

WARNING: From Model Year '97, the "TD" version - previously also for certain Markets - by the version with catalyst known as TD-CAT.
N.B. For the TD-CAT version, refer to the next section 37A.

TD ENGINE CONTROL DEVICES

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FOREWORD

The TD engine (1930 cc.) meets ECE08 regulations on the emission of harmful pollutants due to a series of interventions to reduce the production of these pollutants at the origin:

- the injection pump has a special setting which ensure low levels of smoke;
- the turbocharger operates more smoothly and gradually;
- other devices (mechanical, pneumatic, electric) control the correct operation of the engine itself.

This section brings together these devices and the systems which are controlled and/or actuated **electrically** and adjust the operation of the 1930 TD engine.

These are:

- **GLOW PLUG WARMING;**
- **ENGINE STOP;**
- **COLD ADVANCE (KSB);**
- **FUEL PREHEATING.**

A wiring diagram describes the first 3; a second diagram refers to the fourth (fuel pre-heating).

With regard to the complete description of the various systems, refer to GROUP 10: "ENGINE - SUPPLY"

INERTIAL SWITCH

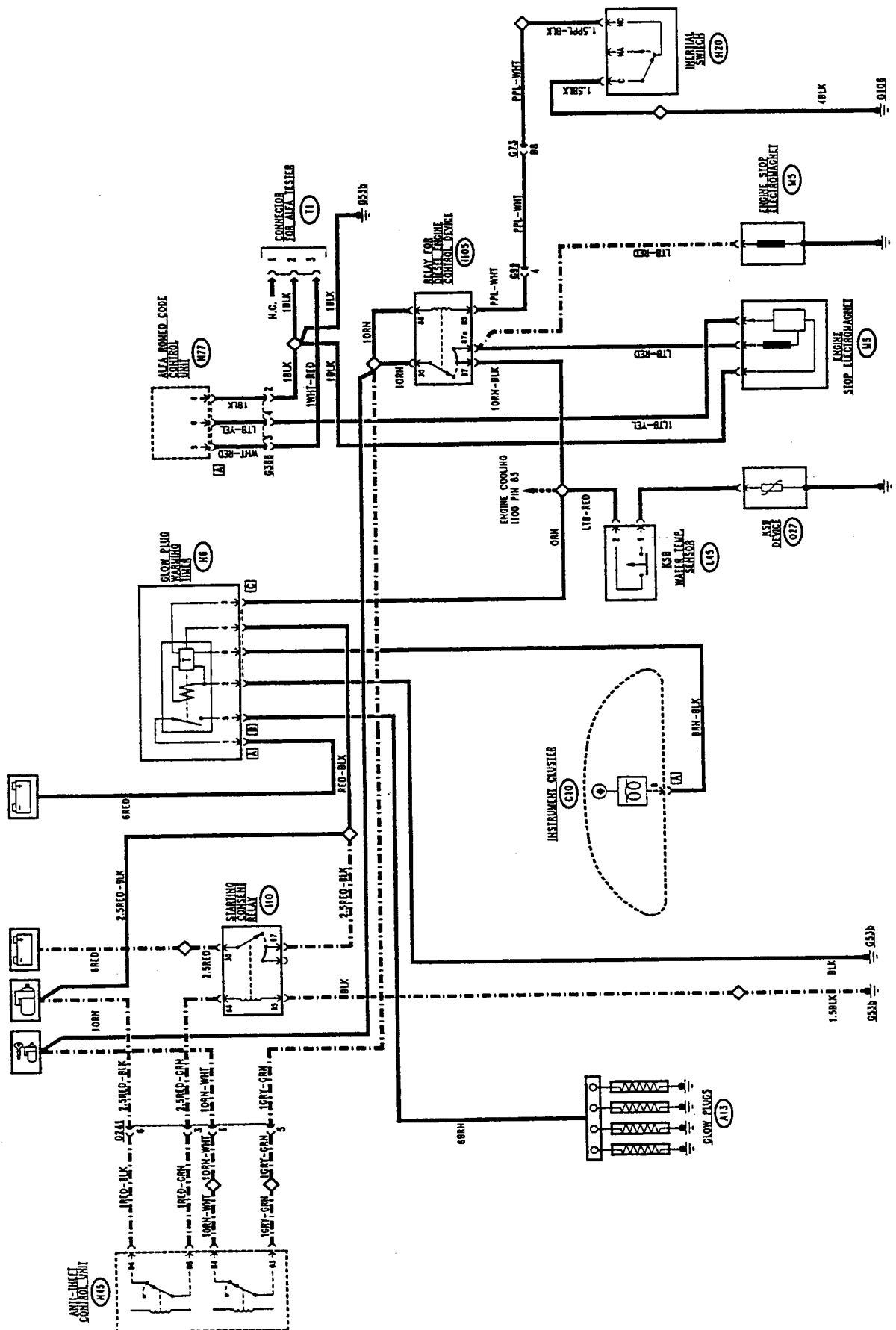
Also the TD version has the protection system with **inertial switch**: this is an electromechanical switch that, in the event of heavy impact, opens to cut off the circuit that supplies the engine stop electromagnet: this way the engine is stopped immediately, thereby preventing any danger.

The supply is also stopped to other circuits (cold advance, glow plugs, engine solenoid valve) which are otherwise always supplied.

This makes it possible to dramatically reduce the hazard of fire, which, though restricted, is also present in Diesel engines.

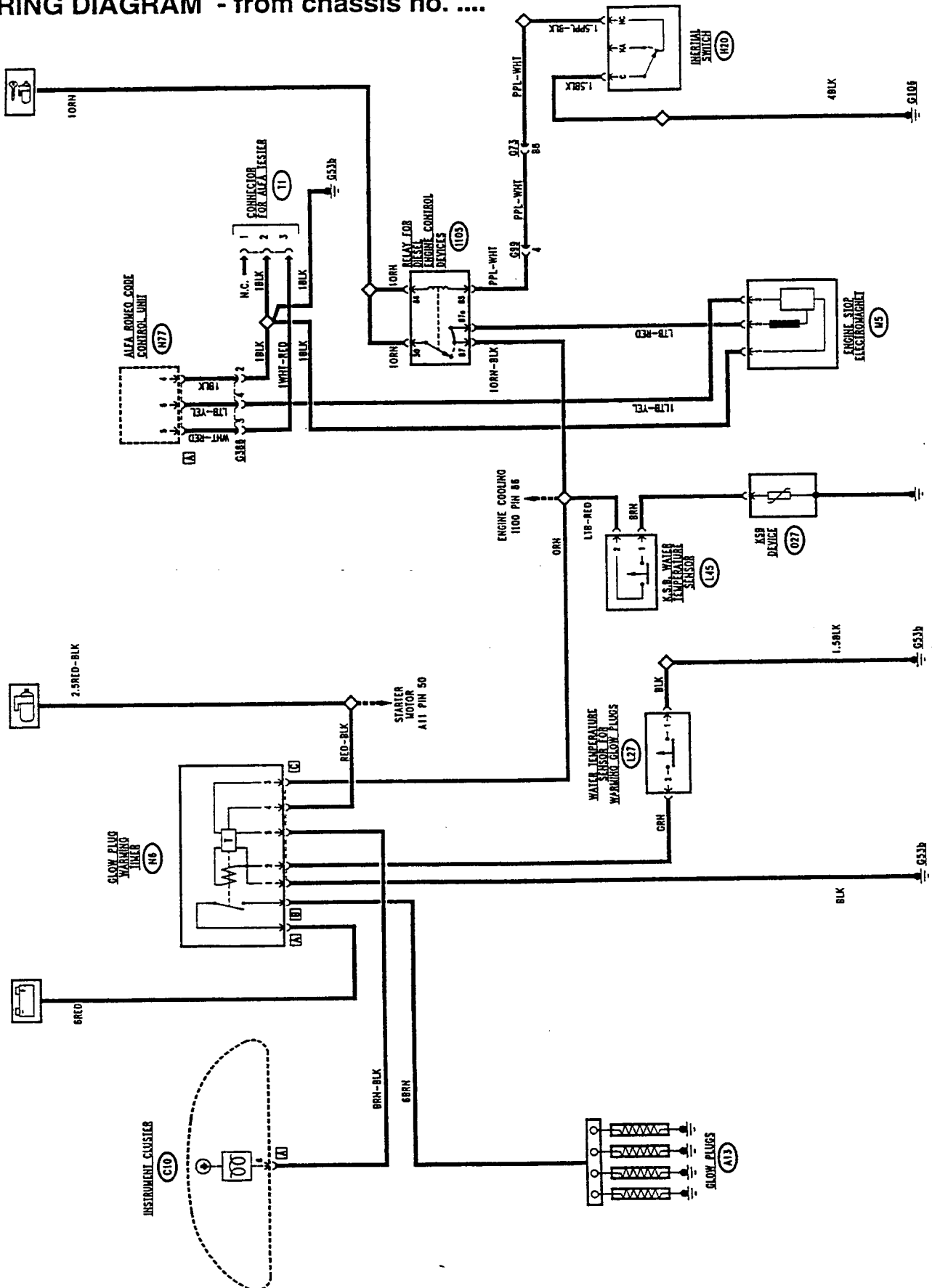
From chassis n., the adoption of a new control unit for glow plug warming lowers the emission of pollutants especially during starting.

GLOW PLUG WARMING - ENGINE STOP - COLD ADVANCE WIRING DIAGRAM - up to chassis no.



--- versions without ALFA ROMEO CODE but with theft alarm

WIRING DIAGRAM - from chassis no.



GLOW PLUG WARMING

General Description

As we all know, in Diesel or "compression ignition" engines, the air/fuel mixture is ignited without outside sparks, simply by compressing the mixture.

However, when the engine is started cold, it is necessary to pre-heat the precombustion chambers - where the fuel and air mix - in order to increase the temperature of the mixture to values that enable self-ignition, upon compression in the cylinders.

This pre-heating is carried out through "**rapid incandescence Glow plugs**" of the bulb type, fitted on the cylinder head, one for each precombustion chamber.

The glow plugs are controlled by a special electronic device which adjusts the operating times and the operating logic, while a warning light on the instrument cluster alerts the driver that the pre-heating function is operational.

Up to chassis no.:

The electronic control unit is located in the engine compartment next to the battery; it incorporates an NTC sensor which detects the temperature in the engine compartment. The device delivers a considerable amount of current to the glow plugs for a certain amount of time, calculated according to the following logic, in three stages:

1) pre-heating time, with "glow plug warming" warning light on the instrument cluster on:

this varies according to the temperature detected: from 1.5 to 4.5 seconds at appr. 70°C up to a maximum of 20-27 seconds at -20°C.

At the end of this time the warning light turns off to inform the driver that the engine can be started.

2) pre-heating time with warning light off:

if the engine is not started immediately, the logic of the device ensures the supply to the glow plugs for a time

known as "distraction time", of 15-20 seconds with the warning light off.

3) after-heating time:

this is a further period of 15-20 seconds of supply to the glow plugs after starting (key released from the START position), after which the supply of current is cut off.

From chassis no.:

The electronic control unit is located in the engine compartment next to the battery; it is connected to the NTC sensor, to be found on the thermostat, which detects the temperature of the engine. The device delivers a considerable amount of current to the glow plugs for a certain amount of time, calculated according to the following logic, in three stages:

1) pre-heating time, with "glow plug warming" warning light on the instrument cluster on:

this varies according to the temperature of the engine which is detected by a special sensor.

At the end of this time the warning light turns off to inform the driver that the engine can be started.

2) pre-heating time with warning light off:

if the engine is not started immediately, the logic of the device ensures the supply to the glow plugs for a time known as "maintenance" for 10 seconds with the warning light off.

3) after-warming time:

this is a further period of supply to the glow plugs after starting (key released from the START position), after which the supply of current is cut off.

This period, too, depends on the engine temperature detected.

In both cases, the control logic also prevents any inconvenience or damage to the engine cutting off the supply if accidental earth contacts are detected at any of the glow plugs or of their supply cables.

Functional Description

The glow plug warming electronic timer device **N6** is connected, as shown in the wiring diagram:

The eyelet of connector A is connected to the battery supply through the branch terminal board.

The eyelet of connector B is connected to the conductor bar of the glow plugs **A13** to which it sends the warming current for the length of time established by the electronic device.

Up to chassis no.:

Pin 2 - connector C - is earthed. The electronic timer circuit is operated when the cluster is turned on via the "key- operated" signal which reaches pin 3 via relay **I105** and - for vehicles without ALFA ROMEO CODE - the consent of the theft alarm control unit **N45** (relay **I105** supplies this and other engine control devices: intervention of the inertial switch **H20** de-energizes the relay and cuts off the supply in the event of a crash/accident). Pin 4 receives the starting signal, also controlled - for vehicles without ALFA ROMEO

CODE - by the theft alarm control unit **N45**.

Lastly a signal from pin 6 - still of connector C - turns on the "glow plug warming" warning light on the instrument cluster **C10**.

From chassis no.:

Pin 1 - connector C - is earthed. The electronic timing circuit is operated by the turning on of the instrument cluster via the "key-operated" signal which reaches pin 3 through relay **I105** (relay **I105** supplies this and other engine control devices: intervention of the inertial switch **H20** de-energizes the relay and cuts off the supply in the event of a crash/accident).

Pin 4 receives the starting signal from the ignition switch.

Pin 2 receives the signal from sensor **L27** which detects the temperature of the engine. Lastly a signal from pin 5 - still of connector C - turns on the "glow plug warming" warning light on the instrument cluster **C10**.

ENGINE STOP

General Description

In a Diesel engine the engine is stopped by interrupting the supply of fuel to the injection pump; this takes place through a special solenoid valve which controls the passage through which the fuel flows into the injection pump.

With the key is at MARCIA and the consent of the ALFA ROMEO CODE control unit, the electromagnet opens the flow of fuel. As soon as the switch is turned to the STOP position, the flow is cut off and, after a few turns, the engine stops.

In the event of violent impact the supply to the solenoid valve might not be cut off, therefore, often the engine stays on. The presence of the inertial switch cuts off the supply, thereby stopping the engine in the case of impact of a certain degree.

Functional Description

For cars without ALFA ROMEO CODE: The engine stop electromagnet M5, connected to earth, is activated if supplied by the "key-operated" line (MARCIA position) of the ignition switch. This line crosses relay I105, which supplies this and other devices under the control of the inertial switch H20).

For cars with ALFA ROMEO CODE: device M5 comprises an electronic control circuit which activates the electromagnet when it receives the "key-operated" signal (pin 2) but also the consent signal (pin 3) from the ALFA ROMEO CODE control unit N77.

With the ignition switch in the STOP position - or with the anti-theft of the inertial switch H20 - this supply ceases and the electromagnet is deactivated thereby cutting off the flow of fuel to the injection pump.

COLD ADVANCE (K.S.B.)

General Description

When the engine is cold, the adjustment of injection advance is carried out through a specific automatic device (called K.S.B.), which replaces the conventional manual control: this enables regular operation of the engine even when it is cold, thus improving starting under all circumstances.

The automatic K.S.B. device acts through a solenoid valve which opens or closes the flow of fuel - inside the injection pump - towards the transfer pressure adjustment valve, consequently increasing or decreasing the pressure on the advance variator.

The solenoid valve is of the type with wax thermal bulb: the supply voltage heats the wax bulb which operates the ball valve that opens.

The solenoid valve is controlled by a thermal contact on the thermostatic cup which opens it when the temperature of the engine coolant is above 60°C.

Functional Description

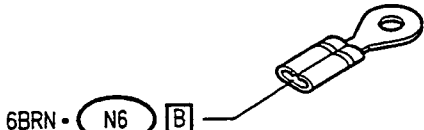
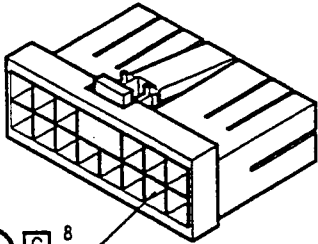
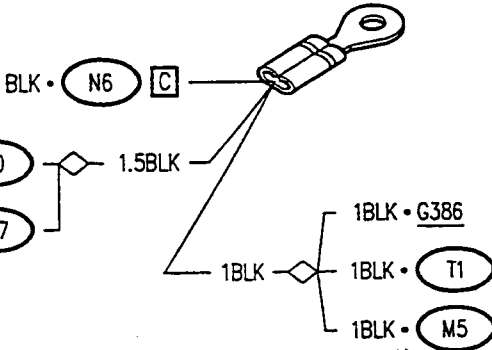
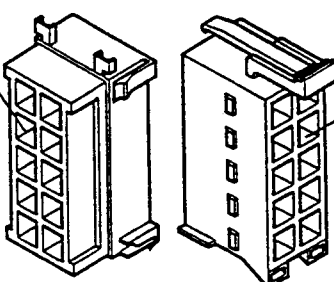
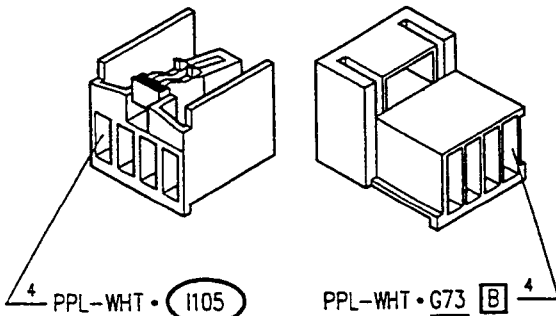
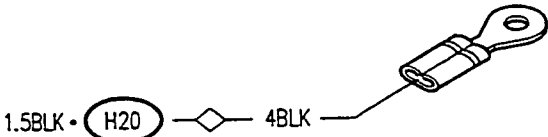
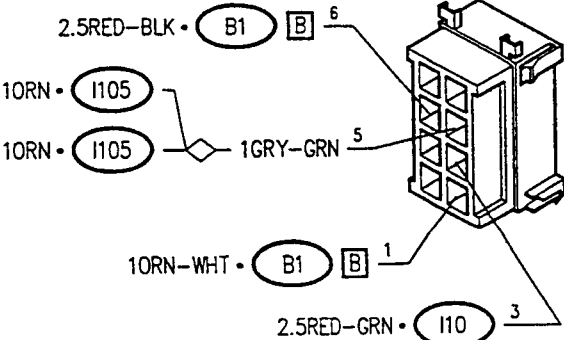
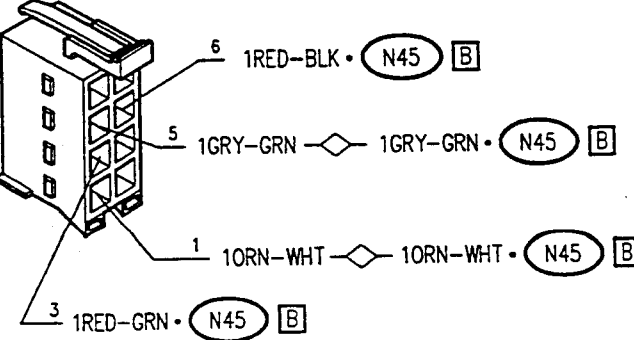
The K.S.B. water temperature sensor L45 receives the "key-operated" supply via relay I105 and - if fitted - the consent of the anti-theft control unit N45 (relay I105 supplies this and other devices under the control of the inertial switch H20).

Adjustment takes place with the following logic:

- with the engine coolant temperature below 60 ± 2 °C, the thermal contact is open and the solenoid valve of the K.S.B. device O27, not supplied, is closed: as a result - through the transfer pressure of the pump - the injection advance is increased;
- when the engine coolant temperature exceeds 60 ± 2 °C, the thermal contact closes, the solenoid valve of O27 is supplied with 12 V (in fact it has an internal earth connection) and opens: as a result, the injection advance returns to normal ratings since the transfer pressure is reduced.
- with decreasing temperature, the thermal contact re-opens below 50 ± 2 °C.

For further details, refer to this subject in Group 10 "ENGINE - SUPPLY".

COMPONENTS AND CONNECTORS

Glow plugs	A13	Instrument cluster	C10 A
 <p>6BRN • N6 [B]</p>	 <p>BRN-BLK • N6 [C] 8</p>		
LH engine compartment earth	G53b	Rear services connector	G73 B
 <p>BLK • N6 [C]</p> <p>(*) BLK • I10</p> <p>(•) BLK • L27</p> <p>1.5BLK</p> <p>1BLK • G386</p> <p>1BLK • T1</p> <p>1BLK • M5</p>	 <p>8 PPL-WHT • G99</p> <p>1.5PPL-BLK • H20</p> <p>8 PPL-WHT</p>		
Engine/dashboard wiring connector	G99	Seat crossmember earth	G106
 <p>4 PPL-WHT • I105</p> <p>PPL-WHT • G73 [B] 4</p>	 <p>1.5BLK • H20</p> <p>4BLK</p>		
Anti-theft wiring connector (*)			G241
 <p>2.5RED-BLK • B1 [B] 6</p> <p>10RN • I105</p> <p>10RN • I105</p> <p>1GRY-GRN 5</p> <p>10RN-WHT • B1 [B] 1</p> <p>2.5RED-GRN • I10 3</p>	 <p>6 1RED-BLK • N45 [B]</p> <p>5 1GRY-GRN • N45 [B]</p> <p>1 10RN-WHT • N45 [B]</p> <p>3 1RED-GRN • N45 [B]</p>		

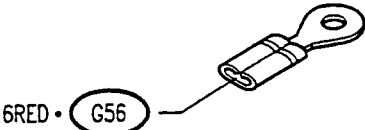
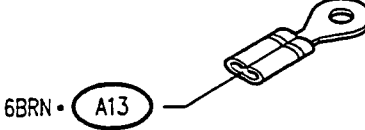
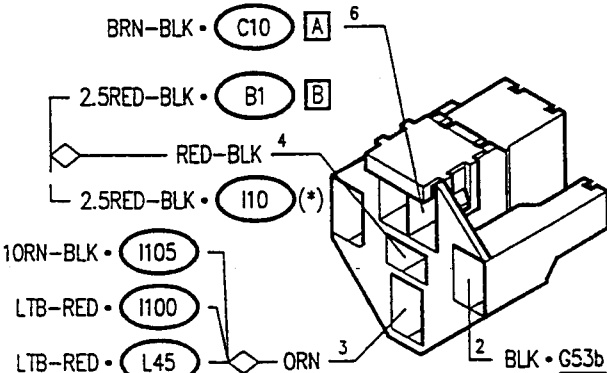
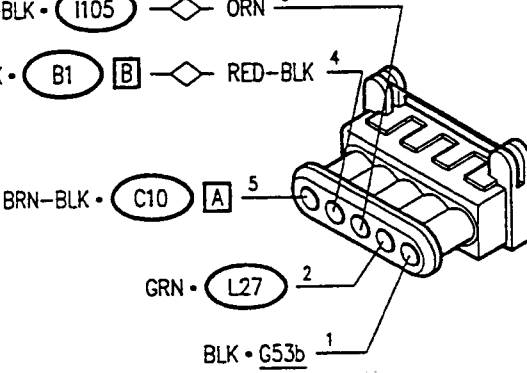
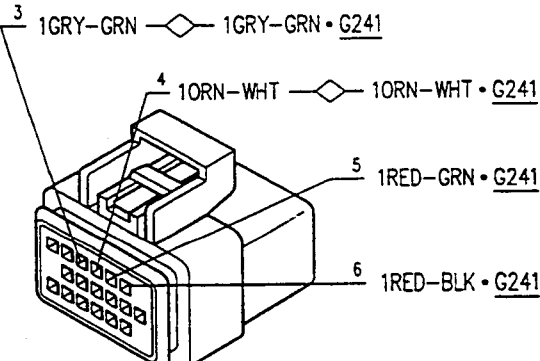
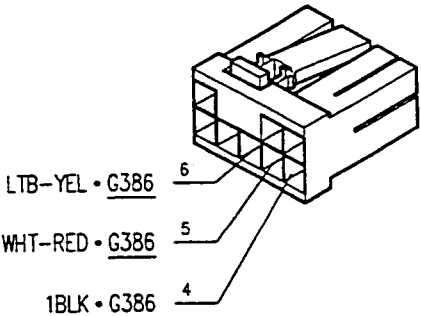
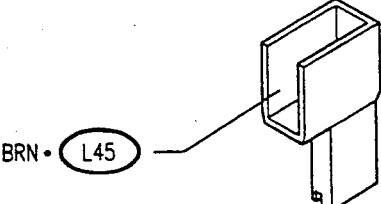
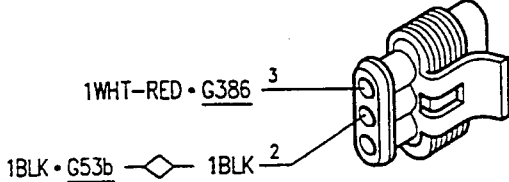
(*)Version without ALFA ROMEO CODE, but with anti-theft system (•) Variant from chassis no....

COMPONENTS AND CONNECTORS (contd.)

ALFA ROMEO CODE connector		G386	Inertial switch		H20	
Starting consent relay (*)			I10	Diesel engine control devices relay		I105
Water temperature sensor for glow plug warming (*)			L27	K.S.B. water temperature sensor		L45
Engine stop electromagnet (*)			M5	Engine stop electromagnet		M5

(*)Version without ALFA ROMEO CODE, but with anti-theft system (•) Variant from chassis no....
PA493000000004

COMPONENTS AND CONNECTORS (contd.)

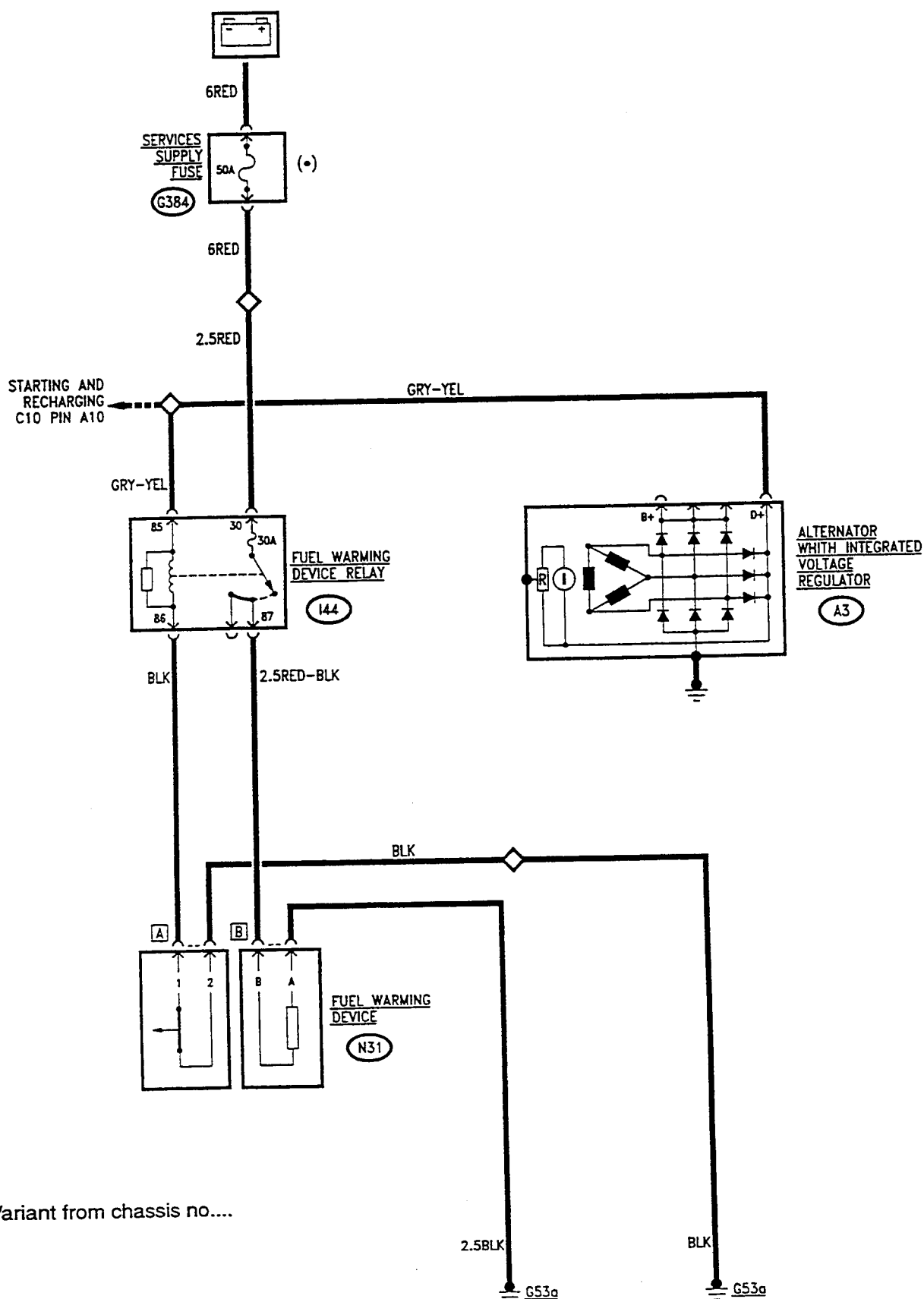
<p>Glow plug warming timer</p> <p>(N6) [A]</p> 	<p>Glow plug warming timer</p> <p>(N6) [B]</p> 
<p>Glow plug warming timer</p> <p>(N6) [C]</p> 	<p>Glow plug warming timer (*)</p> <p>(N6) [C]</p> 
<p>Anti-theft control unit (*)</p> <p>(N45) [B]</p> 	<p>ALFA ROMEO CODE control unit</p> <p>(N77) [A]</p> 
<p>K.S.N. device</p> <p>(O27)</p> 	<p>Connector for ALFA TESTER</p> <p>(T1)</p> 

(*)Version without ALFA ROMEO CODE, but with anti-theft system (*) Variant from chassis no....

PA493000000004

FUEL WARMING

Wiring diagram



(•) Variant from chassis no....

General Description

Satisfactory operation of a Diesel engine at low temperatures may be compromised by the possible solidification of the paraffins contained in the fuel (fuel oil) which impedes the correct flow.

The engine is therefore fitted with a fuel warming device, located on the fuel filter.

A thermal switch, on the filter support, detects low temperatures of the fuel oil: in fact this contact closes for temperatures below 6°C (and re-opens above 15°C).

When the engine is running (information supplied by the turning off of the "battery charging" signal of the alternator) a relay commands the connection of the heating module, in the upper section of the fuel oil filter; this module comprises two variable PTC resistances which, when crossed by current, heat the fuel that flows through the filter: initially, at low temperature, the resistance is low and the current is high;

gradually the resistance increases, thereby reducing heating.

Functional Description

The fuel warming device relay **I44** - with built-in fuse (30A) - controls the operation of the entire system.

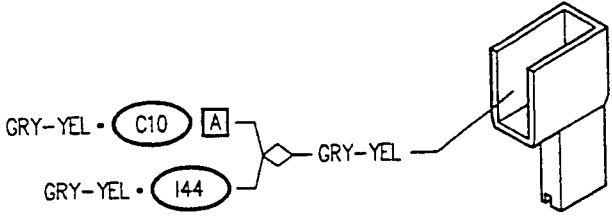
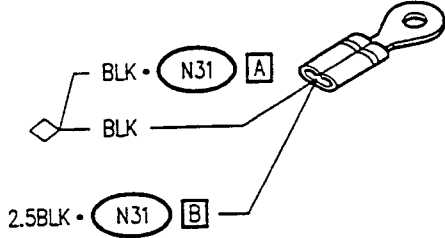
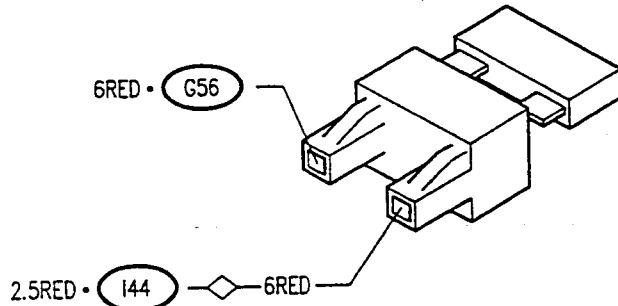
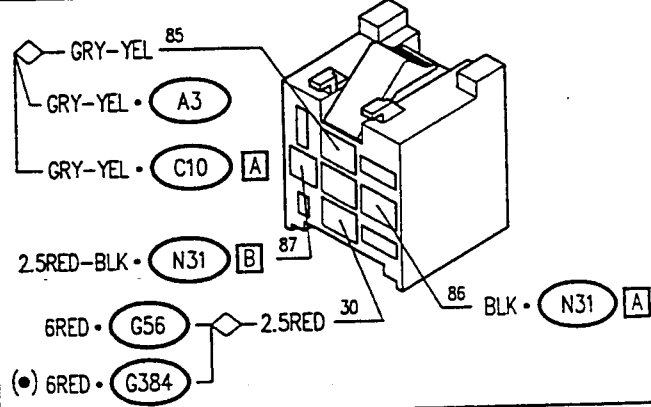
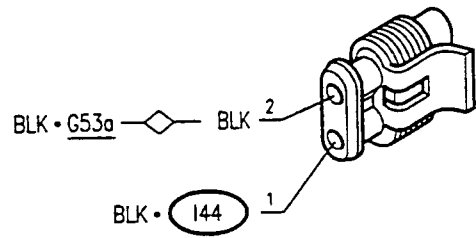
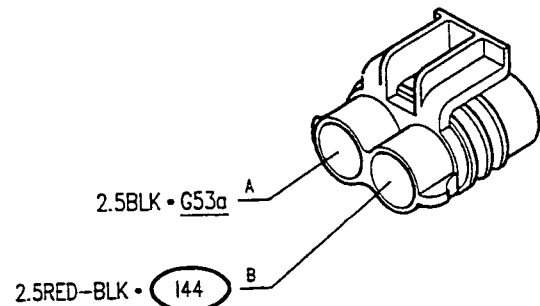
From chassis no. the line that supplies the relay is protected by the services supply fuse **G384**.

When (below 6°C) the contact of the thermal switch - connector A of device **N31** - closes and at the same time the engine is running (12 V signal from pin D+ of the alternator), relay **I44** is energized.

This way the resistances are supplied - connector B of device **N31** - which heat the fuel passing through the filter.

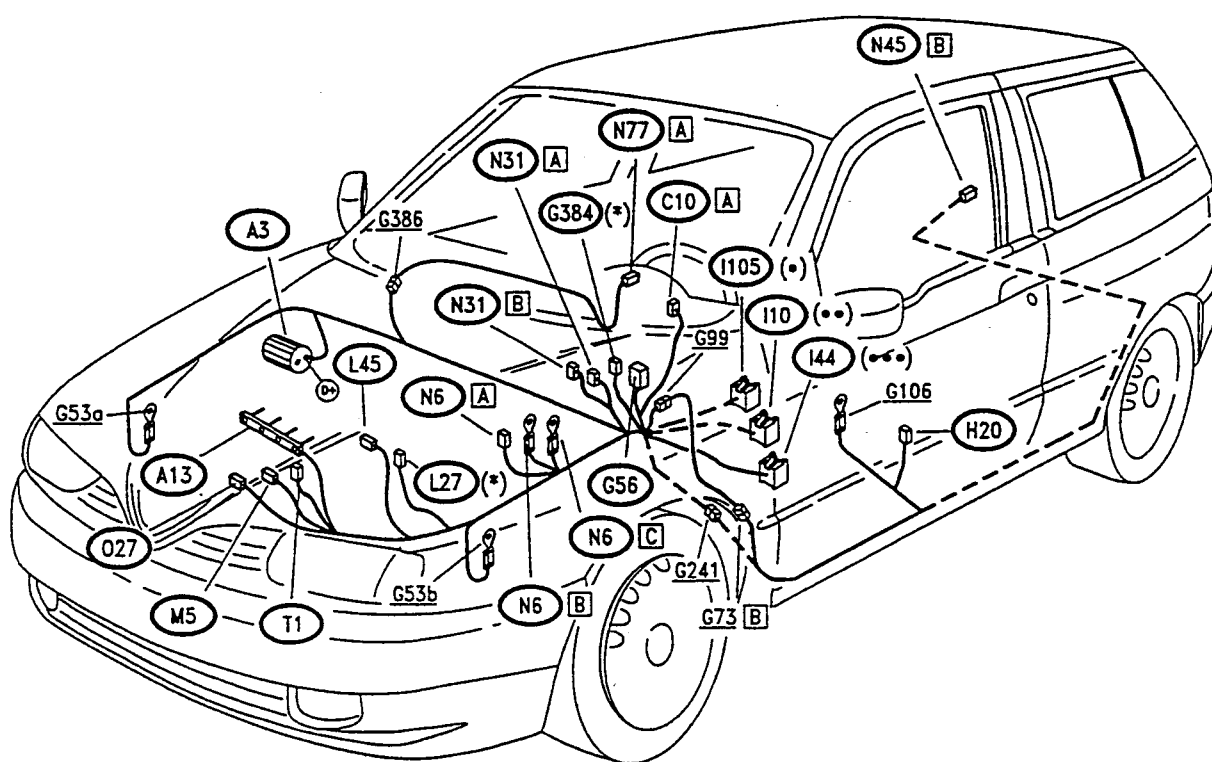
When the thermal switch contact opens (above 15°C), or if the engine is not running, the supply is cut off and heating ceases.

Components and Connectors

<p>Alternator, with voltage regulator incorporated</p> <p>A3</p>  <p>GRY-YEL • C10 A</p> <p>GRY-YEL • I44</p> <p>GRY-YEL</p>	<p>RH engine compt. earth</p> <p>G53a</p>  <p>BLK • N31 A</p> <p>2.5BLK • N31 B</p>
<p>Services supply fuse (•)</p> <p>G384</p>  <p>6RED • G56</p> <p>2.5RED • I44</p> <p>6RED</p>	<p>Fuel warming device relay</p> <p>I44</p>  <p>GRY-YEL 85</p> <p>GRY-YEL • A3</p> <p>GRY-YEL • C10 A</p> <p>2.5RED-BLK • N31 B</p> <p>6RED • G56</p> <p>(•) 6RED • G384</p> <p>86 BLK • N31 A</p> <p>30</p> <p>87</p>
<p>Fuel warming device</p> <p>N31 A</p>  <p>BLK • G53a</p> <p>BLK 2</p> <p>BLK • I44 1</p>	<p>Fuel warming device</p> <p>N31 B</p>  <p>2.5BLK • G53a A</p> <p>2.5RED-BLK • I44 B</p>

(•) Variant from chassis no....

LOCATION OF COMPONENTS



(•) grey base

(••) yellow base

(•••) white base (N.B. Built-in 30A fuse)

(*) present from chassis no.....

— — — — — only versions without ALFA ROMEO CODE and with anti-theft

N.B.

A fault to the devices described here may also originate from other mechanical components of the fuel supply system such as the injection pump, fuel filter, etc....
(For further details see GROUP 10 "ENGINE SUPPLY")

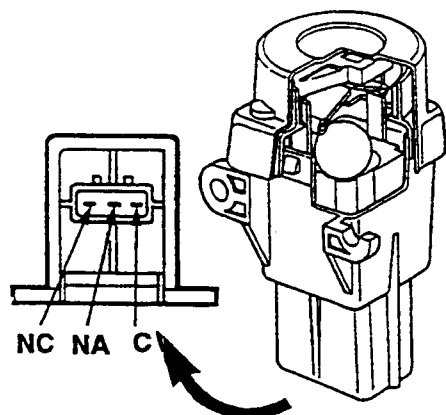
FAULT-FINDING TABLE

Fault	Component to be checked												
	A1	H20	M5	A13	N6	L27	C10 (2)	G384	N31	I44	A3 (3)	L45	O27
The engine fails to start (1)	•	•	•	•	•								
Glow plugs not working properly				•	•	•							
The glow plug warning light fails to turn on when starting					•		•						
Engine fails to start properly when cold				•				•	•	•	•		
Engine fails to "deliver" when accelerating												•	•
Engine fails to stop (1)			•										

- (1) If the engine fails to start, check - as described - firstly the battery **A1** or, especially after a crash even if light, or sharp braking, the inertial switch **H20** and the electromagnet **M5**. Also check the ALFA ROMEO CODE system (see section: "ALFA ROMEO CODE").
- (2) The instrument cluster **C10** cannot be overhauled. Therefore in the event of a fault, it is not possible to replace individual warning lights and a new complete instrument cluster must be installed.
- (3) Check that the "generator" warning light turns on correctly until the alternator recharges, or check the alternator **A3** itself: see section "Starting and Charging".

CHECKING COMPONENTS

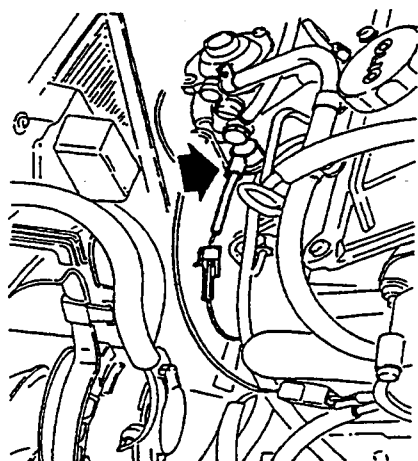
Inertial switch (H20)



SPECIFICATIONS

Check continuity between pins NC and C : this continuity is cut off in the event of a crash: the contact is closed again pressing the special button

Engine stop electromagnet (cars without ALFA ROMEO CODE) (M5)

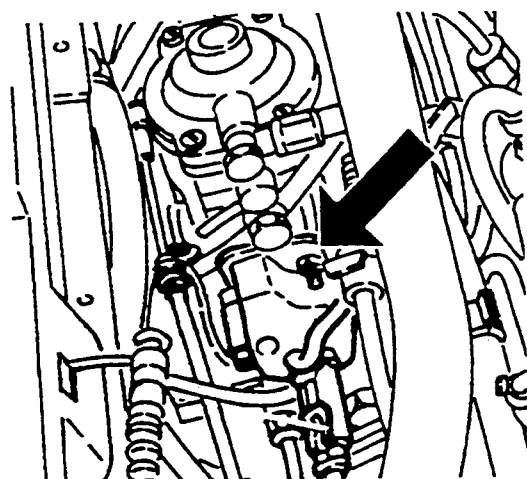


SPECIFICATIONS

Supplying the electromagnet with 12V the solenoid valve opens, while it closes with the supply cut off:
N.B. : valve "seizure" is also possible thus failing to close when the electric supply ceases

NOTE: applying 12V the electromagnet "trips" (the characteristic noise is heard)

Engine stop device (cars with ALFA ROMEO CODE) (M5)

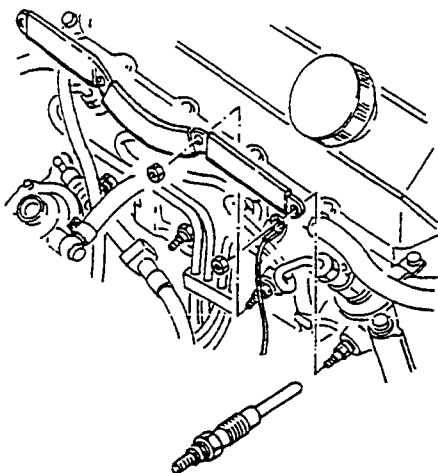


SPECIFICATIONS

SPECIFICATIONS	
pin 1	earth
pin 2	12 V
pin 3	square-wave consent signal from the control unit of the ALFA ROMEO CODE

Under these conditions the solenoid valve opens, while it closes when one of the three signals ceases

Glow plugs (A13)



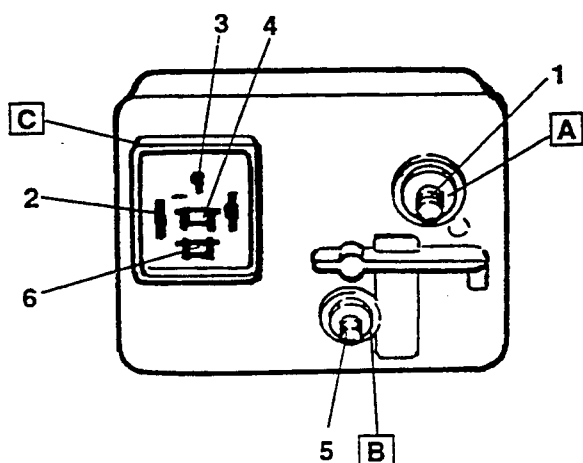
SPECIFICATIONS

Internal resistance	~ 0.6 Ω
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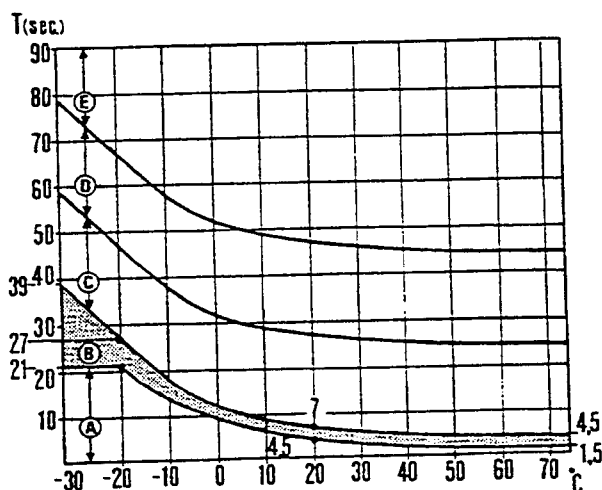
Check the correct fastening and cleaning at the conductor bars connecting the glow plugs

N.B. : Failure to operate of the glow plugs may be caused by blow-by from the cylinder head gasket (see group 10 "ENGINE- SUPPLY")

Glow plug warming timer (up to chassis no.....) (N6)

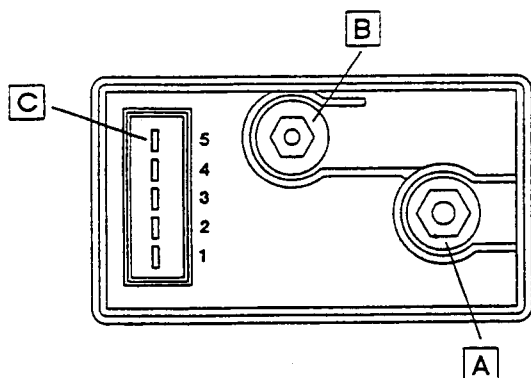


Check device: see test A

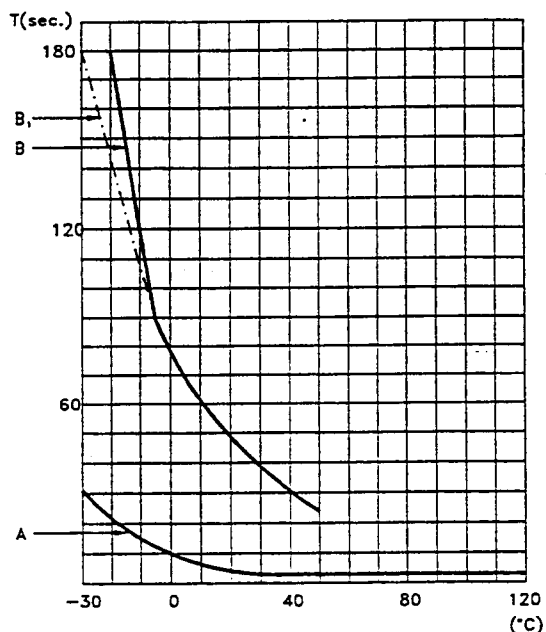


Changes in glow plug warming time in relation to the temperature in the engine compartment

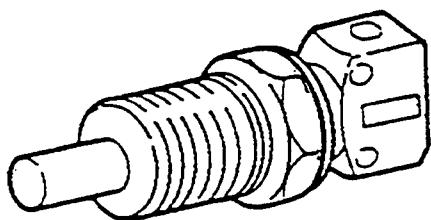
A	Period with warning light on and warming engaged
B	Field of tolerance in which the warning light turns off with warming engaged (dashed area).
C	Period with warming engaged and warning light off. This phase, characterised by 15 ÷ 20 sec. of constant operation, is counted starting from the turning off of the warning light
D	After-warming period, with glow plugs engaged and warning light off. This phase, characterised by 15 ÷ 20 sec. of constant operation, is counted beginning from the end of starting with the engine running
E	Period with warning light and warming off

Glow plug warming timer (from chassis no.....) **(N6)**

Check device: see test A

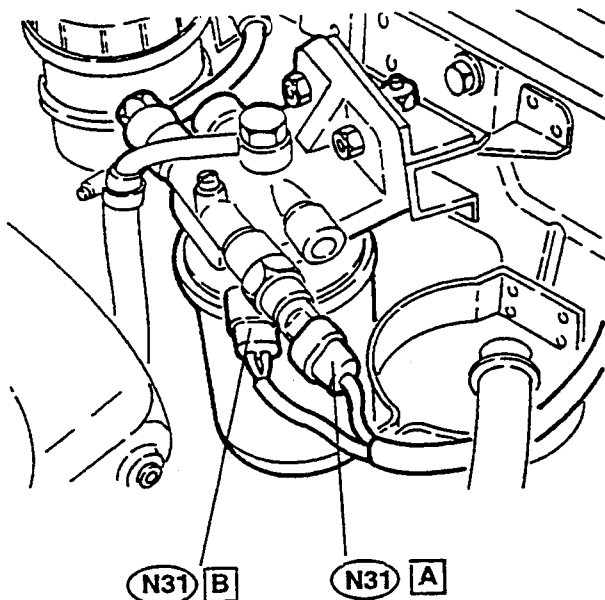
**Changes in glow plug warming time**

- **Curve A** shows the warming times (glow plugs supplied warning light on) in relation to the temperature of the engine cooling water. Warming must not be stopped for temperatures of the engine water below 80°C
- **"Maintenance" time** (glow plugs supplied warning light off) = 10 constant sec. counted from the moment the warning light goes off.
- **Curve B** shows the after-warming times (glow plugs supplied warning light off) counted starting from the instant the engine starts. The device cuts itself off at the end of the after-warming phase. (B1 = permissible after-warming curve).

Water temperature sensor for glow plug warming **(L27)****SPECIFICATIONS**

Temperature (°C)	Resistance (Ω)
-10°C	8100 ÷ 10770 Ω
+20°C	2280 ÷ 2720 Ω
+80°C	292 ÷ 362 Ω

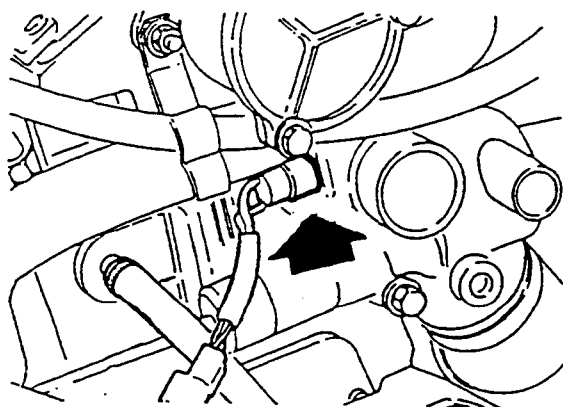
Fuel warming device (N31)



SPECIFICATIONS	
Thermal contact (conn. A)	
Contact closes (with decreasing temperature)	< 6°C
Contact opens (with increasing temperature)	> 15°C
Heating resistances (conn. B)	
supplied at 12V the device must heat	
NOTE: as these resistances are PTC, heating varies according to the temperature: at low temperature the resistance is low and the current is high; gradually - after appr. 60 sec - the temperature reaches such a level that the current thus heating are decreased). N.B.: carry out the test disconnecting the device	

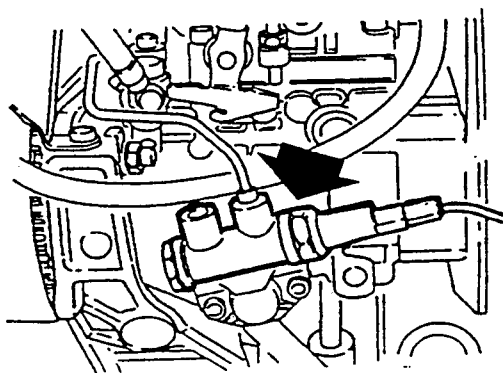
NOTE: a fault to the fuel warming system may also be caused by other mechanical components of the fuel supply system

K.S.B. temperature sensor (L45)



SPECIFICATIONS	
Thermal contact opens (with increasing temperature)	> 60° ± 2°C
Thermal contact closes (with decreasing temperature)	< 50° ± 2°C











K.S.B. device (O27)



SPECIFICATIONS
supplied at 12V the valve must be closed; when the supply ceases, it must open again

CHECK GLOW PLUG WARMING TIMER
 (version up to chassis no.....) **(N6)**
TEST A

Work without disconnecting the device, checking as mentioned on the cable input side

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
A1	CHECK TIMER		THE DEVICE IS WORKING PROPERLY Check the connections with other components
– With the ignition key at MARCIA check for 12V at connector B of N6 for appr. 30 seconds (*) and at pin 6 of connector C for appr. 7 seconds (*). Start the engine and check for 12V at connector B for another 20 seconds appr. (*), there is no supply at pin 6 of connector C.			Carry out step A2
A2	CHECK VOLTAGE		Carry out step A3
– Check for 12 V at connector A of N6			Restore the wiring between connector A of N6 and the branch terminal box G56
A3	CHECK VOLTAGE		Carry out step A4
– Check, with the key turned, for 12 V at pin 3 (connector C) of N6			Restore the wiring between pin 3 (connector C) of N6 and the ignition switch B1, through relay I105 and - where fitted - the anti-theft control unit N45. Also check that the anti- theft system is working properly
A4	CHECK VOLTAGE		Carry out step A5
– Check, with the starter motor energised (key at START), for 12 V at pin 4 (connector C) of N6			Restore the wiring between pin 4 (connector C) of N6 and the ignition switch B1 through - where fitted - relay I10 and the anti-theft control unit N45 Also check that the anti-theft system is working properly
A5	CHECK EARTH		Replace device N6
– Check for 0 V at pin 2 (connector A) of N6			Restore the wiring between pin 2 (connector A) of N6 and earth G53b

(*) Temperatures variable depending on the engine temperature - see corresponding graph; the values given refer to a temperature of 20°C in the engine compartment.

CHECK GLOW PLUG WARMING TIMER (version from chassis no.....)

N6

TEST A

Work without disconnecting the device, checking the items mentioned on the cable input side

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
A1	CHECK TIMER	OK ➔	THE DEVICE IS WORKING PROPERLY Check the connections with other components
	– With the ignition key at MARCIA check for 12V at connector B of N6 for appr. 45 seconds (*) and at pin 5 of connector C for appr. 5 seconds (*). Start the engine and check for 12V at connector B for another 45 seconds appr. (*), while there is no supply at pin 5 of connector C.	OK ➔	Carry out step A2
A2	CHECK VOLTAGE	OK ➔	Carry out step A3
	– Check for 12 V at connector A of N6	OK ➔	Restore the wiring between connector A of N6 and the branch terminal box G56
A3	CHECK VOLTAGE	OK ➔	Carry out step A4
	– Check, with the key turned, for 12 V at pin 3 (connector C) of N6	OK ➔	Restore the wiring between pin 3 (connector C) of N6 and the ignition switch B1, through relay I105.
A4	CHECK VOLTAGE	OK ➔	Carry out step A5
	– Check, with the starter motor energised (key at START), for 12 V at pin 4 (connector C) of N6	OK ➔	Restore the wiring between pin 4 (connector C) of N6 and the ignition switch B1.
A5	CHECK EARTH	OK ➔	Replace device N6
	– Check for 0 V at pin 1 (connector A) of N6	OK ➔	Restore the wiring between pin 1 (connector A) of N6 and earth G53b

(*) Temperatures variable depending on engine temperature - see corresponding graph; the values given refer to 20°C

