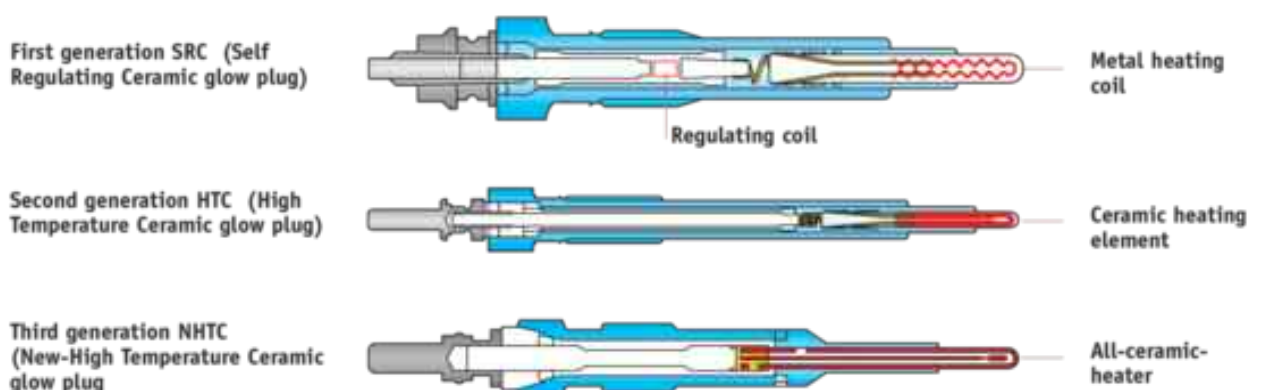
CERAMIC GLOW PLUGS are engineered to perform under the most extreme conditions. Compared to a metal sheathed plug they have a more robust heating element which is made from a special high melting point material.

This is encased in New Ceramic (Silicon Nitride) which has extremely good thermal conductivity properties and can withstand very rapid heating times over extended service periods.

## 10. WHAT ARE THE BENEFITS OF CERAMIC GLOW PLUGS?

THE COMBINATION OF HEATING coil and ceramic coating allows ceramic glow plugs to reach higher temperatures than metal sheathed-type glow plugs, thus enabling the engine to reach operating temperature particularly quickly, even at temperatures well below freezing.

Due to the robust nature of the heating coil and the ceramic materials, post-glow times of up to ten minutes can be employed. A further advantage of ceramic glow plugs is that the cross sectional area heating portion can be made a much smaller. This is a major advantage to modern diesel engines where space is severely restricted around the combustion chamber.







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## 11. WHAT IS SRM TECHNOLOGY?

SRM IS AN ABBREVIATION of “Self Regulated Metal”. Similar to QGS glow plugs with two heating coils, SRM sheathed-type glow plugs have a heating coil and a regulating coil.

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## 12. WHAT IS QGS TECHNOLOGY?

QGS IS AN ABBREVIATION of “Quick Glow System”. QGS metal sheathed-type glow plugs heat up extremely quickly. This means that they are very quick to preheat and improve cold-start behaviour.



This type of glow plug is only used in conjunction with a special QGS controller that regulates the energy supplied and thus the heating of the glow plug. There are two types of quick-start glow plugs. They are not interchangeable as they differ in internal design and construction.

The following types are available:

- QGS glow plug with one heating coil
- QGS glow plug with one heating and one regulating coil

The heater coil in the first type has a very low resistance which allows an extremely large current flow providing the very rapid warm up characteristic. The second type has an additional regulating coil which increases its resistance as the temperature rises.

This provides a certain degree of control for the heating coil. As QGS glow plugs are designed to consume very large amounts of current it is very important that they are only used where the vehicle is designed with a specific QGS control system.

## 13. WHAT IS AQGS TECHNOLOGY?

AN EVOLUTION OF THE QGS TYPE, AQGS is an abbreviation of “Advanced Quick Glow System”. Their very high performance characteristics allow even faster heating times than either the SRM or QGS types.

These double coil glow plugs are designed to operate at battery voltage at the very short pre heating stage, approximately 6.5 volts during cranking and 5.0 volts in the post glow period. Due to the high inrush current and the specific stages of applied voltage they require very precise control by PWM (pulse width modulation) via the ECU. This strategy enables strict control of their long post glow performance as the ECU can take data from various sensors around the engine ensuring that the glow plug performance is at its optimum allowing further reduction of harmful emissions.

Except at very low ambient temperatures the glow plug is primarily used to control smoke and other emissions after the start up and just as importantly for the driver, good performance from cold.

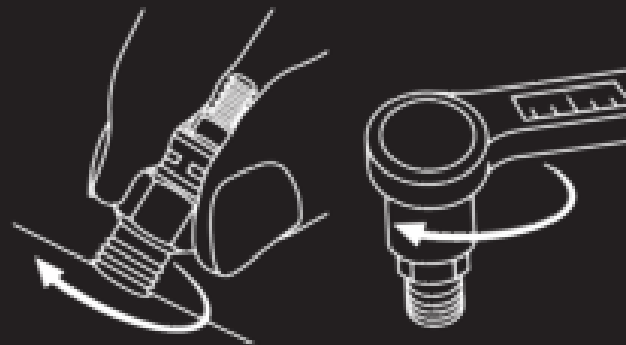
## 14. HOW DO I FIT A GLOW PLUG?

BEFORE FITTING a glow plug, you should always make sure that the thread is clean.

Once you have done this, screw in the glow plug by hand until the seating comes into contact with the cylinder head. It can then be tightened using the appropriate tightening torque (see below).

### PLEASE NOTE:

**Ceramic glow plugs are very robust against combustion conditions however, ceramic materials are by their very nature, brittle and must be handled accordingly. Careless handling during installation or removal could damage the ceramic probe rendering the plug unserviceable.**



### Tightening torques of glow plugs:

Thread diameter	Appropriate tightening torques
8 mm	8–15 Nm
10 mm	15–20 Nm
12 mm	20–25 Nm
14 mm	20–25 Nm
18 mm	20–30 Nm

### Tightening torques of terminal nuts:

Thread diameter	Appropriate tightening torques
4 mm (M4)	0,8–1,5 Nm
5 mm (M5)	3,0–4,0 Nm

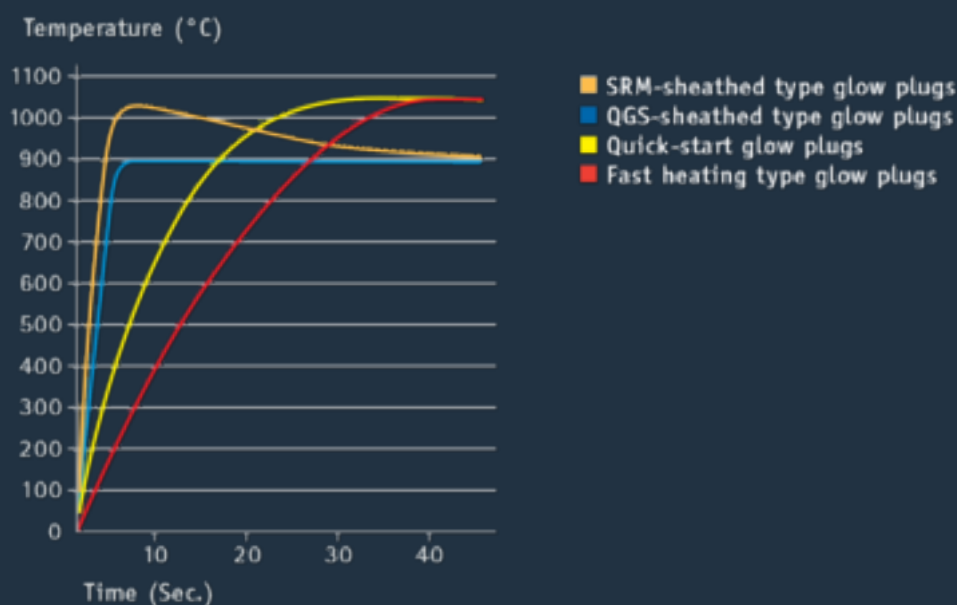


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## 15. WHY ARE GLOW PLUGS SO ENGINE SPECIFIC?

GLOW PLUGS ARE DESIGNED to reach their saturation temperature after a specific period of time at a given voltage application.

This temperature has to be maintained for a specific period of time to provide stable combustion conditions. Diesel engine operation and toxic emissions can only be improved if the glow plug matches or exceeds the engine manufacturer's specification.



## 16. WHEN ARE GLOW PLUGS REQUIRED?

GLOW PLUGS ARE REQUIRED when the temperature inside the combustion chamber is not high enough to ignite by the heat generated from compression of the intake air; e.g. under cold start conditions.

Some older engine designs even require a preheating period after a relatively brief period of rest. Modern diesel engines also often require the “post-glow” function of the glow plugs to help further reduce emissions.

## 17. WHAT CAN I EXPECT FROM A GLOW PLUG?

WHEN CHOOSING A GLOW PLUG, do not compromise on the following features:

- Safe start-up from low ambient temperatures
  - Low emissions during warm-up phase
  - Stable idling running before engine reaches operating temperature
  - High quality coating on shell for high resistance to corrosion
  - Unique shell design for excellent heat transfer, perfect gas tight sealing and high resistance to deformation and security of the heating coils.
- Many car manufacturers are not prepared to compromise on these features either - which is why they choose proven NGK technology.



## 18. WHAT TECHNOLOGICAL ADVANCES ARE ON THE HORIZON?

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## 19. HOW DO I TEST GLOW PLUGS?

TO ENSURE THAT A SHEATHEDTYPE GLOW PLUG is functioning correctly, you should measure the resistance between the terminal and the metal casing.

Some older engine designs even require a preheating period after a relatively brief period of rest. Modern diesel engines also often require the “post-glow” function of the glow plugs to help further reduce emissions.

For reliable results, you should make the following preparations:

- Ensure that your measuring instrument is capable of displaying even the most minimal testing voltages. The reason for this is that a QGS glow plug at ambient temperature only has a resistance of approximately 0.1  $\Omega$ .
- Before taking the measurements, remove any rust, dirt, oil or lacquer from the thread of the glow plug.
- Ideally, you should check ceramic glow plugs without removing from the engine. This reduces the risk of damage as a result of dismantling.

You evaluate the results of the measurement as follows:

- If a resistance of  $\infty$  is displayed, the heating coil is broken.
- If the resistance is below 5  $\Omega$  the heating coil is functioning properly.
- The resistance of ceramic glow plugs is usually below 1  $\Omega$ .

**Please take particular note of the following:  
It is not recommended to check a glow plug by applying battery voltage until it glows. The heating coil temperature can be raised to the point of damage before the tube appears to be well heated; this is especially true for QGS types.  
There is also a great risk of personal injury.**

red =  
terminal

black/white =  
metal shell



Glow plug of type Y



Glow plug of type CY, CZ



Glow plug of type CX



## 20. WHAT SIGNIFICANCE DOES THE USE OF MODERN GLOW PLUG TECHNOLOGY HAVE FOR THE ENVIRONMENT?

INNOVATIVE GLOW PLUGS are a key component in effective pollution control. NGK recognised this and invested in ceramic glow plugs as a future market at a time when most people still considered the new technology to be uneconomical.

Their success has proven that this was the right strategy: EU emissions standards are becoming increasingly more stringent and, in respect of exhaust emissions, require perfect interaction between all components of the engine. They are also beneficial for the development of diesel engines which operate at a lower compression ratio. What significance does the use of modern glow plug technology have for the environment?

These engines are reliant on high-performance glow plugs, such as the NGK ceramic glow plugs, to meet the stringent requirements from Brussels.

