WARNING:
From Model Year '97, - and previously for certain Markets - it replaces the previous "TD" version - Refer to the section 37.

TD - CAT ENGINE CONTROL DEVICES

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FOREWORD

The TD engine (1930 cc:) is supplied - **in the "TD-CAT" version** - with a series of additional devices which further enhance performance regarding the emission of pollutants owing to a series of notions to reduce the production of such pollutants at their origin:

- **Degussa catalyst;**
- **new injection pump with specific innovations for optimising the operating features of the engine under all conditions;**
- **adoption of a potentiometer on the pump itself to control the accelerator;**
- **exhaust gas recirculation system (E.G.R.) with electronic control.**

This section brings together the devices and systems - controlled and/or operated **elettrically** - which govern the operation of this engine.

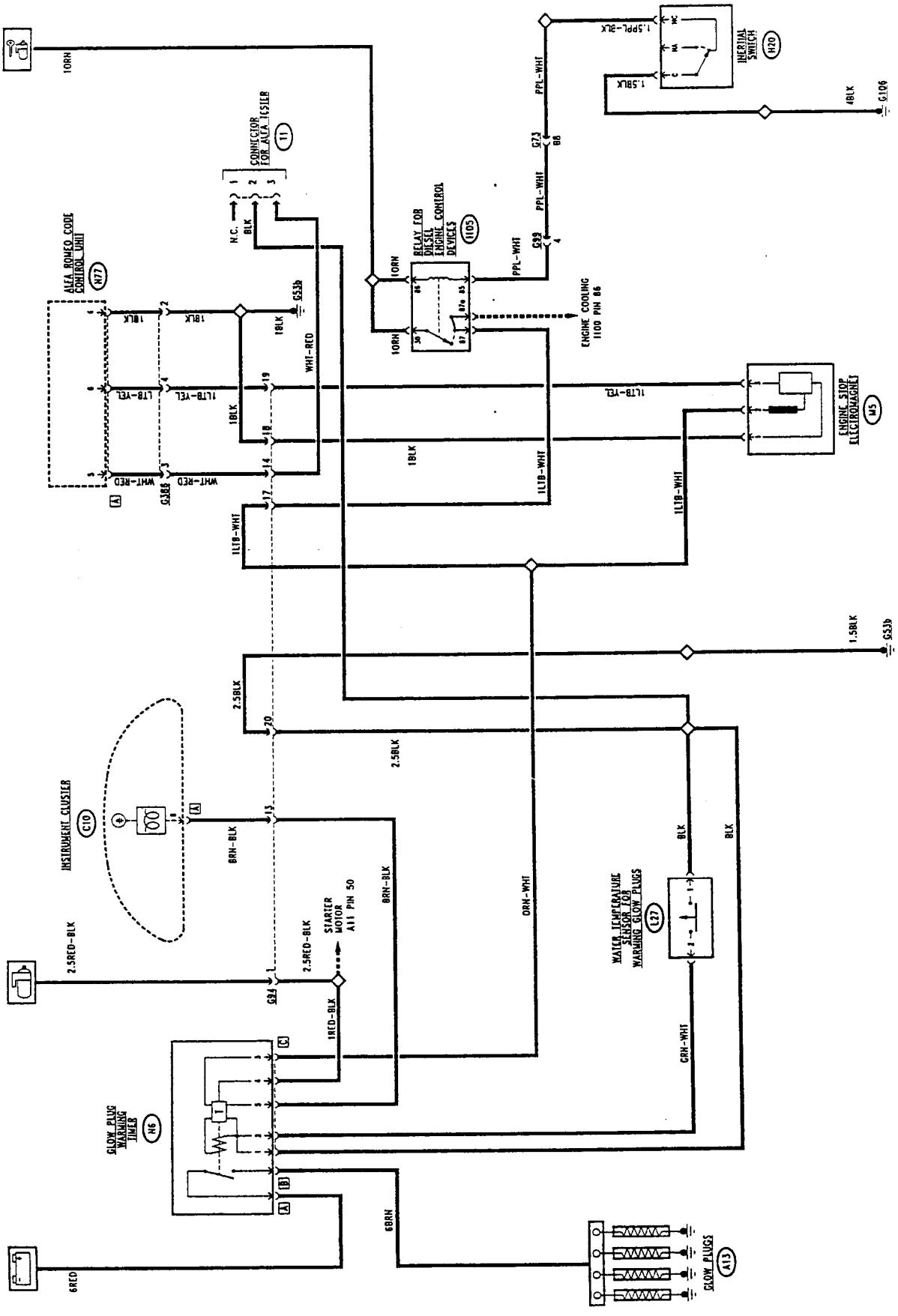
These are:

- **GLOW PLUG WARMING;**
- **ENGINE STOP;**
- **COLD ADVANCE (KSB);**
- **E.G.R. CONTROL**
- **FUEL WARMING**

For the complete, mechanical and functional description of the various systems, refer to GROUP 10: "ENGINE - SUPPLY"

WARNING:
The ENGINE STOP function is controlled by the ALFA ROMEO CODE system, which allows it to operate only after checking the secret memorised code (for further details see section "ALFA ROMEO CODE").

GLOW PLUG WARMING - ENGINE STOP
WIRING DIAGRAM



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 in 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.

The electronic control unit is located in the engine compartment next the battery; it incorporates an NTC sensor - on the thermostat - which detects the temperature in the engine compartment. The device delivers a considerable amount of current to the glow plugs for a given amount of time, which is 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 engine temperature detected by the 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 time", of 10 seconds with the warning light off.

3) after-heating 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 time, too, depends on the temperature of the engine.

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.
Pin 1 - 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** (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. 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 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.

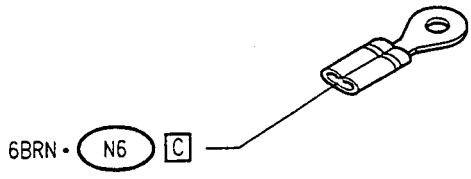
Functional Description

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**.

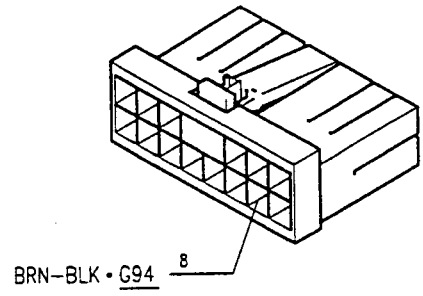
With the ignition switch in the STOP position - or with the anti-theft of the inertial switch **H20** - this supply ceases and the electromagnet is deactivated thereby cutting off the flow of fuel to the injection pump.

COMPONENTS AND CONNECTORS

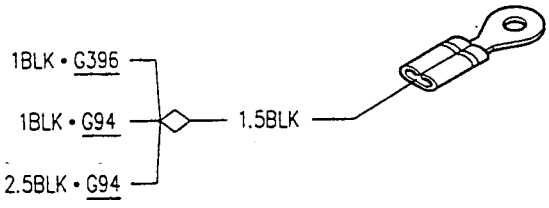
Glow plugs — A13



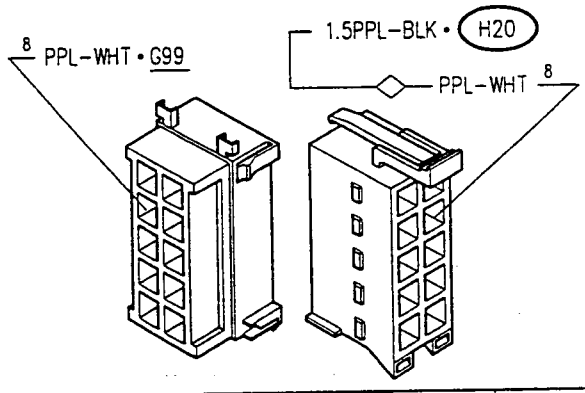
Instrument cluster — C10 A



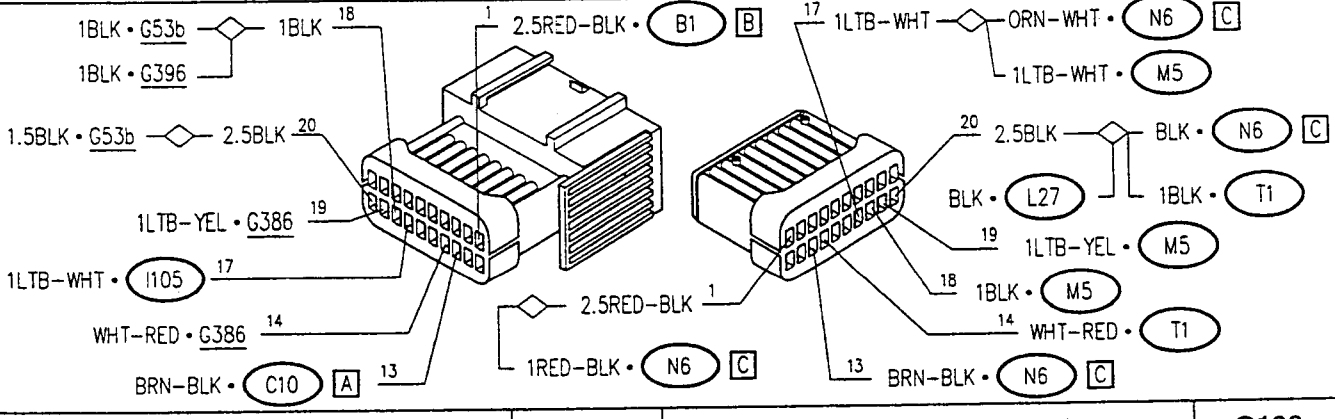
RH engine compt. earth — G53b



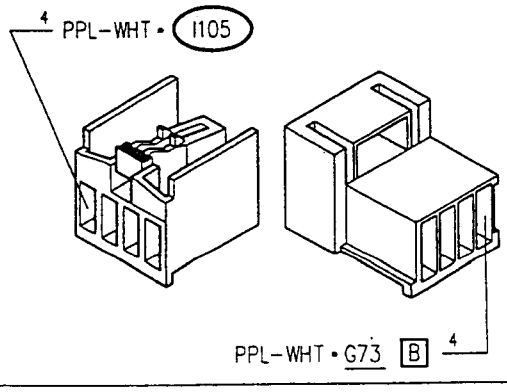
Connector for rear services — G73 B



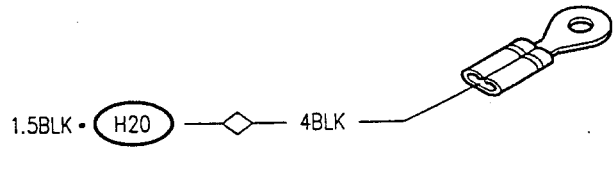
Engine compartment connector — G94



Dashboard/engine wiring connector — G99

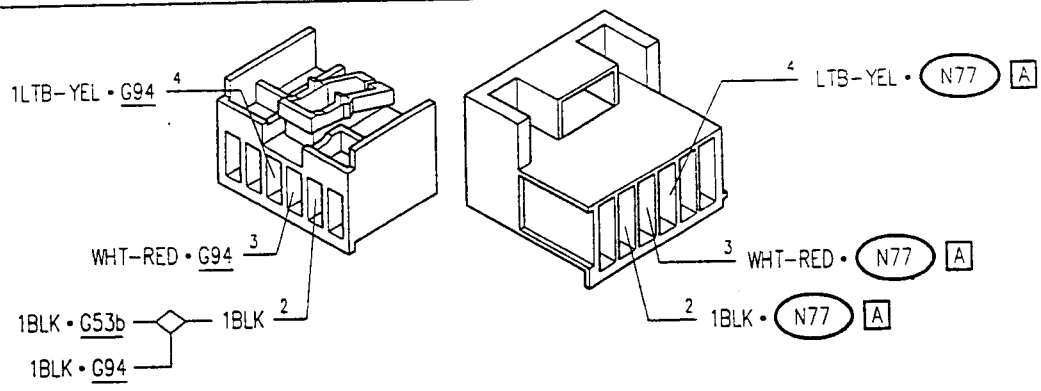


Seat crossmember earth — G106

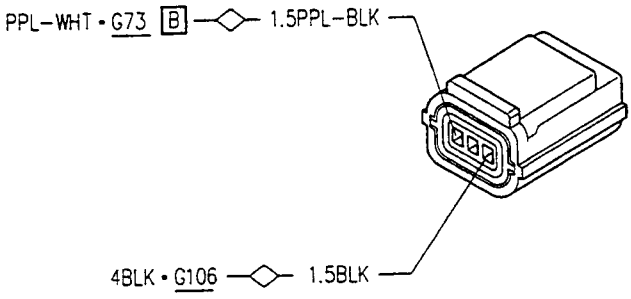


COMPONENTS AND CONNECTORS (contd.)

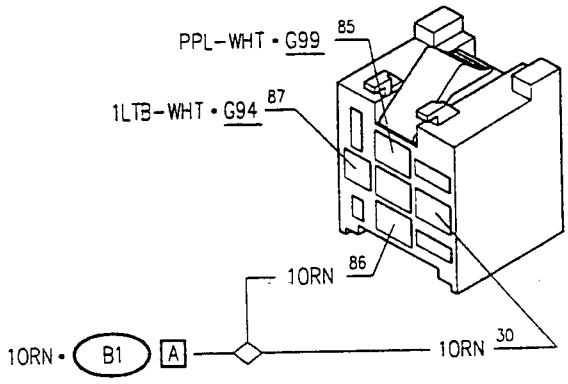
ALFA ROMEO CODE system connector — G386



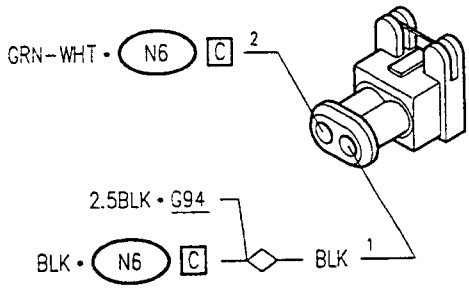
Inertial switch — H20



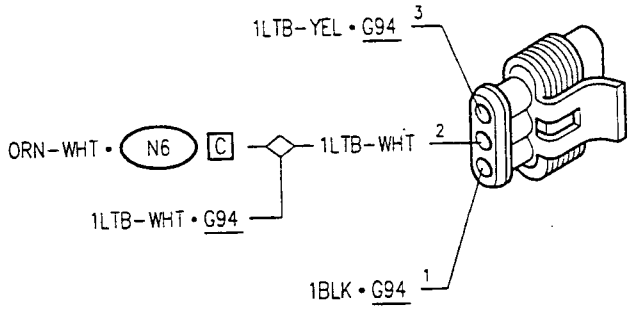
Diesel engine control devices relay — I105



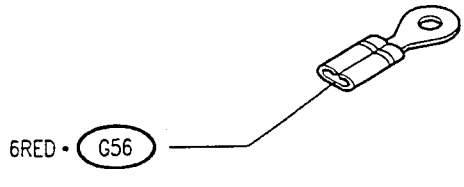
Water temperature sensor for glow plug warming — L27



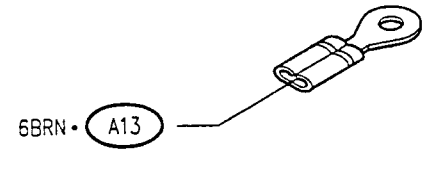
Engine stop electromagnet — M5



Glow plug warming timer — N6 A

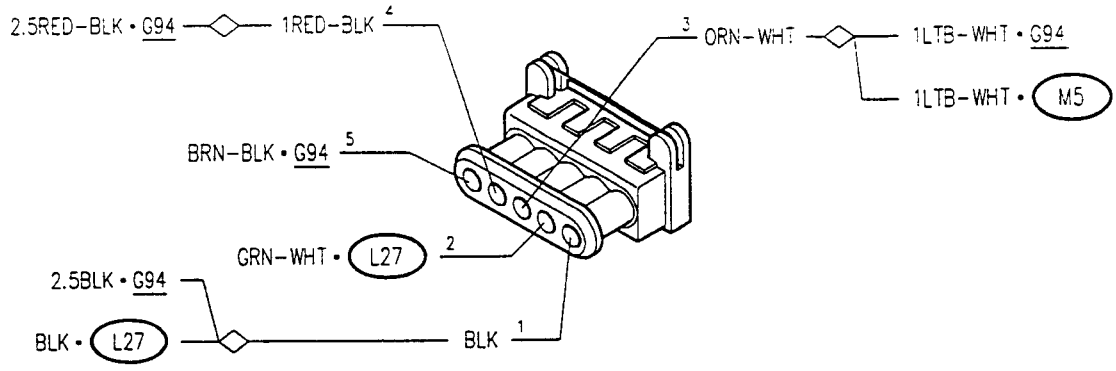


Glow plug warming timer — N6 B

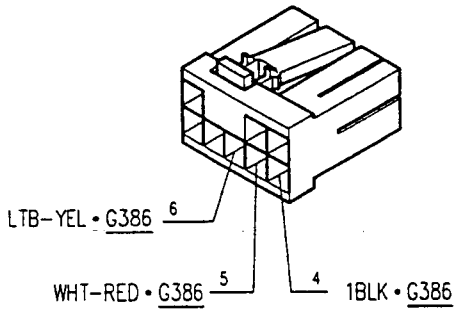


COMPONENTS AND CONNECTORS (contd.)

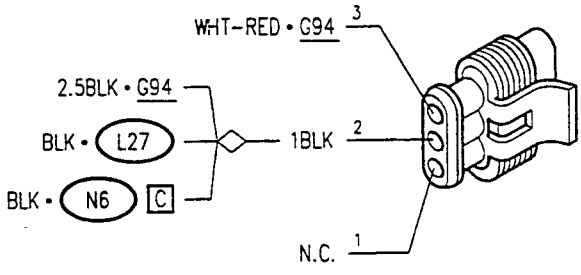
Glow plug warming timer — N6 C



ALFA ROMEO CODE control unit — N77 A

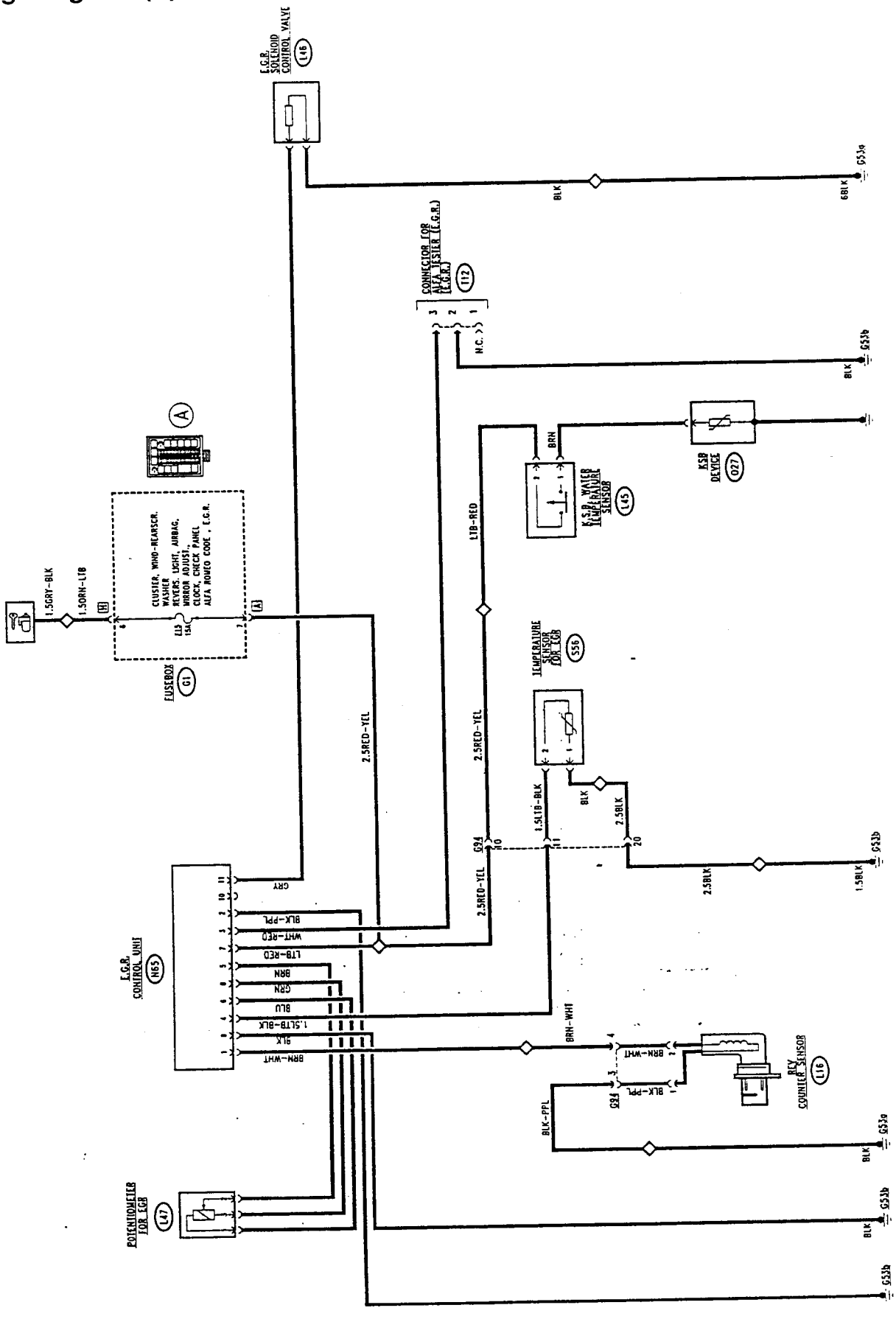


Connector for ALFA ROMEO TESTER (engine management-ALFA ROMEO CODE) — T1

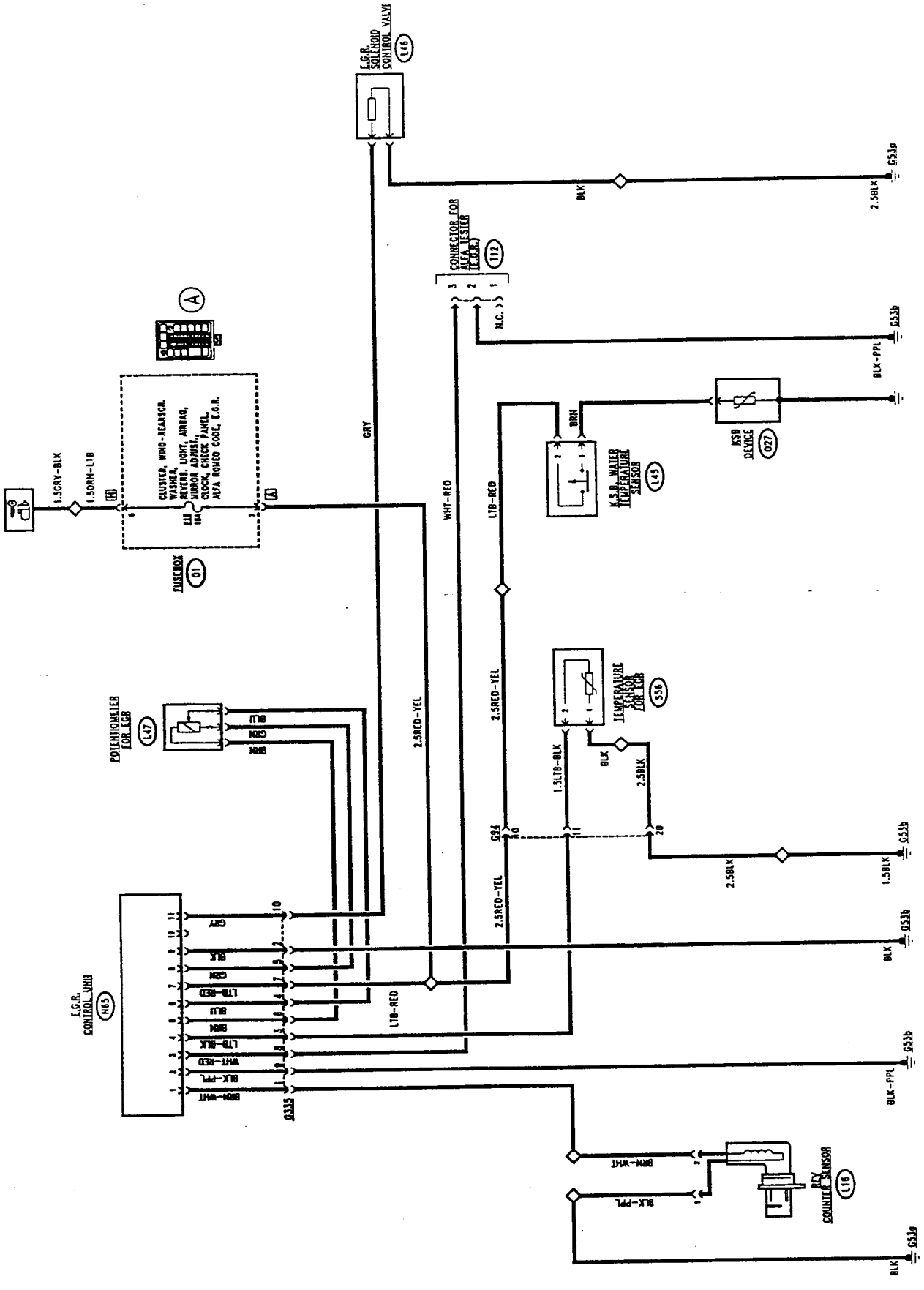


E.G.R. CONTROL - COLD ADVANCE

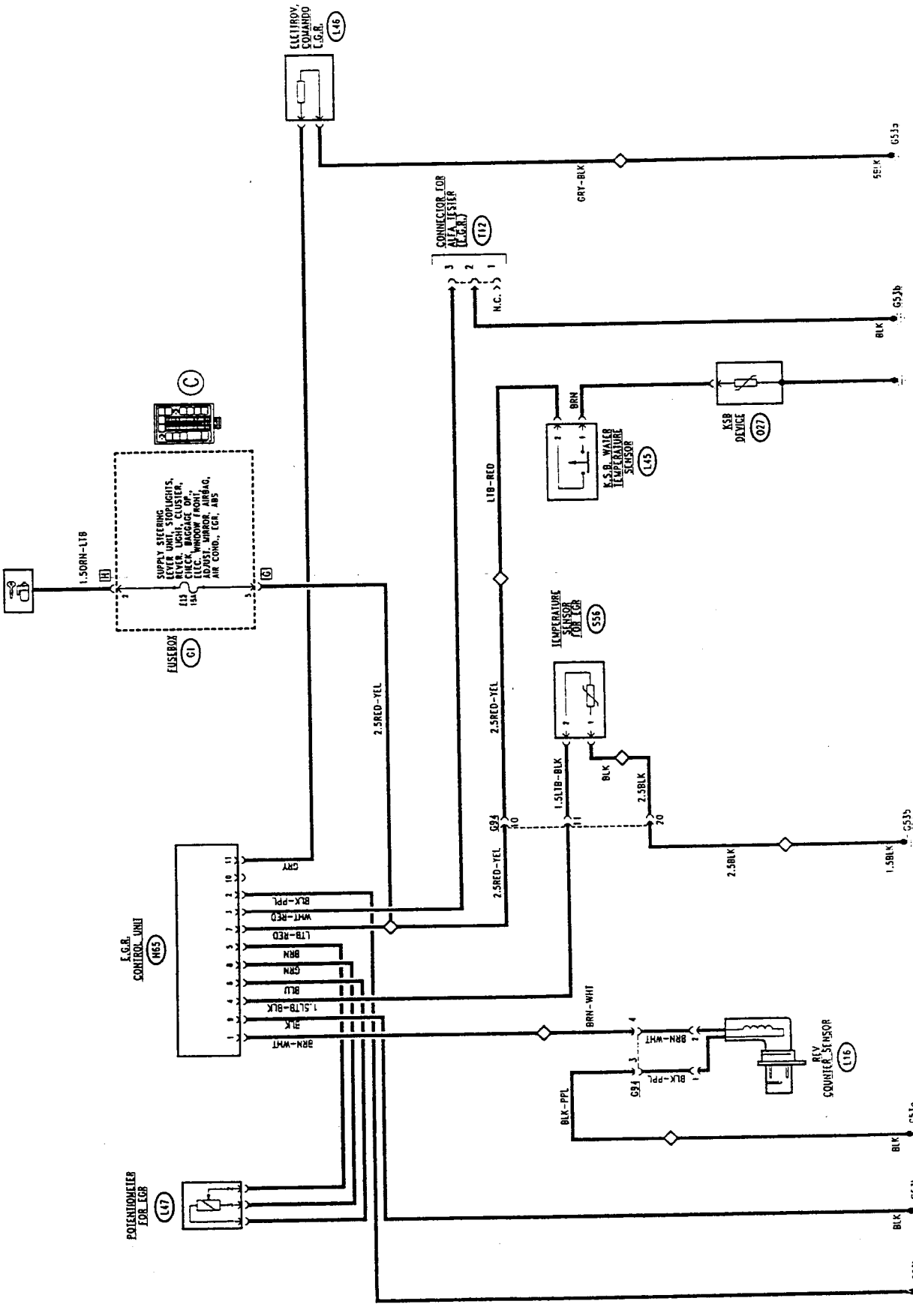
Wiring Diagram (up to chassis no. ...)



Wiring Diagram (from chassis no. ...)



Wiring Diagram



E.G.R. CONTROL

General Description

This system makes it possible to send part (5 ÷ 15%) of the exhaust gas back to the intake, under determinate operating conditions of the engine.
This way the fuel mixture is diluted with inert gases, lowering the peak temperature in the combustion chamber: this reduces the formation of nitric oxides (NOx), reducing them by 30 ÷ 50% at the exhaust.
Gas recirculation is only allowed at medium-high loads, when the fuel-air ratio is very high and the operation of the engine is not adversely affected by the presence of inert gas instead of air.
The recirculation system is controlled by an electronic control unit which receives the signals of the potentiometer on the accelerator lever and from the rpm and coolant fluid temperature sensors, and sends a command signal for the Borg Warner E.G.R. control modulating solenoid valve. The latter is connected to the atmosphere by a filter and, on the basis of the signals it receives, it transmits a lower or higher vacuum, leading from the special servobrake vacuum pump to the Pierburg E.G.R. valve.
This valve, if the vacuum is sufficient, opens, putting the exhaust manifold into communication with the intake manifold.
It is therefore possible to change the amount of gas recirculated adjusting the opening of the Pierburg E.G.R. valve continuously, using the maps stored containg the degree of opening in relation to the signals received.

The control unit has a connector for the serial output for the Alfa Tester, through which it is possible to reveal any faults detected during operation for servicing purposes.

Functional Description

The control unit **N65** controls the E.G.R. system detecting certain signals from special sensors and controlling the E.G.R. solenoid valve in such a way as to adjust recirculation according to the different engine parameters.

The control unit receives the "key-operated" supply at pin 7 through the line of fuse **F15** of fusebox **G1**; pin 2 and pin 9 area earthed.

The potentiometer **L47** installed on the injection pump, detects the angular position of the accelerator lever and informs the control unit about the engine load.
The rotation of the lever changes the internal resistance of the potentiometer, therefore, with a supply at 3.7± 0.2 V constant supplied by the control unit from pins 8 and 6, output voltages are obtaied varying between 0.57 V at idle speed. to 1 ÷ 2.9 V at full load: this signal is sent to pin 5 of **N65**.

The rpm sensor **L16** fitted on the gearbox cover in correspondence of he flywheel ring gear. is a passive. electromagnetic detector: at the passage of each flywheel tooth, it supplies a sinusoidal shaped voltage signal, which is variable in amplitude and frequency according to the engine rpm: signal sent to pin 1 of **N65**

Sensor **S56** is fitted on the thermostat body with the sensitive part in contact with the coolant fluid. This comprises an NTC resistance which changes its resistance inversely proportionately with the temperature: pin 4 of **N65**.

The Borg Warner solenoid valve **L46** is connected to the pneumatic system of the E.G.R. by a vacuum takeoff, leading from the servobrake vacuum pump, with an output to be connected to the Pierburg E.G.R. valve and with two atmospheric pressure takeoffs which draw from a filter (for further details see GROUP 10 - ENGINE SUPPLY -).

The solenoid valve is driven directly by the electronic control unit **N65** - pin 11 - with a square wave signal at a frequency of 140 Hz, a voltage of 12V and a variable Duty- Cycle which determines a current of from 0 to appr. 800 mA, condition in which the maximum vacuum rate is transmitted to the Pierburg valve.

Lastly at pin 8 of **N65** the diagnosis connector **T12** is connected.

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** of the fusebox **F15**.

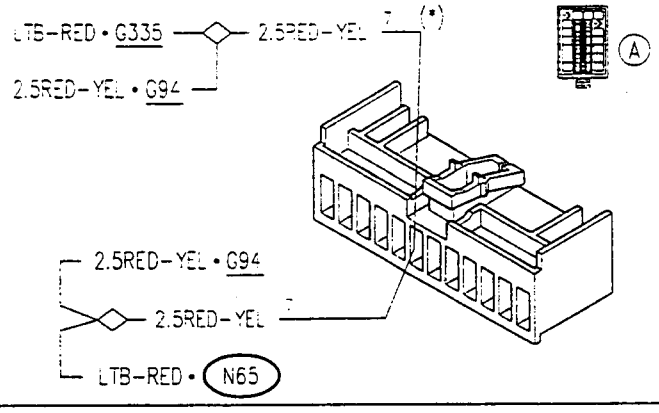
Adjustment takes place with the following logic:

- 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.

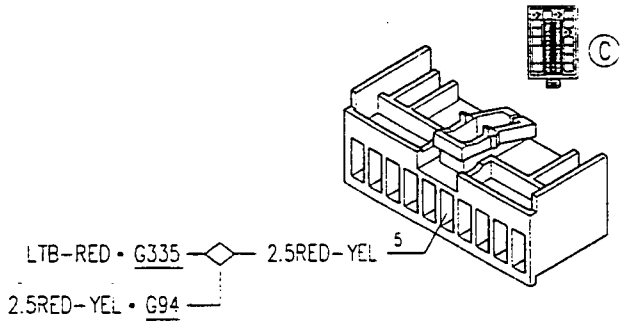
For further details, refer to this subject in Group 10 "ENGINE - SUPPLY".

COMPONENTS AND CONNECTORS

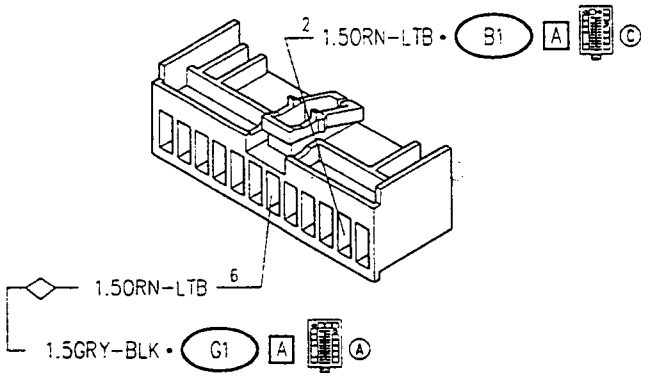
Fusebox — G1 A



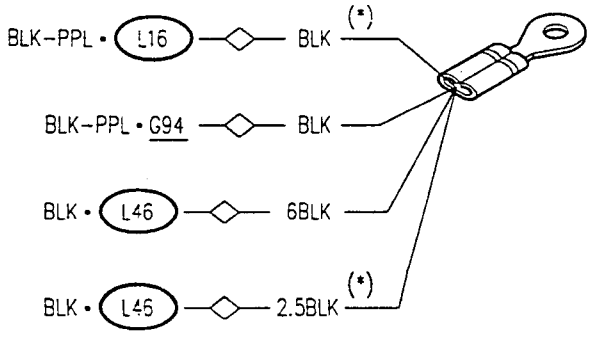
Fusebox — G1 G



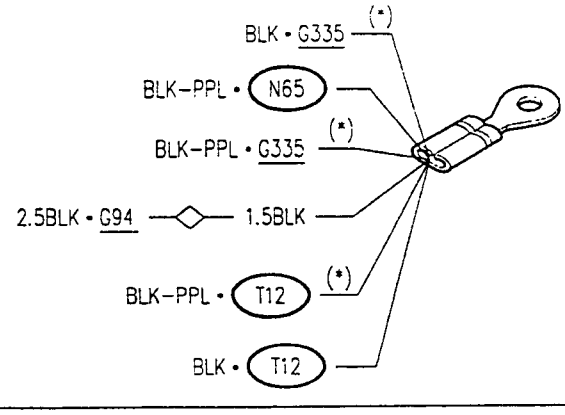
Fusebox — G1 H



RH engine compartment earth — G53a



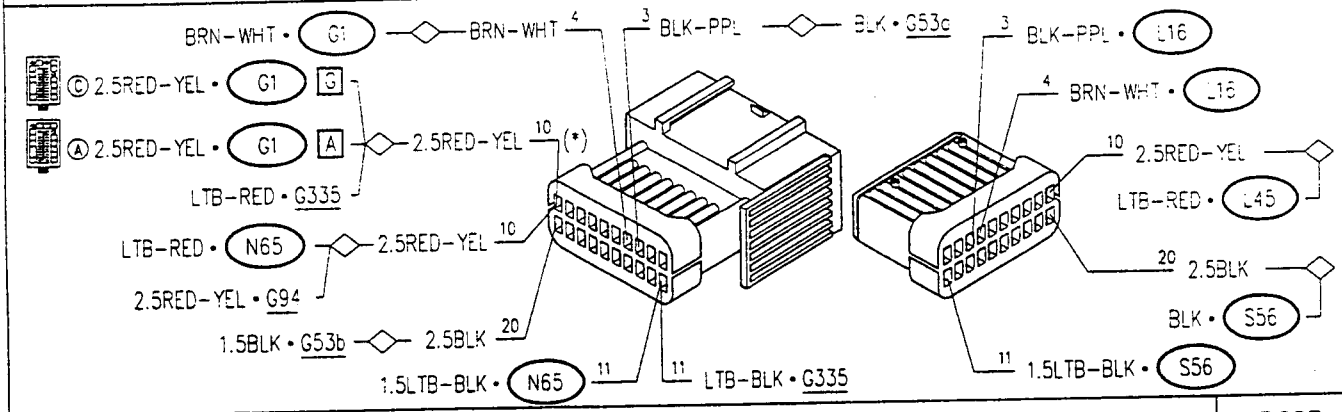
LH engine compartment earth — G53b



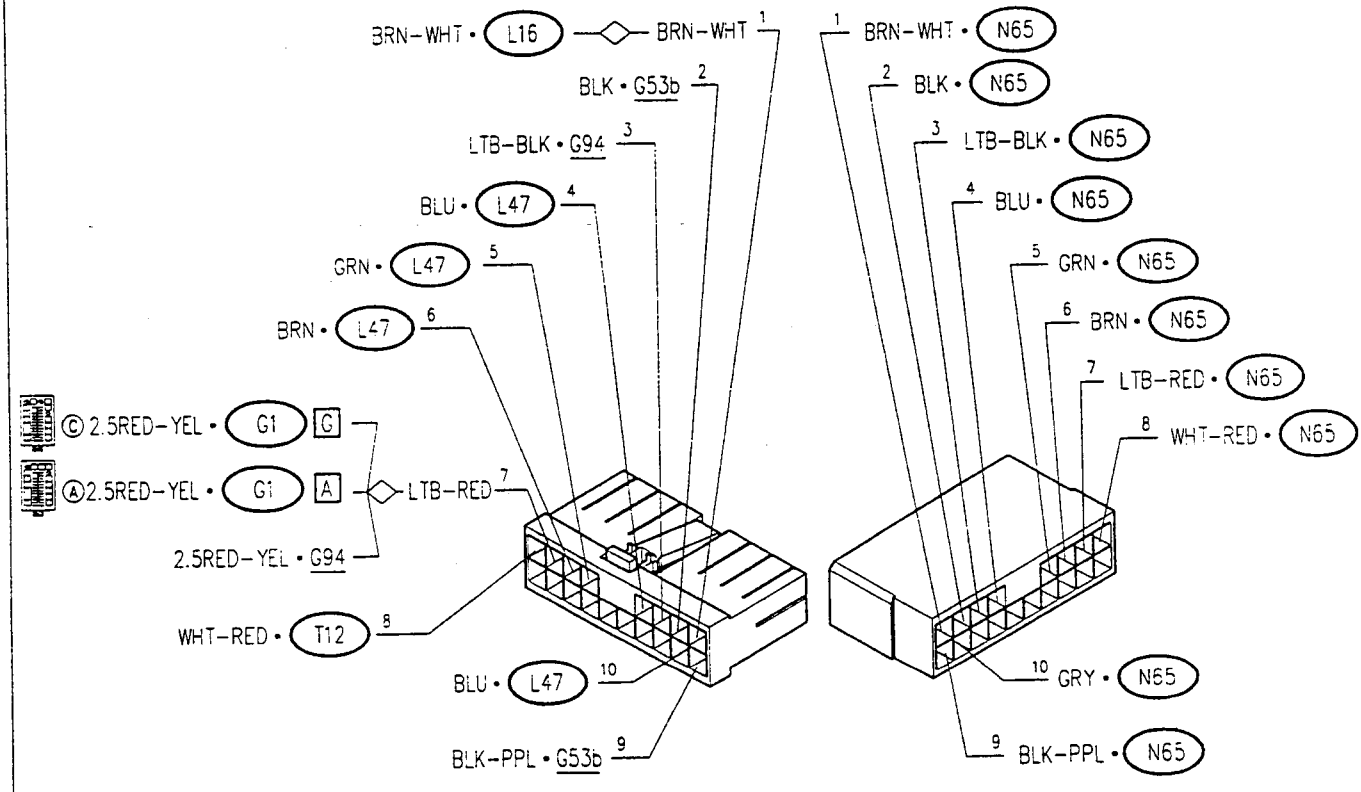
(*) from chassis no. ...

COMPONENTS AND CONNECTORS (contd.)

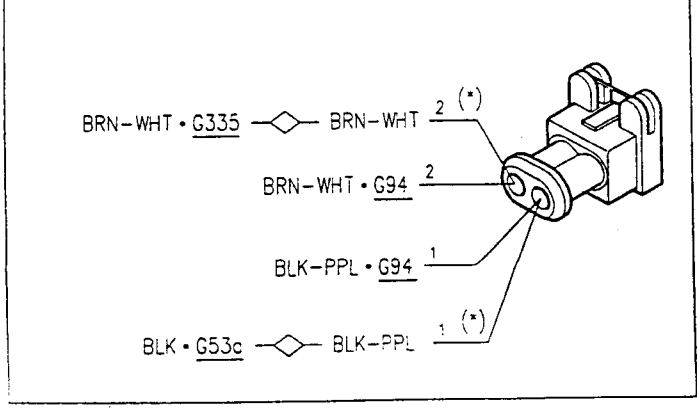
Engine compartment connector — G94



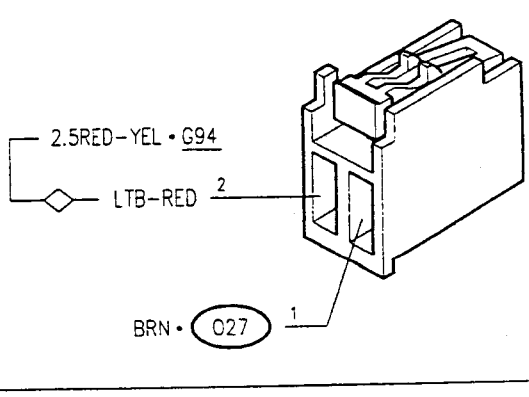
E.G.R. connector — G335



Rev counter sensor — L16



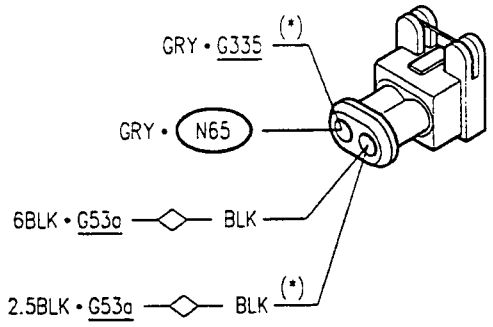
K.S.B. water temperature sensor — L45



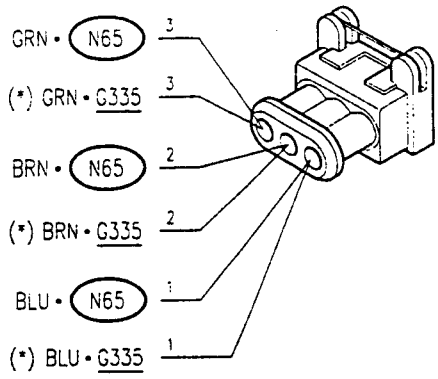
(*) from chassis no. ...

COMPONENTS AND CONNECTORS (contd.)

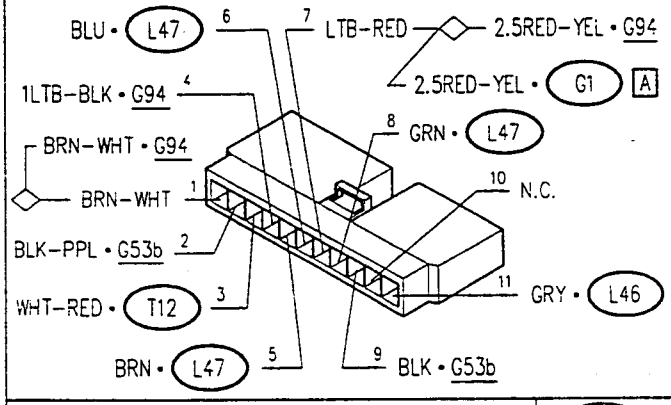
E.G.R. control solenoid valve — L46



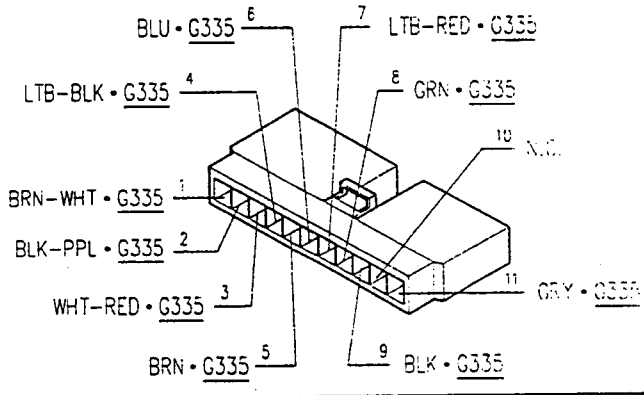
Potentiometer for E.G.R. — L47



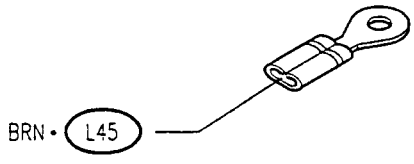
E.G.R. control unit — N65



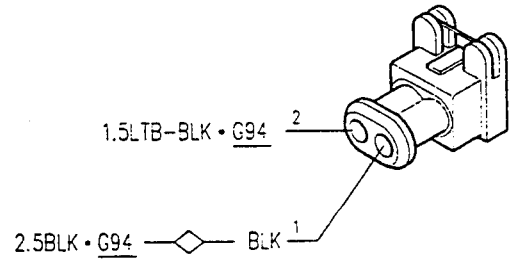
E.G.R. control unit (*) — N65



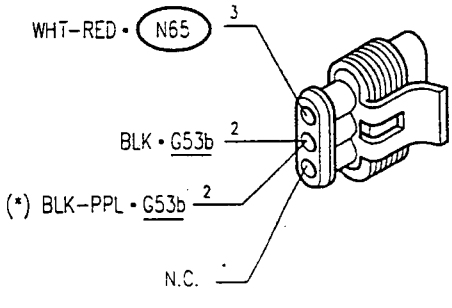
K.S.B. device — O27



Water temperature sensor for E.G.R. — S56

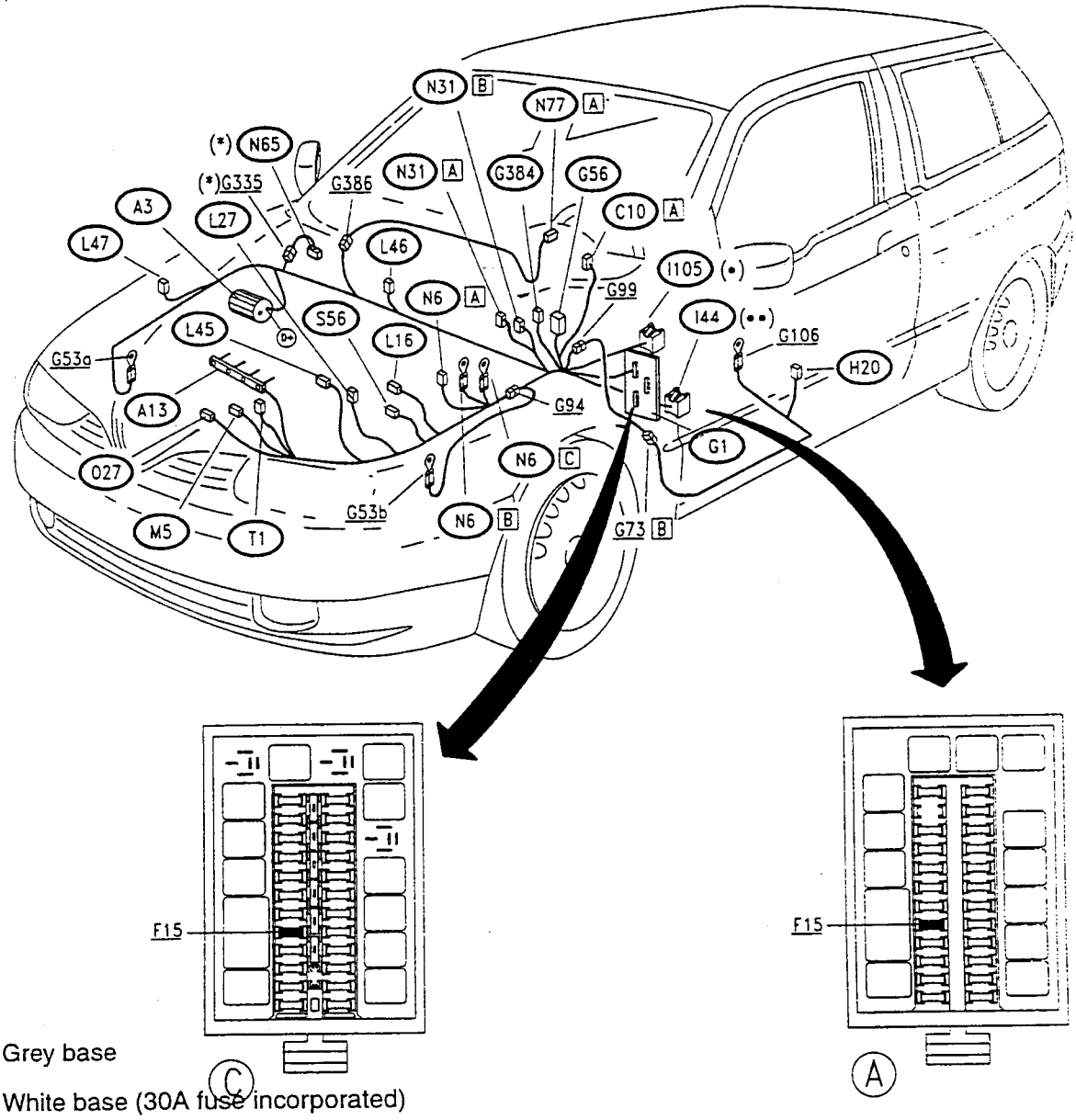


Connector for ALFA TESTER (E.G.R.) — T12



(*) from chassis no. ...

LOCATION OF COMPONENTS



(•) Grey base

(••) White base (30A fuse incorporated)

(*) From chassis no. ...

FAULT-FINDING TABLE

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

Fault	Component to be checked											
	A1	H20	M5	A13	N6	L27	C10 (2)	N31	I44	L45	O27	N65 (3)
Engine fails to start (1)	•	•	•	•	•							
Glow plugs not working properly				•	•	•						
Glow plug warning light fails to light up when starting					•		•					
The engine fails to start regularly when cold				•				•	•			
The cold engine fails to "deliver" when accelerating										•	•	
Engine fails to stop			•									
High levels of emission at the exhaust					•							•

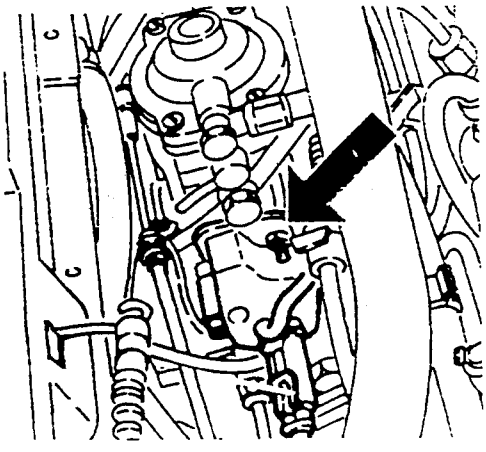
(1) If the engine fails to start, check - as described - firstly the battery **A1** or, especially after a crash, even slight or sharp braking, the inertial switch **H20** and the electromagnet **M5**. Also check the ALFA ROMEO CODE system (see section: "ALFA ROMEO CODE").

(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) The E.G.R. control unit **N65** is fitted with self- diagnosis which may be used through the Alfa Tester - See: FAULT FINDING - , before connecting with the Tester, carry out TEST B

CHECKING COMPONENTS

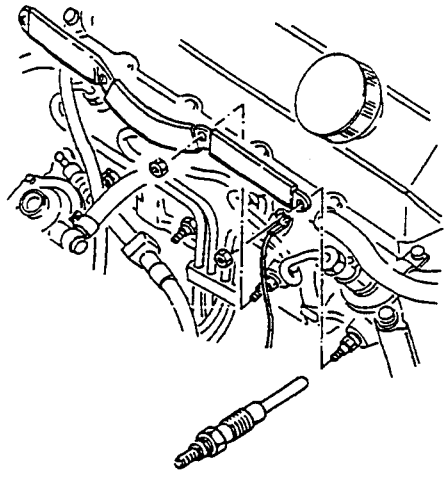
Engine stop device (M5)



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

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

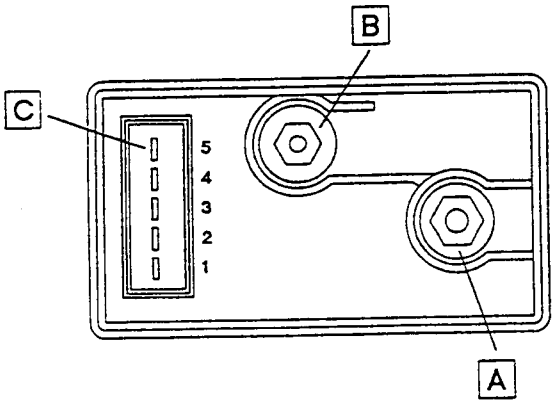
Glow plugs (A13)



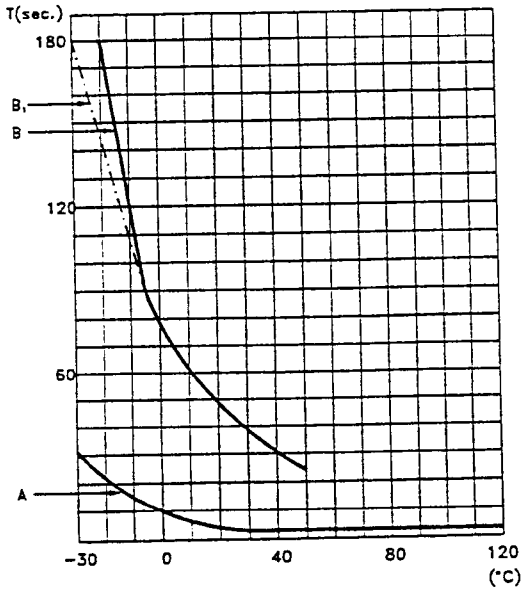
SPECIFICATIONS	
Internal resistance	~ 0.6 Ω
Check the correct fastening and cleaning of the conductor bars connecting the glow plugs	

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 (N6)

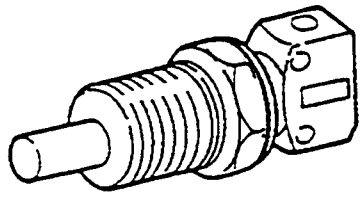


Check the device: see **test A**



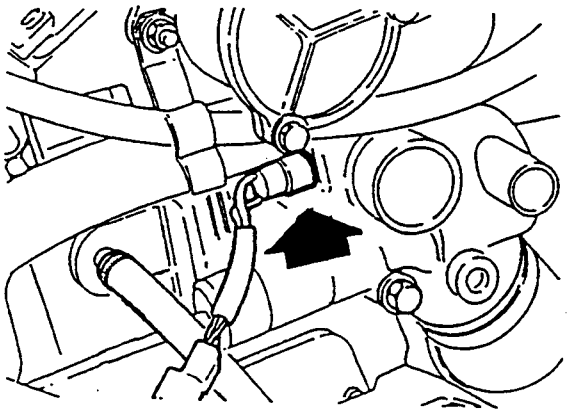
Changes of the glow plug warming time
– Curva A shows the warming times (glow plugs supplied warning light on) depending on the engine cooling water temperature. Warming must not be interrupted for engine water temperatures below 80°C
– **"Maintenance" time** (glow plugs supplied warning light off) = 10 sec. constant counted starting from the instant the warning light goes out.
– Curve B **shows the after-warming times (glow plugs supplied warning light off) counted starting from the instant the engine is started. At the end of the after-warming phase the device cuts itself off. (B1 = permissible after-warming curve).**

Water temperature sensor for warming glow plugs (L27)



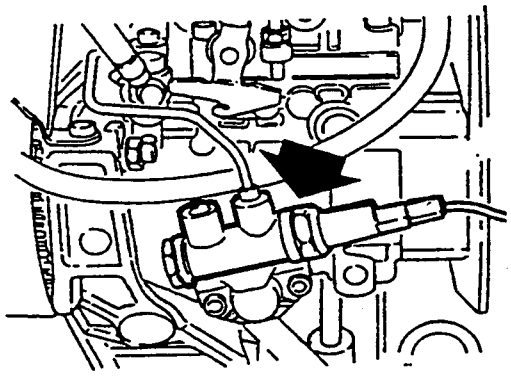
SPECIFICATIONS	
Temperature	Resistance
-10°C	8100 ÷ 10770 Ω
+20°C	2280 ÷ 2720 Ω
+80°C	292 ÷ 362 Ω

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; as the supply ceases, it must open again

PRELIMINARY CHECK FOR E.G.R. SYSTEM	TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK FUSE – Check the intactness of fuse **F15** at the fusebox **G1**	OK ▶ OK ▶	Carry out step **B2** Replace the fuse (15A)
B2 CHECK VOLTAGE – Check for **12 V** with the key turned at pin 7 of **N65**	OK ▶ OK ▶	Carry out step **B3** Restore the wiring between **G1**, connector A and **N65**
B3 CHECK EARTH – Check that pins 2 and 9 of **N65** are earthed (OV)	OK ▶ OK ▶	CONTINUE DIAGNOSIS USING THE ALFA ROMEO TESTER. Restore the wiring between **N65** and earth **G53b**