General

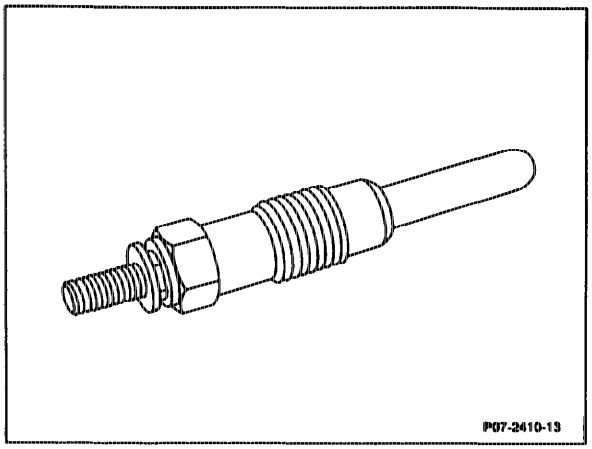
On a diesel engine, combustion occurs when the fuel is injected into the highly compressed and thus greatly heated combustion air and self-ignites.

When the engine is cold, the self-ignition temperature is not reached by compression alone. It is therefore necessary to provide a preglow system to raise the temperature of the compressed air, enabling the cold engine to start by igniting fuel particles on the glow plugs.

The duration of preglow depends on the ambient temperature.

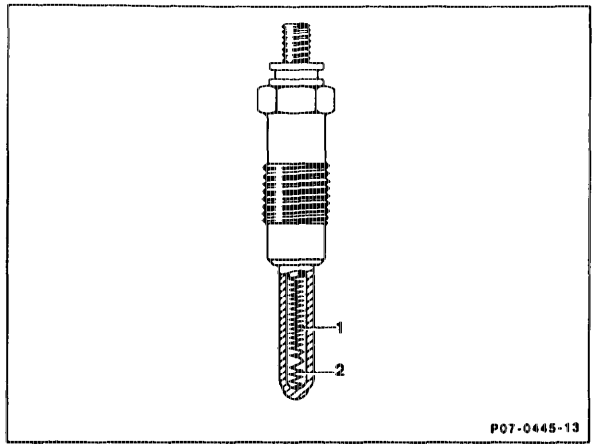
Design of the Quick-start Pencil-type Glow Plugs

The pencil-type glow plugs consist essentially of a housing with a M12 × 1.25 external thread and a heating element press-fitted into the housing.



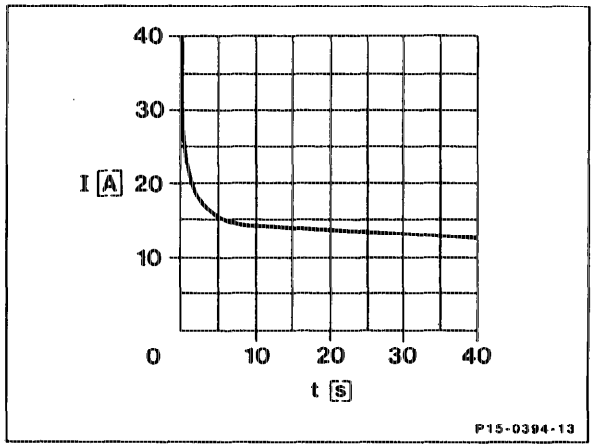
The single-pin connecting pin is screwed into the housing by a non-detachable brass round nut. The pencil-type glow plugs are designed for a voltage of 11.5 Volts and are connected in parallel.

The heating element consists of a series-connected heating and control winding.



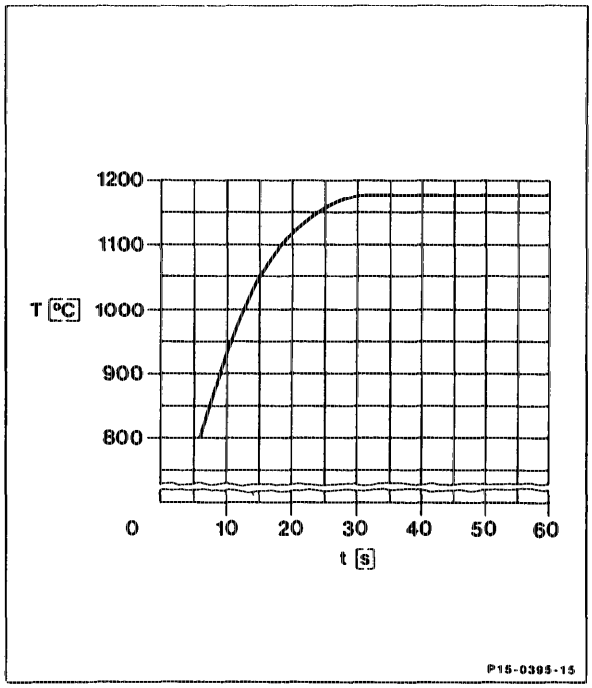
1 Control winding
2 Heating winding

When the glow system is switched on, a current of approx. 30 amperes flows to each glow plug. The heating winding heats the glow plug very rapidly. The control winding increases its resistance as the temperature rises and limits the current to approximately 8–15 amperes. The glow plug is thus protected against overload.

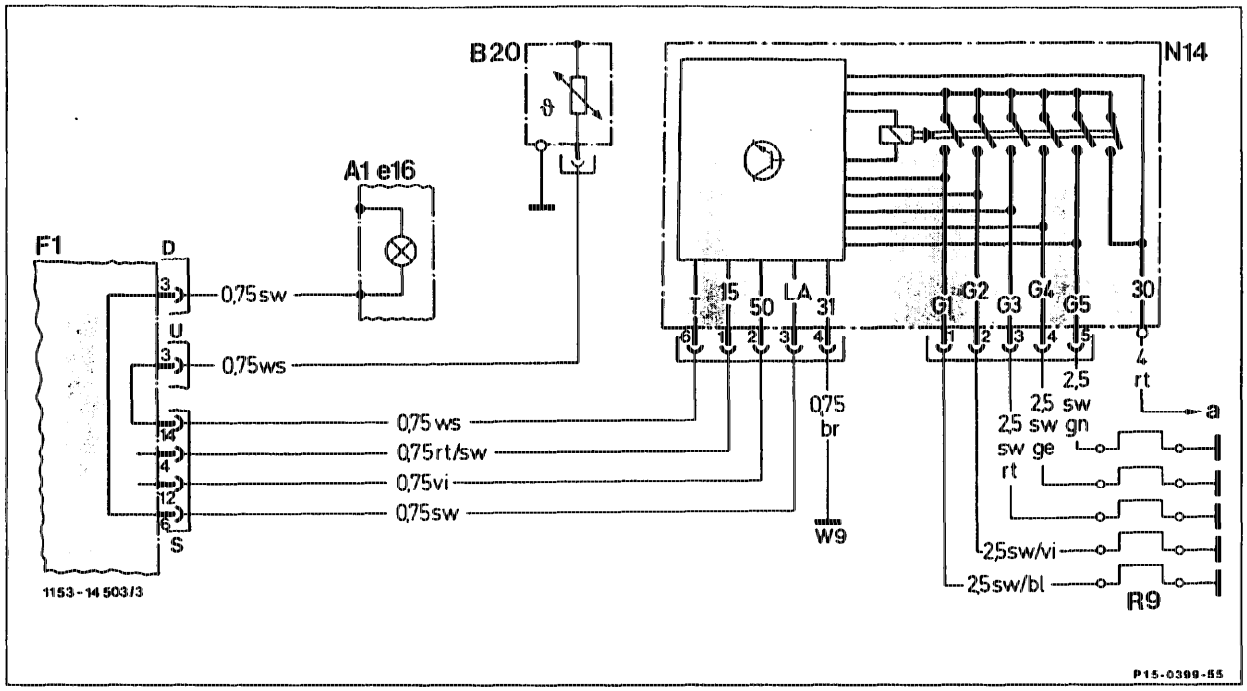


Current curve of quick-start pencil-type glow plug

After a glow period of 9 seconds, a heating element temperature of 900 °C is reached, the maximum temperature of 1180 °C being reached after 30 seconds.

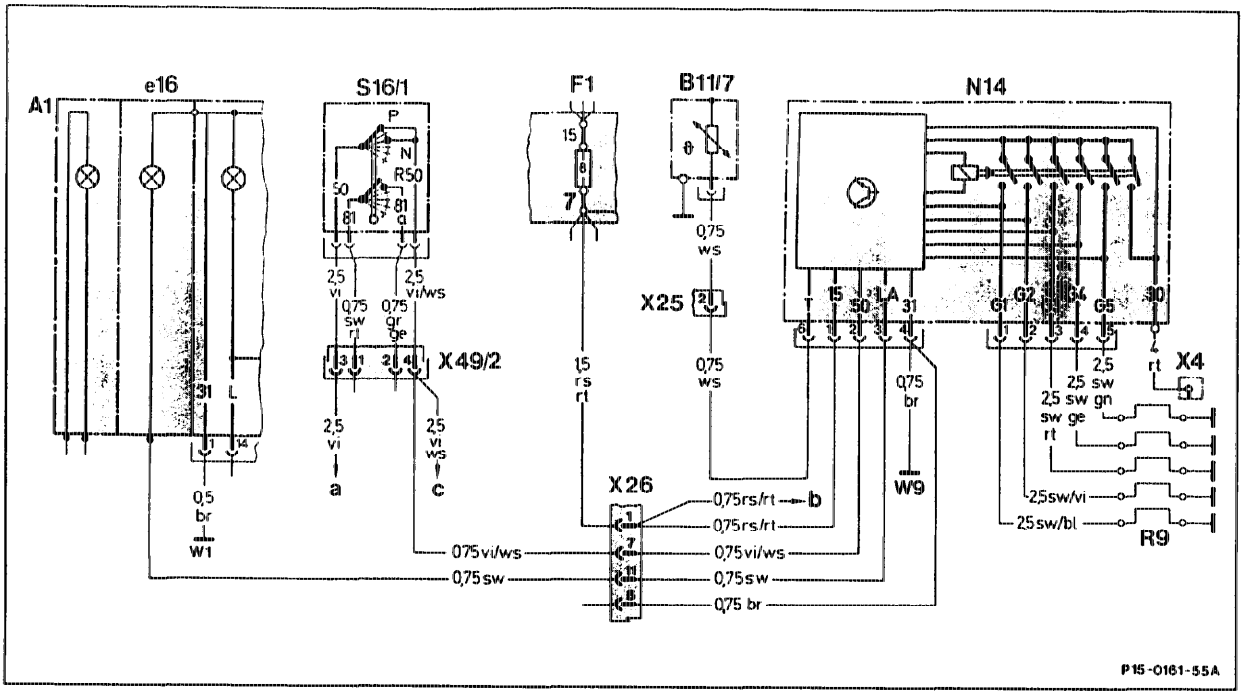


Temperature curve of quick-start pencil-type glow plug



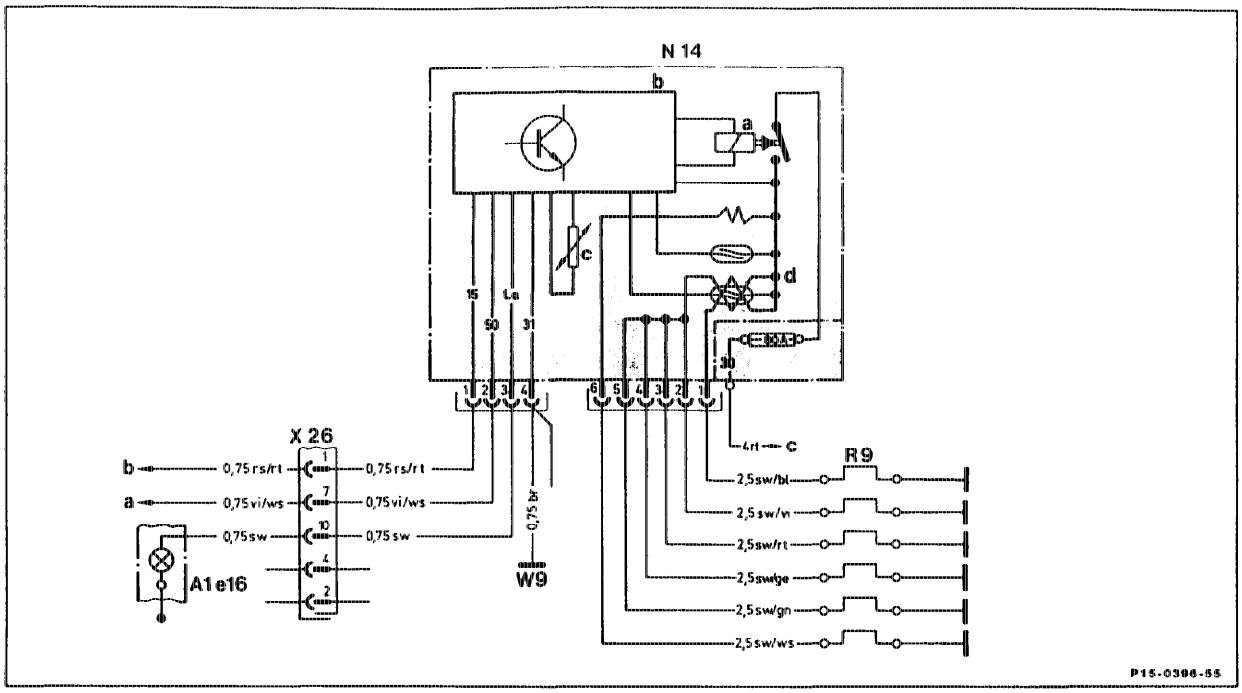
Wiring Diagram Engine 602.961, Model 201.128

A1e16	Instrument cluster, preglow indicator	R9	Glow plugs
B20	Temperature sensor (preglow)	W9	Ground, front left (next to lamp unit)
F1	Electrical centre	a	X35 terminal block, terminal 30
N14	Preglow time relay		



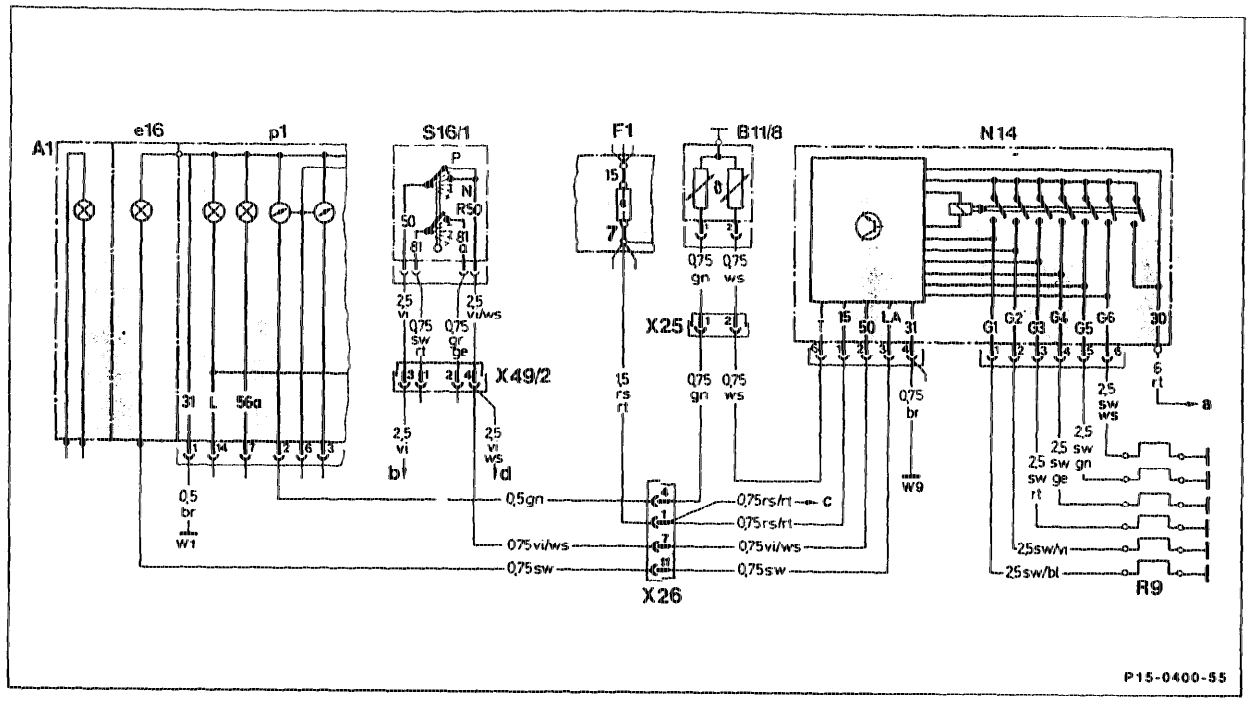
Wiring Diagram Engine 602.962, Model 124.128

A1e16	Instrument cluster, preglow indicator	X4	Terminal block, terminal 30 (fuse and relay box)
B11/7	Temperature sensor (preglow)	X25	Plug connector, preglow wiring harness
F1	Fuse and relay box	X26	Plug connector, interior/engine 12-pin
N14	Preglow time relay	X49/2	Plug connector, starter lockout and reversing light switch
R9	Glow plugs		
S16/1	Starter lockout and reversing light switch (with automatic transmission only)	a	S2/2 glow start switch terminal 50
		b	K1 Relay, overvoltage protection contact 3 (with air-conditioning system only)
W1	Main ground (behind instrument cluster)		
W9	Ground, front left (next to lamp unit)	c	X27 plug connector, starter wiring harness contact 2



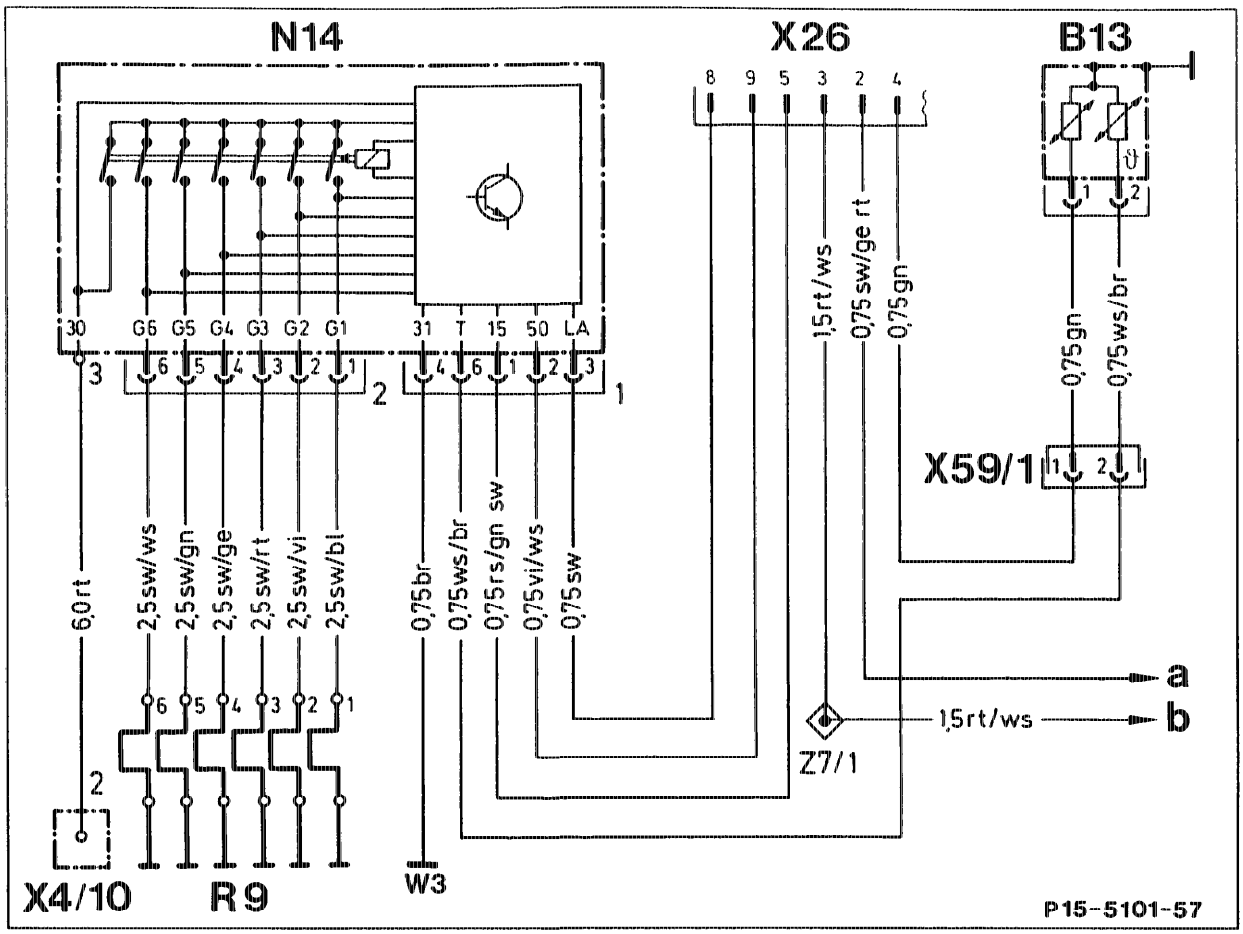
Wiring Diagram Engine 603.96 except (J) 1988, Models 124, 126

A1e16	Preglow indicator in instrument cluster	X26	Plug connector, interior/engine 12-pin
N14	Preglow time relay	W9	Ground, front left (next to lamp unit)
	a Power relay	a	X49/1 plug connector, backup light switch
	b Electronic unit	b	Fuse 7, terminal 15 (unprotected)
	c Temperature sensor (NTC resistor)	c	X4 Terminal block, terminal 30 (fuse and relay box)
	d Reed relay		
R9	Glow plugs		



Electric Wiring Diagram Engine 603.96 (J) 1988, 603.96 from Model year 1989, Model 124

A1	Instrument cluster
A1e16	Preglow indicator
A1p1	Coolant temperature gauge
B11/8	Coolant temperature sensor
F1	Fuse and relay box
N14	Preglow relay
R9	Glow plugs
S16/1	Starter lockout and reversing light switch
W1	Main ground (behind instrument cluster)
W9	Ground, front left (next to light unit)
X25	Plug connector, preglow cable harness
X26	Plug connector, interior/engine
X49/2	Plug connector, starter lockout and reversing light switch
a	Cable connector X4 (terminal 30)
b	Glow plug switch S2/2 (terminal 50)
c	Over-voltage protection relay (jack 3)
d	X27 Plug connector, starter cable harness jack 2



Wiring Diagram Engine 603.971 (USA) Model Year 1992, Model 140

B13	Coolant gauge temperature sensor	a	Relay, key-operated engine stop, pin 4
N14	Preglow time relay	b	Relay, key-operated engine stop, pin 3
R9	Glow plugs		
W3	Ground, front left wheelhouse		
X4/10	Terminal block, terminal 30		
X26	Plug connection, interior/engine		
X59/1	Plug connection, engine fan/coolant temperature sensor		
Z7/1	Connector sleeve, terminal 30		

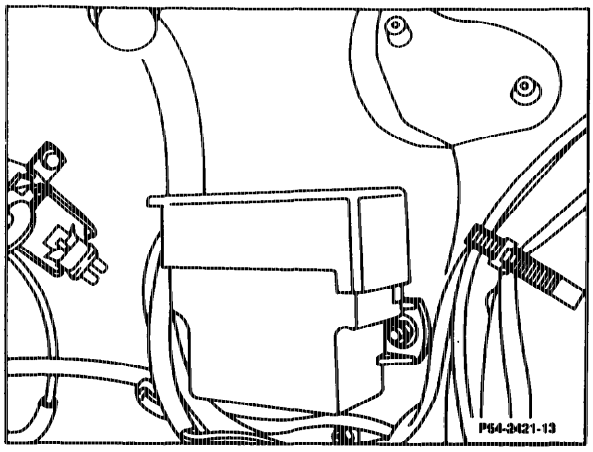
Table of assignment of preglow time relay – engine – model

Engine	Model	Control unit Part no.	Version of injection system/preglow system	Remarks
602.96	124	007 545 99 32	Oblique injection, precombustion chamber 5°/180°, 60 s afterglow up to max. 25 °C coolant temperature	as of 02/89 (USA) 1990
	201	008 545 01 32		
	124	001 545 98 32 002 545 06 32	Vertical injection without afterglow	up to 01/89
	201	003 545 10 32 003 545 60 32		
	201	006 545 22 32		Standard and (USA)
			Oblique injection, precombustion chamber 5°, 15 s afterglow up to max. 60 °C coolant temperature	
603.96	124	007 545 16 32	Oblique injection, precombustion chamber 5°/180°, 60 s afterglow up to max. 25 °C coolant temperature	as of 02/89
		005 545 45 32		up to 01/89
		006 545 91 32	Vertical injection without afterglow	(J) 1988 (CH) 1988
			Oblique injection, precombustion chamber 5°, 15 s afterglow up to max. 60 °C coolant temperature	
	124 126	005 545 45 32	Vertical injection without afterglow	(USA) 1986/87
	126	007 545 16 32		(USA) 1990
			Oblique injection, precombustion chamber 5°/180°, 15 s afterglow up to max. 60 °C coolant temperature	

Location of preglow time relay

The preglow time relay is housed in the engine compartment on the left wheelhouse.
The electrical connections are accessible after removing the protective cap.
On Model 140 the preglow time relay must be taken out in order to be able to remove the protective cap.

Shown on Model 201



Functions of Preglow Time Relay

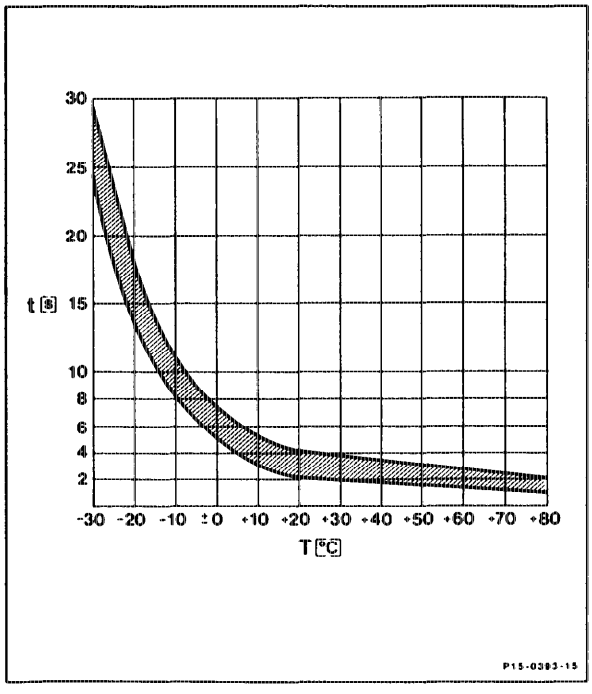
The preglow time relay has the following functions:

- Switching on the glow current
- Indicating readiness to start
- Safety cutout
- Fault indication

Preglow without Afterglow Model 124 Engine 603.96 Except (J) 1988

T Ambient temperature of preglow time relay in °C

t Preglow time in seconds

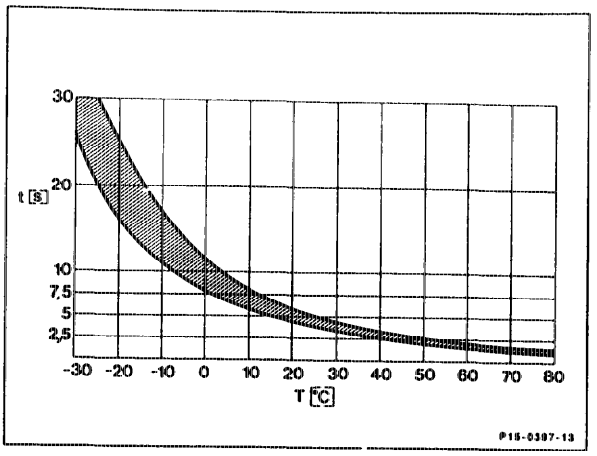


Preglow with Afterglow

Preglow Time

T Coolant temperature in °C

t Preglow time in seconds



Afterglow Time

To improve warming-up properties, the glow plugs continue to glow when the engine is running dependent on the coolant temperature.

a) Version:

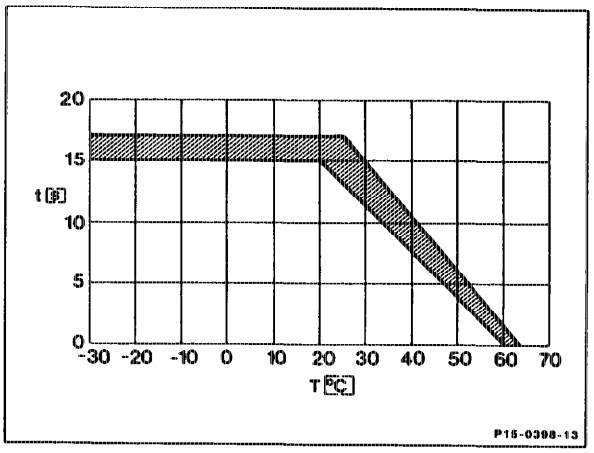
Model 124 Engine 603.96 (J) 1988,

Model 201 Engine 602.961 Model Year 1988

T Coolant temperature in °C

t Afterglow time in seconds

Afterglow time up to max. 17.5 s (refer to diagram)



b) Version:

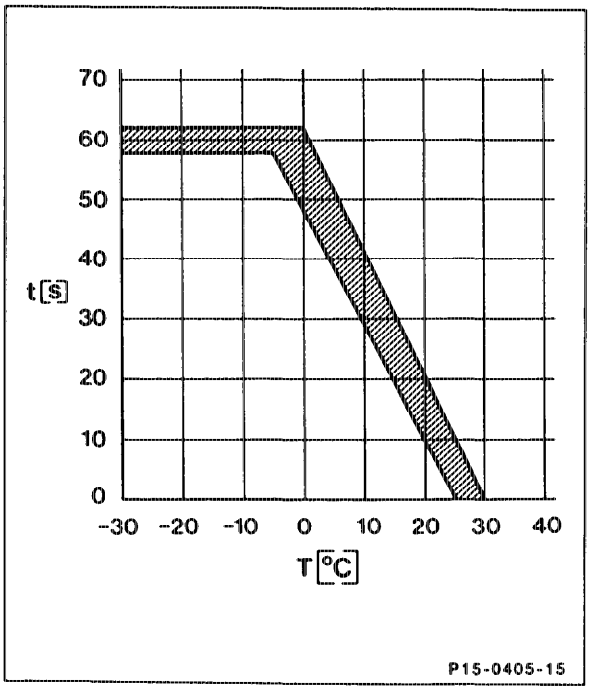
Models 124, 201 Engines 602.961/962,

Model 124 Engine 603.96 from Model Year 1989

T Coolant temperature in °C

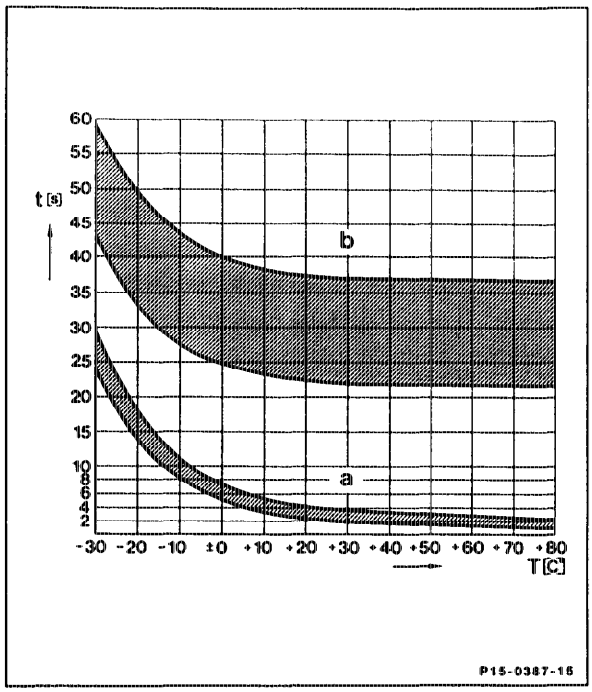
t Afterglow time in seconds

Afterglow time up to max. 60 s (refer to diagram)



Safety Cutout

If the engine is not started within 20–25 seconds after the readiness to start indication being given, the glow current is interrupted by the safety cutout. If the engine is then started, the glow system is switched on again for the duration of the starting operation.
The duration of safety cutout is not fixed. It results from the time up to readiness to start (preglow indicator lamp going out) plus 20–35 seconds.



b Safety cutout

Actuating the Glow Current

When the key is moved into position "2" (preglow, drive), the preglow time relay is switched on (voltage to terminal 15). The preglow time relay closes the circuit from terminal 30 (positive) to the glow plugs (R9).

If the key is turned into position "3" (start), the preglow time relay remains activated and remains picked up through terminal 50. The glow process is continued until the key is turned back to position "2".

Readiness to Start Indication

a) Model 124 Engine 603.96 except (J) 1988

When the glow system is switched on, the preglow indicator lamp in the instrument cluster lights up. The glow duration is determined by a temperature sensor installed in the preglow time relay. Once the required glow time has been reached, depending on the ambient temperature of the preglow time relay, the preglow indicator lamp goes out, thus indicating that the engine is ready for starting.

b) Models 124, 126 Engine 603.96 (J) 1988, Model 201 Engine 602.961, Model 124 Engine 602.962, Engine 603.96 Effective 1989

When the glow system is switched on, the preglow indicator lamp in the instrument cluster lights up. The glow duration is determined by the temperature sensor in the coolant. Once the required glow time has been reached, the preglow time relay switches off the preglow indicator lamp, indicating that the engine is ready for starting.

Fault Indication

Model 124 Engine 603.96 Except (J) 1988

A fault in the preglow system is indicated by the preglow indicator lamp failing to light up when the key is moved into position "2".

The following faults are detected:

- Interrupt in the cable to connection terminal 30.
- 80 ampere fuse faulty.
- Fault in power relay of preglow time relay.
- Interrupt in one or several cables to the glow plugs.
- Interrupt in one or several glow plugs.

Fault Indication

Models 124, 201 Engine 602.961, 602.962, 603.96 (J) 1988 603.96 as of 1989

A fault in the preglow system is indicated by the preglow indicator lamp failing to light up when the key is turned into position "2". In addition, the preglow indicator lights up for approx. 1 minute when the engine is running.

The following faults are detected:

- Interrupt in the cable to connection terminal 30.
- Preglow time relay faulty.
- Interrupt in one or several cables to the glow plugs.
- Interrupt in one or several glow plugs.
- Short-circuit at one or several glow plugs or in the cables.