



NGK Glow Plugs: 20 Questions & Answers



20 Questions & Answers

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1

Why are glow plugs fitted?

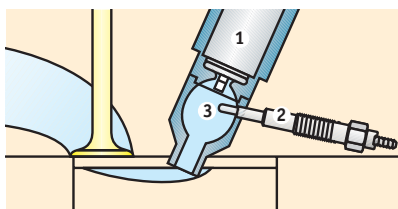
DIESEL ENGINES have spontaneous ignition, which means that the injected fuel does not require a spark to ignite it. The high temperature, which occurs as a result of compressing intake air, is sufficient to ignite the fuel.

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.

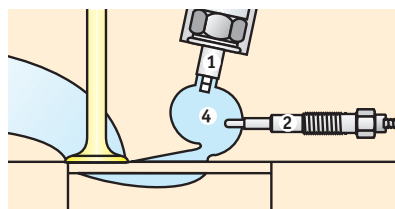
The 'glow pencil' (rod-like heating element) of the glow plug (which fits in the cylinder head) protrudes into the glow chamber or pre-combustion chamber. It is most effective when positioned on the edge of the mixing vortex. If it protrudes too far into the combustion chamber, it impedes the preparation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

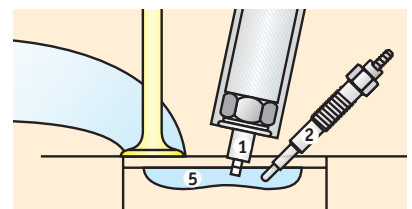
- 1 Fuel injector
- 2 Sheathed glow plug
- 3 Prechamber
- 4 Swirl chamber
- 5 Combustion chamber



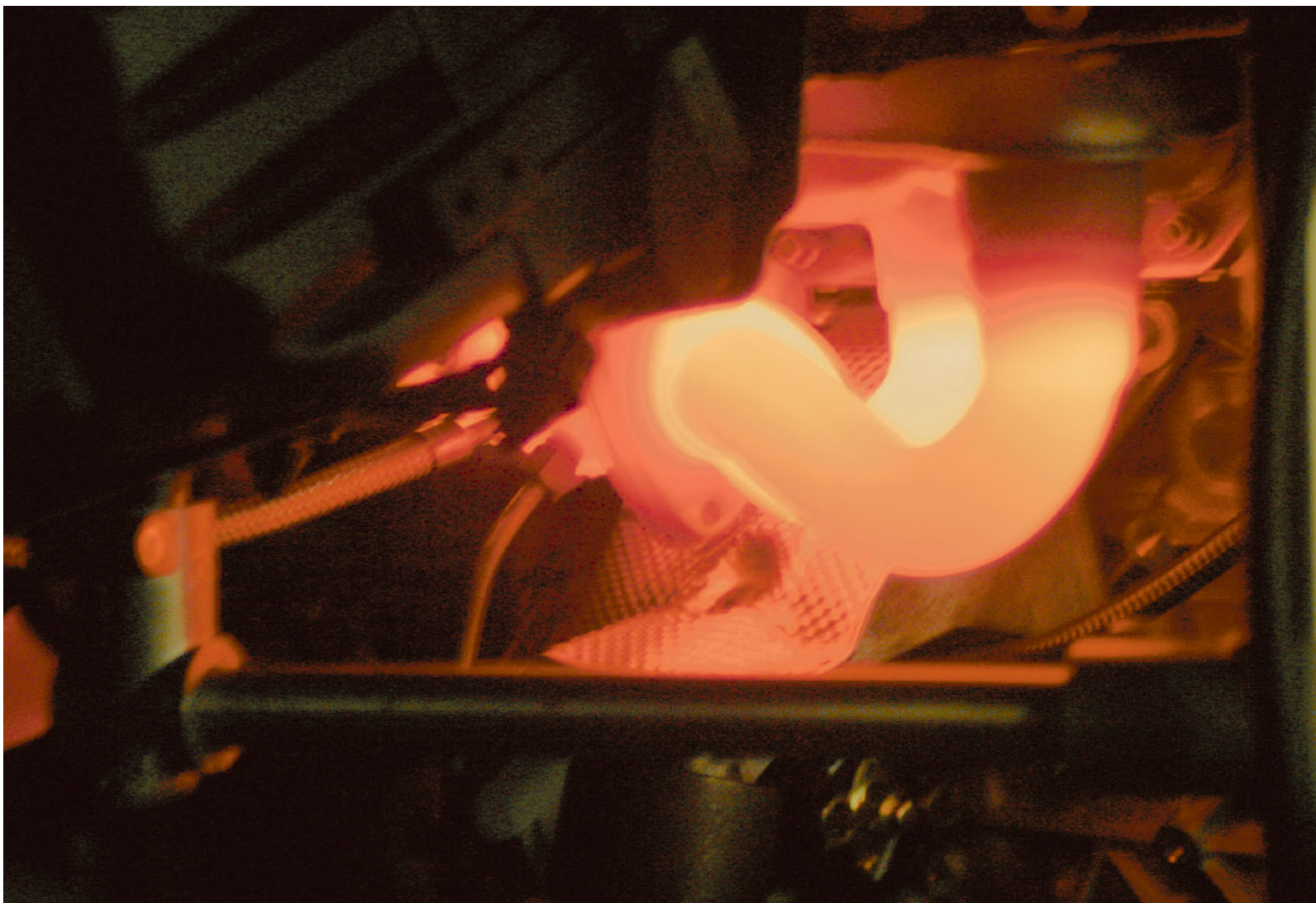
Indirect-injection engine



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

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				Preheating times
Sheathed type glow plug	with single coil	Standard	e.g. Y-103-2, Y-173	20-25 Sec. to 800°C
		QGS glow plug	e.g. Y-103 V, Y-106 V	15-17 Sec. to 800°C
		QGS glow plug	e.g. Y-128 T, Y-204 T S1	13-14 Sec. to 800°C
		QGS glow plug	e.g. Y-112 M 1	approx. 10 Sec. to 900°C
	with double coil	QGS glow plug	e.g. Y-107 R, Y-112 R 1	approx. 6 Sec. to 900°C
		self-regulating	e.g. Y-707 RS, Y-702 U	approx. 6 Sec. to 900°C
			e.g. Y-701 J, Y-515 J	approx. 4 Sec. to 900°C

4

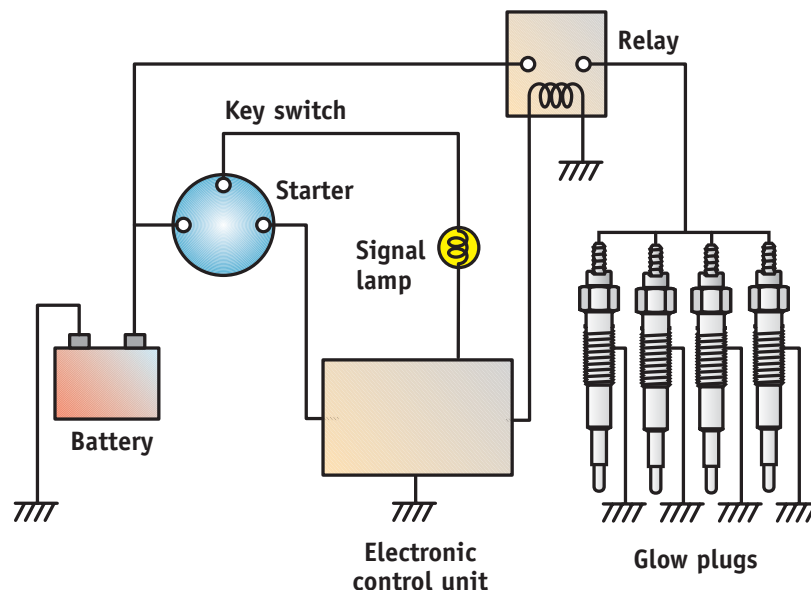
What is “post-glow”?

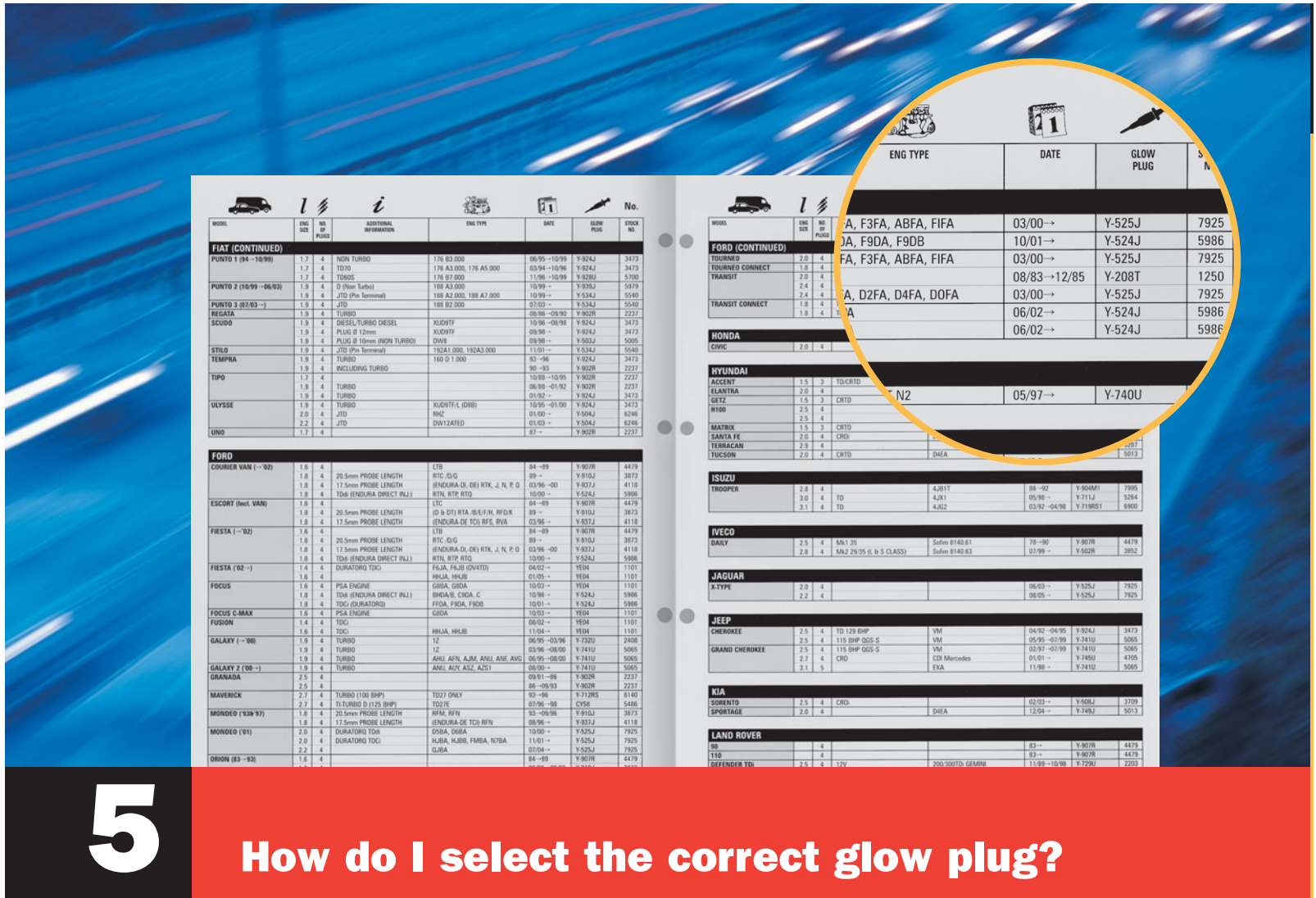
Post-glow takes place after ignition when the engine is running - possibly the first few hundred meters with SRM travelled by the car. It is required to prevent heat loss whilst the engine is warming up to its normal operating temperature.

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.

The post-glow switching principle





MODEL	ENG SIZE	NO OF PLUGS	ADDITIONAL INFORMATION	ENG TYPE	DATE	GLOW PLUG	STOCK NO.
FIAT (CONTINUED)							
PUNTO 1 (94-10/99)	1.7	4	NGK TURBO	1.76 B3 000	06/95-10/99	Y 924J	3473
	1.7	4	TD05	1.76 A3 000, 1.76 A5 000	03/94-10/96	Y 924J	3473
	1.7	4	TD05S	1.76 B7 000	11/96-10/99	Y 920B	5300
PUNTO 2 (10/99-06/03)	1.9	4	D (Non Turbo)	1.88 A3 000	10/99-	Y 929J	5979
	1.9	4	JTD (Pne Terminal)	1.88 A2 000, 1.88 A7 000	10/99-	Y 524J	5640
PUNTO 3 (07/03-)	1.9	4	JTD	1.88 B2 000	07/03-	Y 524J	5540
REGATA	1.9	4	TURBO		08/98-09/90	Y 902B	2237
SCUDO	1.9	4	DIESEL TURBO DIESEL	XUDTFF	10/96-06/98	Y 924J	3473
	1.9	4	PLUS 0 12mm	XUDTFF	09/98-	Y 924J	3473
	1.9	4	PLUS 0 10mm (NON TURBO)	DWB	09/98-	Y 503J	5005
STILO	1.9	4	JTD (Pne Terminal)	1.92A1 000, 1.92A3 000	11/01-	Y 524J	5640
TEMPRA	1.9	4	TURBO	1.90 D 1 900	93-96	Y 924J	3473
	1.9	4	INCLUDING TURBO		90-93	Y 902B	2237
TIPO	1.7	4	TURBO		10/98-10/99	Y 902B	2237
	1.9	4	TURBO		06/98-01/92	Y 902B	2237
	1.9	4	TURBO		01/92-	Y 924J	3473
ULYSSE	1.9	4	TURBO	XUDTFF (DBI)	10/95-01/00	Y 924J	3473
	2.0	4	JTD	RMC	01/00-	Y 504J	6266
	2.2	4	JTD	DW12ATED	01/00-	Y 504J	6266
UNO	1.7	4			87-	Y 902B	2237
FORD							
COURIER VAN (-92)	1.8	4	L16		84-89	Y 907B	4479
	1.8	4	20.5mm PROBE LENGTH	RTC, G/G	89-	Y 910J	3873
	1.8	4	17.5mm PROBE LENGTH	(ENDURA DI, DE) RTK, J, N, P, D	03/96-00	Y 937J	4118
	1.8	4	TDS (ENDURA DIRECT INJ)	RTN, RTP, RTQ	10/90-	Y 524J	5986
ESCORT (incl. VAN)	1.6	4	L16		84-89	Y 907B	4479
	1.8	4	20.5mm PROBE LENGTH	(D & DT) RTA, B, U, F, H, W, D, X	89-	Y 910J	3873
	1.8	4	17.5mm PROBE LENGTH	(ENDURA DE TCI) RFS, RVA	03/96-	Y 937J	4118
Fiesta (-92)	1.6	4	L16		84-89	Y 907B	4479
	1.8	4	20.5mm PROBE LENGTH	RTC, G/G	89-	Y 910J	3873
	1.8	4	17.5mm PROBE LENGTH	(ENDURA DI, DE) RTK, J, N, P, D	03/96-00	Y 937J	4118
	1.8	4	TDS (ENDURA DIRECT INJ)	RTN, RTP, RTQ	10/90-	Y 524J	5986
Fiesta (92-)	1.4	4	DURATORIO TDC	FLJA, FLJB (V4T)	04/02-	Y504	1101
	1.6	4		HLJA, HLJB	01/00-	Y504	1101
FOCUS	1.6	4	PSA ENGINE	GDA, GDA	10/00-	Y504	1101
	1.8	4	TDS (ENDURA DIRECT INJ)	BHGA, BHGC, C	10/98-	Y 524J	5986
	1.8	4	TDC (DURATORIO)	FFDA, FDDA, FDDB	10/01-	Y 524J	5986
FOCUS CMAX	1.6	4	PSA ENGINE	GDA	10/00-	Y504	1101
FUSION	1.4	4	TDC		08/00-	Y504	1101
	1.6	4	TDC	HLJA, HLJB	11/04-	Y504	1101
GALAXY (-90)	1.9	4	TURBO	LZ	06/90-03/96	Y 720J	2400
	1.9	4	TURBO	LZ	03/96-08/00	Y 741U	5065
	1.9	4	TURBO	AHJ, AFH, AJM, ANJ, ANE, AVG	06/95-08/00	Y 741U	5065
GALAXY 2 (90-)	1.9	4	TURBO	ANJ, AHJ, ASZ, AZS1	08/00-	Y 741U	5065
	2.5	4			09/91-96	Y 902B	2237
GRANADA	2.5	4			86-09/93	Y 902B	2237
MAVERICK	2.7	4	TURBO (100 BHP)	TDZ7 ONLY	93-96	Y 712BS	6140
	2.7	4	Ti TURBO D (125 BHP)	TDZ7	07/96-98	CY58	5486
MONDEO (1987)	1.8	4	20.5mm PROBE LENGTH	RTA, RTN	93-09/98	Y 910J	3873
	1.8	4	17.5mm PROBE LENGTH	(ENDURA DE TCI) RFN	06/96-	Y 937J	4118
MONDEO (91)	2.0	4	DURATORIO TDS	DGSA, DGSA	10/90-	Y 525J	7925
	2.0	4	DURATORIO TDC	HJSA, HJRB, FJBA, N7BA	11/00-	Y 525J	7925
	2.2	4		GJBA	07/04-	Y 525J	7925
ORION (83-93)	1.6	4			84-89	Y 907B	4479

MODEL	ENG SIZE	NO OF PLUGS	ADDITIONAL INFORMATION	ENG TYPE	DATE	GLOW PLUG	STOCK NO.
FORD (CONTINUED)							
TOURNEO	2.0	4		A, F3FA, ABFA, F4FA	03/00-	Y-525J	7925
TOURNEO CONNECT	1.9	4		JA, F9DA, F9DB	10/01-	Y-524J	5986
TRANSIT	2.0	4		FA, F3FA, ABFA, F4FA	03/00-	Y-525J	7925
TRANSIT CONNECT	2.0	4			08/83-12/85	Y-208T	1250
TRANSIT CONNECT	1.8	4		A, D2FA, D4FA, DOFA	03/00-	Y-525J	7925
	1.8	4			06/02-	Y-524J	5986
	1.8	4			06/02-	Y-524J	5986
HONDA							
CRV	2.0	4					
HYUNDAI							
ACCENT	1.5	3	TD CRTD				
ELANTRA	2.0	4					
GETZ	1.5	3	CRTD	N2	05/97-	Y-740U	
W100	2.5	4					
	2.5	4					
MATRIX	1.5	3	CRTD				
SANTA FE	2.0	4	CRD				
TERRACAN	2.9	4					
TUCSON	2.0	4	CRTD	DELA			5013
ISUZU							
PROPER	2.8	4		4JH1	88-92	Y 904M1	7995
	3.0	4	TD	4JX1	05/98-	Y 711J	5264
	3.1	4	TD	4JZ2	03/92-04/98	Y 719M1	8900
IVECO							
DAILY	2.5	4	MA1 25	Sofim 8140.61	78-90	Y 907B	4479
	2.8	4	MA2 29.25 (L & S CLASS)	Sofim 8140.63	07/99-	Y 562B	3852
JAGUAR							
X-TYPE	2.0	4			06/03-	Y 525J	7925
	2.2	4			06/05-	Y 525J	7925
JEEP							
CHEROKEE	2.5	4	TD 129 BHP	VM	04/92-04/95	Y 924J	3473
	2.5	4	115 BHP QIG-S	VM	05/95-07/99	Y 741U	5065
GRAND CHEROKEE	2.5	4	115 BHP QIG-S	VM	02/97-07/99	Y 741U	5065
	2.7	4	CRD	CDi Mercedes	01/01-	Y 745U	4705
	3.1	5		EVA	11/98-	Y 741U	5065
KIA							
SORENTO	2.5	4	CRD		01/03-	Y 505J	3709
SPORTAGE	2.0	4		DELA	12/04-	Y 740J	5013
LAND ROVER							
90		4			83-	Y 907B	4479
110		4			83-	Y 907B	4479
DEFENDER TD	2.5	4	TD	200 200TD GEMINI	11/89-10/98	Y 720J	2400

5

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 and select Part Finder.



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)

Special tube materials

Revisions number

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

J: SRM
K or no letter: Standard
B: Change
U: QGS
AS: AQGS



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 lug

Y: SRC
Z: QGS
X: QGS with double isolators

The last two figures build the serial number

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

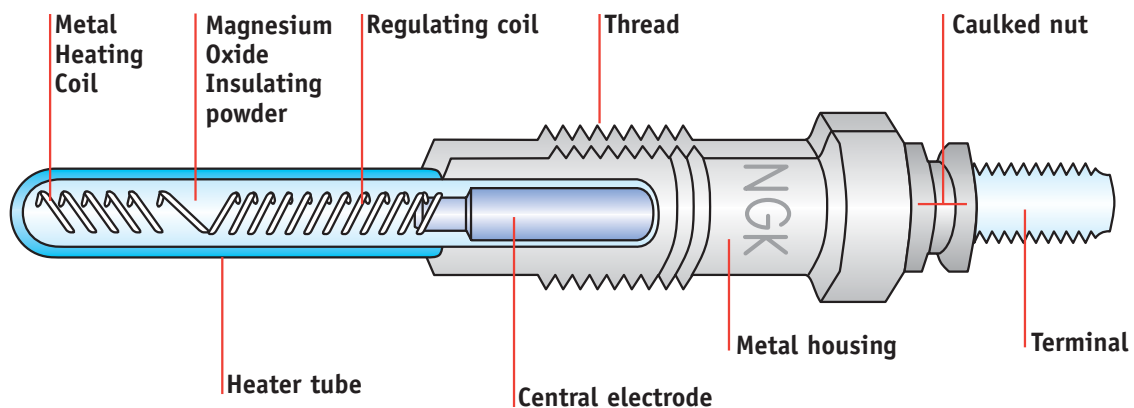
There are two types of ceramic glow plug available:

- QGS glow plugs
- Self-regulating glow plugs

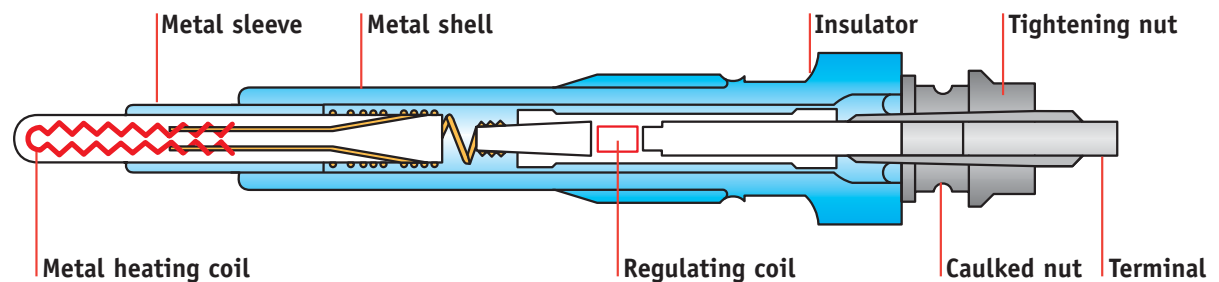
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How is a glow plug constructed?

Structure of a self-regulating metal glow plug



Structure of a self-regulating ceramic glow plug



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

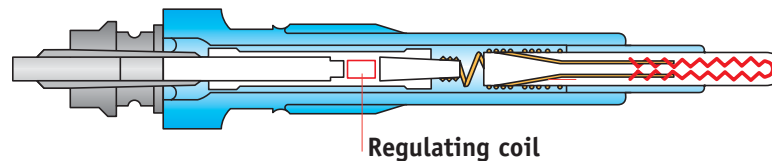
What are the benefits of ceramic glow plugs?

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.

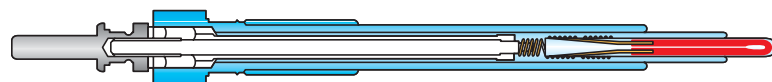
Due to the robust nature of the heating coil and the ceramic materials, post-glow times of up to ten minutes can be employed.

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.

First generation SRC (Self Regulating Ceramic glow plug)



Second generation HTC (High Temperature Ceramic glow plug)



Third generation NHTC (New-High Temperature Ceramic glow plug)



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.

The heating coil heats up very quickly and as the temperature of the control coil rises so the resistance increases, thus regulating the current flow.

The self regulation provided by the control coil allows SRM glow plugs to be run with almost no external control or monitoring, thus providing excellent preheating and post-glow properties.

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 AQS technology?

An evolution of the QGS type, AQS 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 in rush 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:

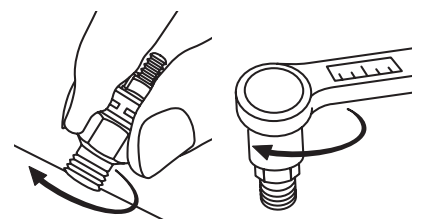
Ceramic glow plugs are very robust against combustion conditions however, ceramic materials are by their very nature, brittle and must be handled accordingly. Careless handling during installation or removal could damage the ceramic probe rendering the plug unserviceable.

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



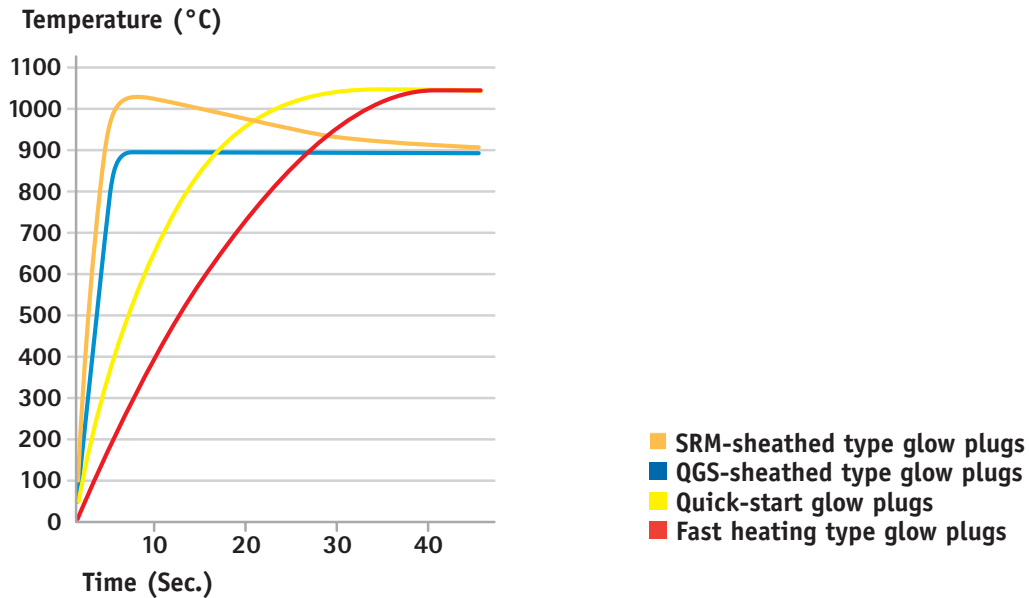
15

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.



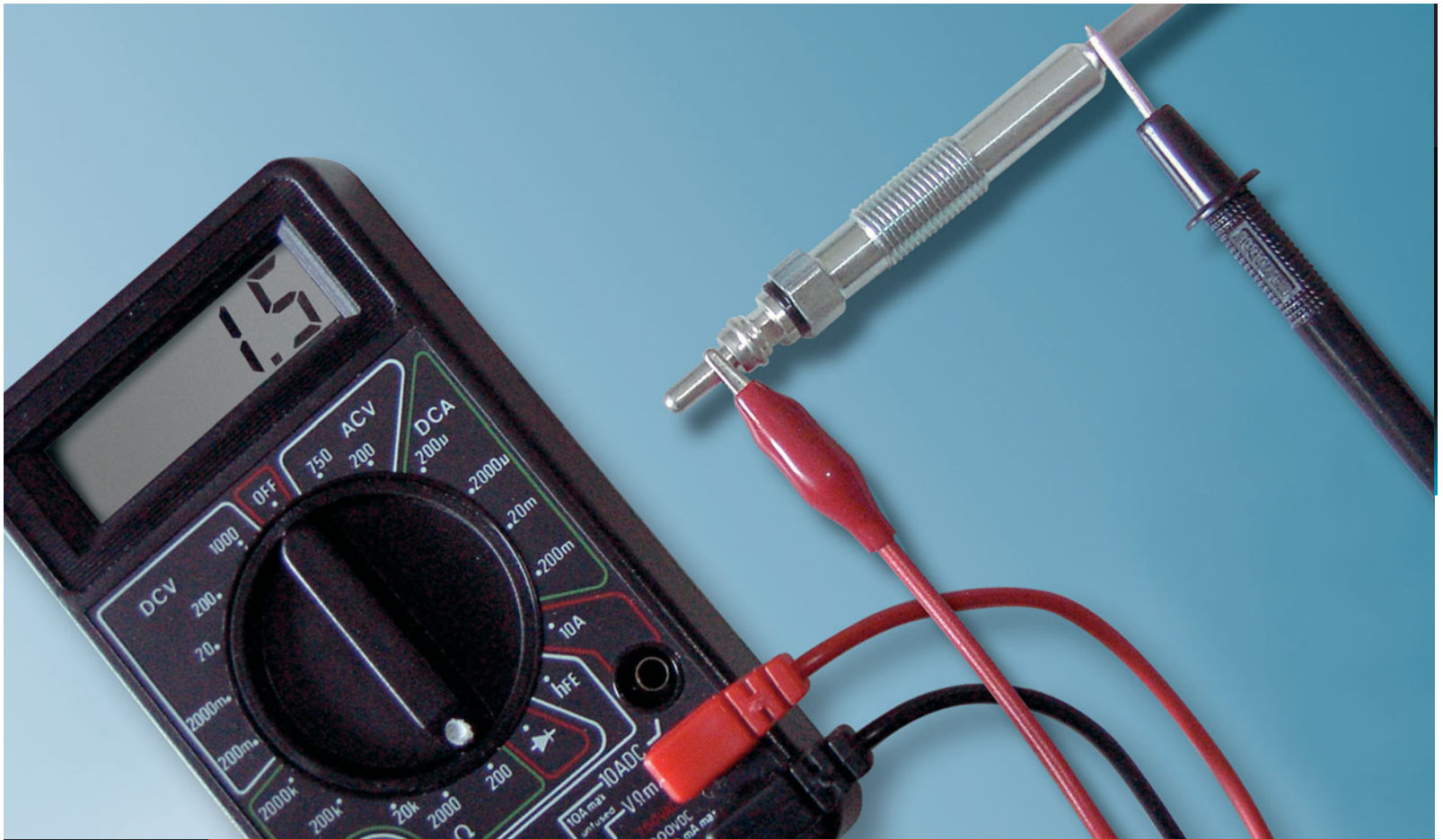
17

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

How do I test glow plugs?

To ensure that a sheathed-type glow plug is functioning correctly, you should measure the resistance between the terminal and the metal casing.

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 Ω.

- 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:

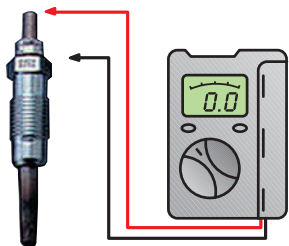
- If a resistance of ∞ is displayed, the heating coil is broken.
- If the resistance is below 5 Ω, the heating coil is functioning properly.
- The resistance of ceramic glow plugs is usually below 1 Ω.

Please take particular note of the following:

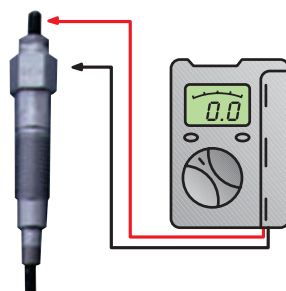
It is not recommended to check a glow plug by applying battery voltage until it glows. The heating coil temperature can be raised to the point of damage before the tube appears to be well heated; this is especially true for QGS types. There is also a great risk of personal injury.

red = terminal

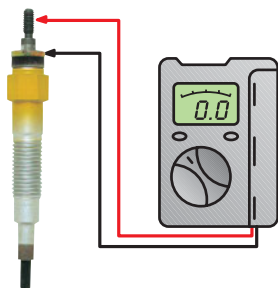
black/white = metal shell



Glow plug of type Y



Glow plug of type CY, CZ



Glow plug of type CX

19

What technological advances are on the horizon?



NGK leads the way in the development of new technologies for this dynamic market. Anticipating trends and developing solutions at an early stage has always been an NGK forte.

Taking emissions as an example, the impending EU emissions standards Euro 4 and Euro 5 will soon make it necessary to lower the comparatively high compression ratio of diesel engines.

In order to guarantee reliable ignition for such engines, NGK has developed NHTC generation ceramic glow plugs.

The secret of these glow plugs is their longer heating element and narrow diameter which enable them to increase temperature by up to 1,000°C in less than two seconds.

They also have a longer post-glow duration and, for the first time ever, offer an intermittent-glow function to reduce emissions.

NHTC glow plugs: ground-breaking technology from NGK.

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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.

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





For up-to-date information
about glow plugs go to:
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