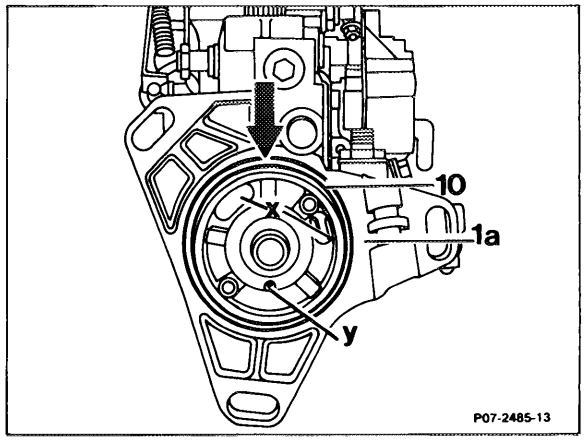
A. Lubrication of injection pump

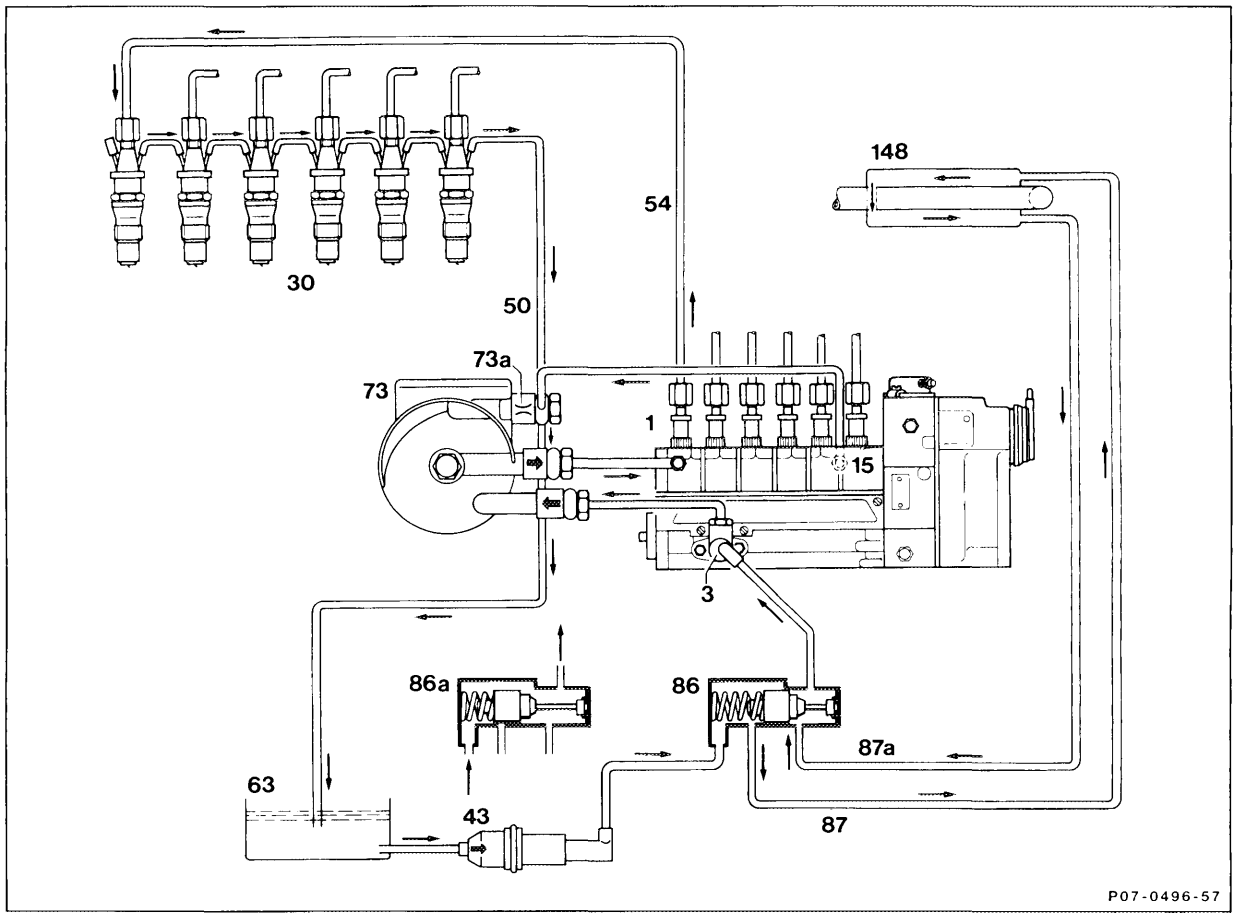
The injection pump is connected through an oil passage (arrow) to the engine oil circuit. The oil flows back into the crankcase through the annular gap (x) between bearing and housing.

The O-ring (10) on the flange (1a) acts as a seal. The drilling (y) serves to relieve oil from the radial seal.



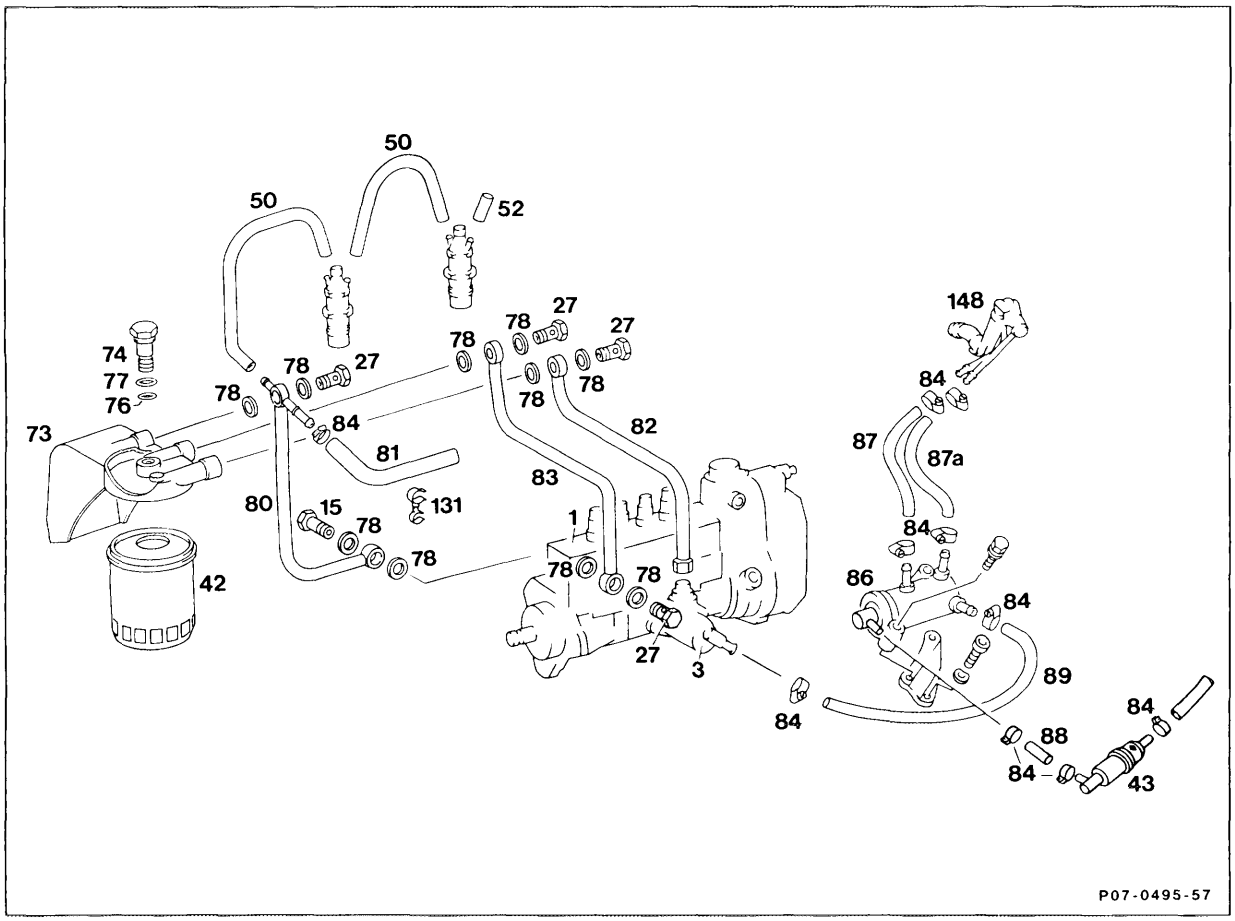
B. Fuel circuit

a) Fuel circuit diagram



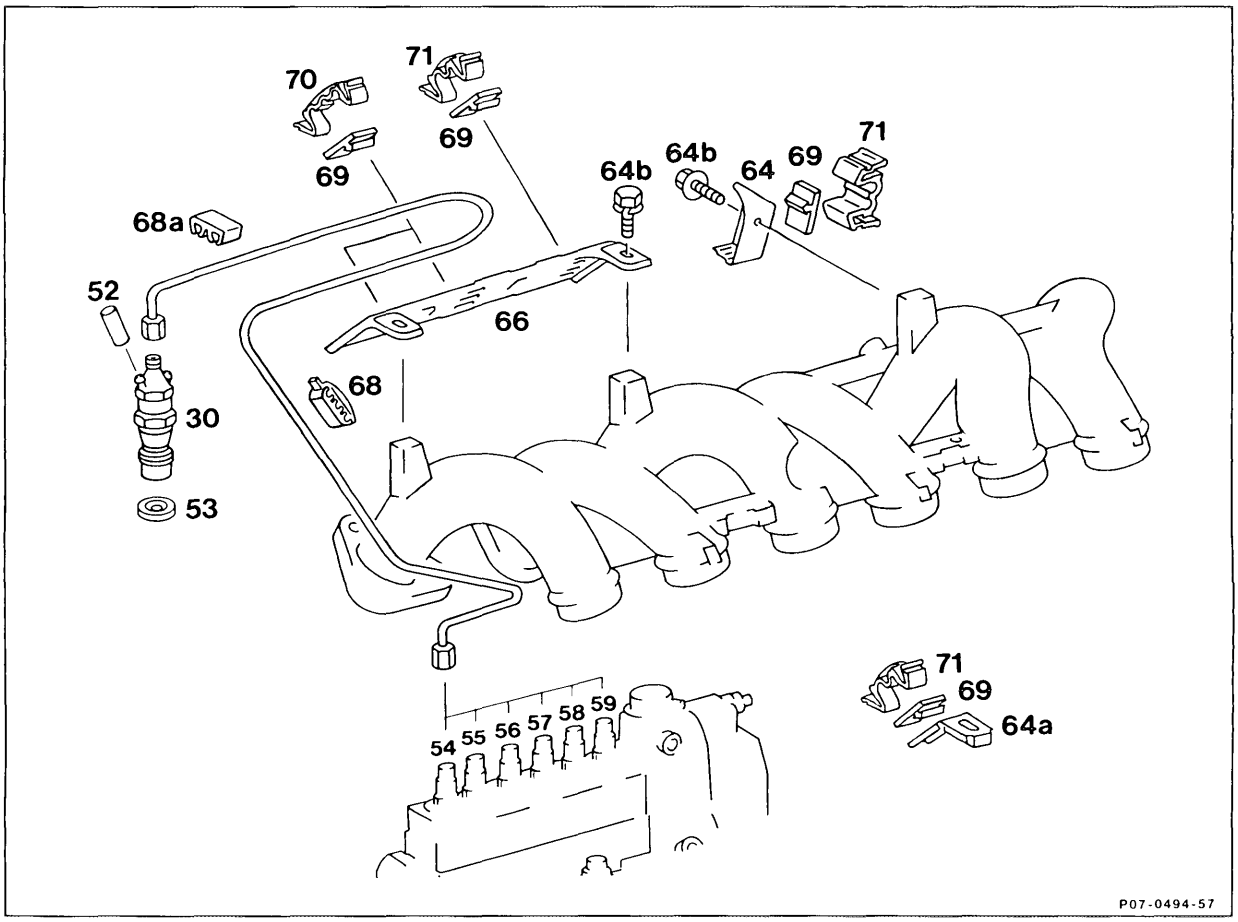
1	Injection pump	73a	Restriction orifice in fuel filter top section Ø 0,8 mm
3	Fuel pump	86	Fuel thermostat open, position up to + 8 °C, fuel is preheated
15	Bypass valve with restriction Ø 1,5 mm	86a	Fuel thermostat closed, position from + 25 °C, fuel is no longer preheated
30	Injection nozzles	87	Inlet line - cold fuel
43	Fuel prefilter	87a	Return line - preheated fuel
50	Fuel leak-off hose	148	Heater inlet pipe with fuel heat exchanger
54	Injection line, No. 1 cylinder		
63	Fuel tank		
73	Fuel filter top section		

b) Low-pressure side



1	Injection pump	80	Return line
3	Fuel pump	81	Fuel hose return line
15	Bypass valve with restriction Ø 1,5 mm	82	Fuel filter inlet line
27	Hollow screw	83	Injection pump inlet line
42	Fuel filter	84	Hose clip
43	Fuel prefilter	86	Fuel thermostat
50	Fuel leak-off hose	87	Fuel heat exchanger inlet line
52	Plug	87a	Fuel heat exchanger return line
73	Fuel filter top section	88	Fuel thermostat inlet line
74	Fuel filter hollow screw	89	Fuel pump suction line
76	O-ring	131	Plastic holder
77	Fuel filter seal	148	Heater inlet pipe with fuel heat exchanger
78	Seal		

c) High-pressure side



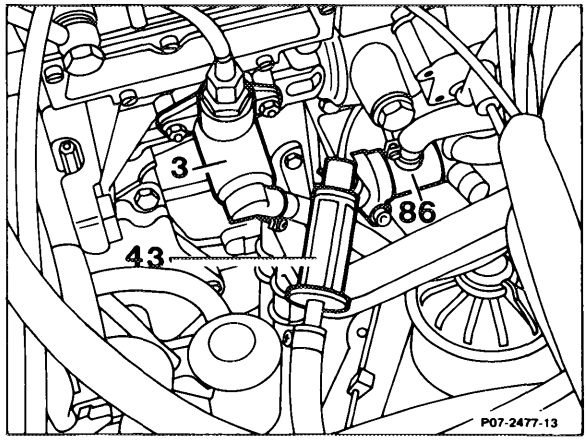
30	Injection nozzle - complete	64	Bracket, cylinder 4, nozzle end
52	Plug	64a	Bracket, cylinder 4, injection pump end
53	Nozzle shim	64b	Bolt
54	Injection line 1	66	Line mounting bracket
55	Injection line 2	68	Plastic clips for 3 lines
56	Injection line 3	68a	Plastic clips for 2 lines
57	Injection line 4	69	Rubber base
58	Injection line 5	70	Plastic holder for 3 lines
59	Injection line 6	71	Plastic holder for 2 lines

Note

Injection lines for cylinders 2-6 are not illustrated.
Bracket for injection lines of cylinders 5-6 as bracket of cylinder 4.

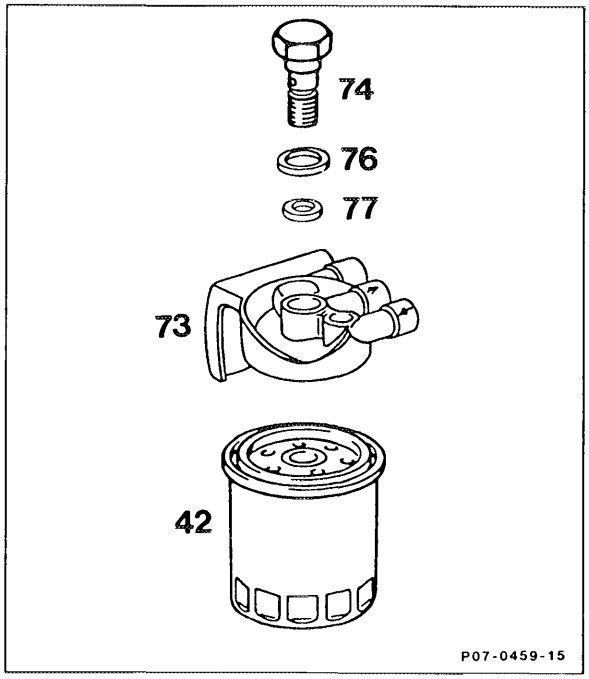
C. Fuel prefilter (43)

Installed in the suction line upstream of the fuel pump (3). The filter housing is of transparent plastic.
The mesh size is 600 µm (0.6 mm).



D. Fuel filter (42)

The fuel filter is installed in the pressure line between fuel pump and injection pump.
The paper filter element is integrated in a metal housing. The element has a mean pore width of 6-10 µm (0.006-0.01 mm).

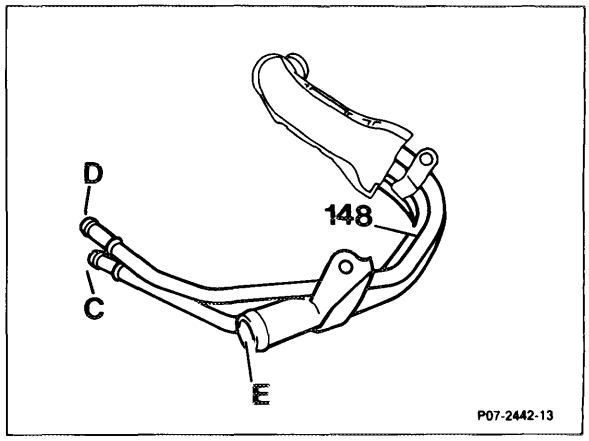


42	Filter
73	Fuel filter top section
74	Bolt
76	O-ring
77	Sealing ring (alu)

Note
When the engine is started, the fuel system is bled automatically due to increased delivery of the fuel pump and the restrictions in the top section of the filter as well as at the injection pump.

E. Fuel preheater (148)

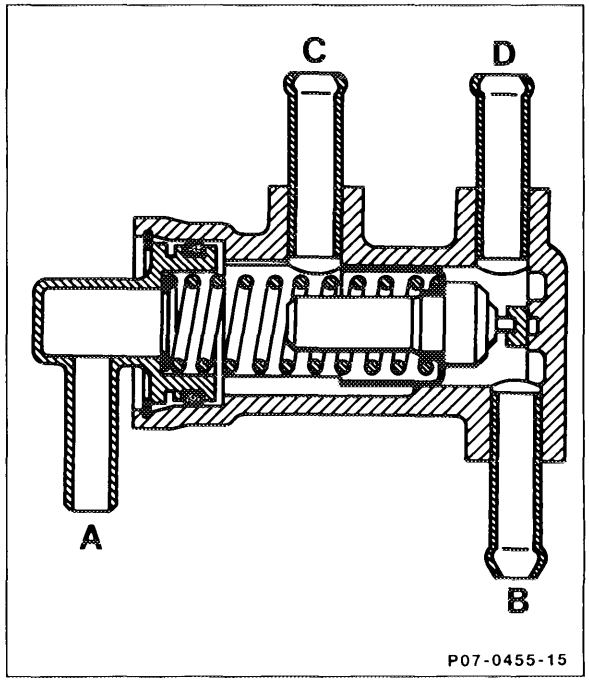
A heat exchanger (148) is installed in the inlet line of the heater in order to preheat the fuel.



Heat exchanger
C Inlet line
D Return line
E Heater inlet
148 Heat exchanger

Function

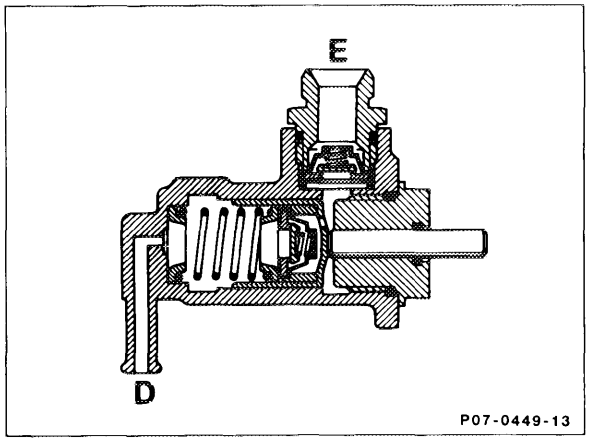
Full preheating up to + 8 °C fuel temperature; the required fuel is drawn in through the heat exchanger by the fuel pump.
From + 8 °C to + 25 °C mixed operation; the required fuel flows partially through the heat exchanger.
Above + 25 °C the heat exchanger is bypassed by the thermostat; the fuel is drawn in directly by the fuel pump. Fuel preheating ensures trouble-free operation with winter-grade diesel fuel as a rule down to approx. - 25 °C ambient temperature.



Fuel thermostat
A Inlet line from fuel tank
B Suction line to fuel pump
C Inlet to heat exchanger
D Return line from heat exchanger

F. Fuel pump (3)

As a result of the high delivery of the fuel pump, the fuel system is self bleeding, which eliminates the need for a hand priming pump. Delivery > 150 cm^3/30 s, at a starting speed > 150/min, measured in the fuel return line.

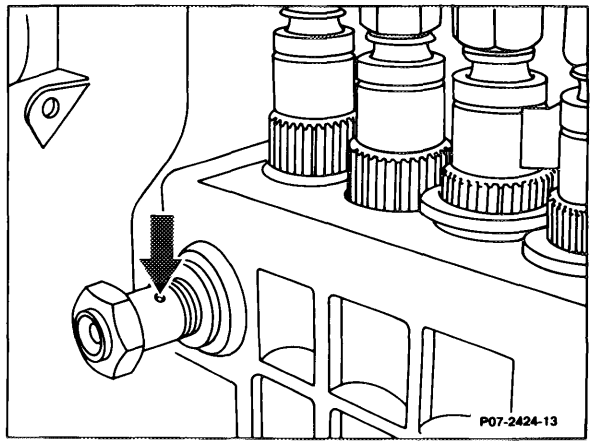


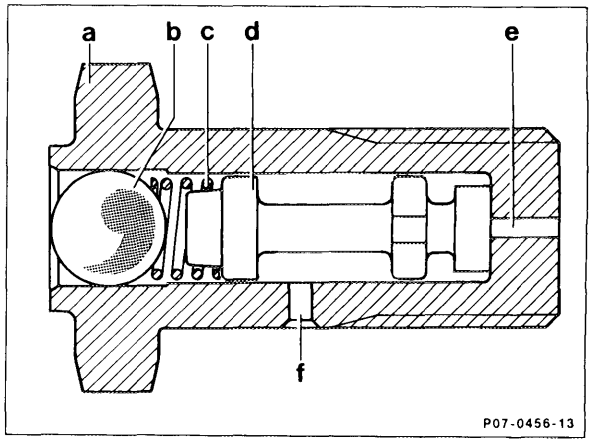
E Pressure side
D Suction side

A restriction in the bypass valve at the injection pump is required for bleeding the injection pump.

Bypass valve with restriction 1,5 mm dia. (arrow).

The bypass valve prevents unfiltered fuel flowing along the return line into the injection pump if the inlet line is clogged (e.g. filter).

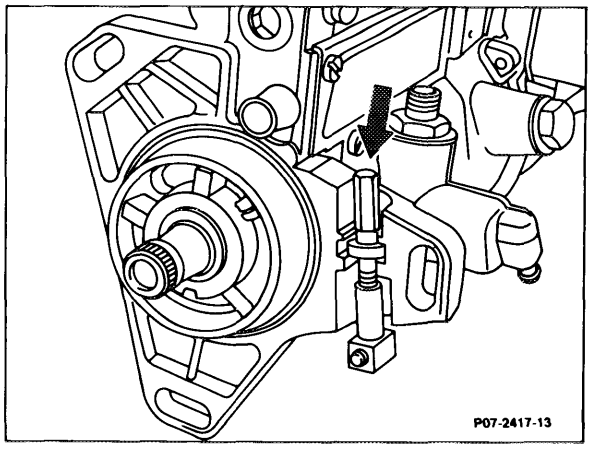




Restriction with bypass valve
a Housing
b Ball
c Spring
d Slide
e Inlet
f Restriction orifice 1,5 mm dia.

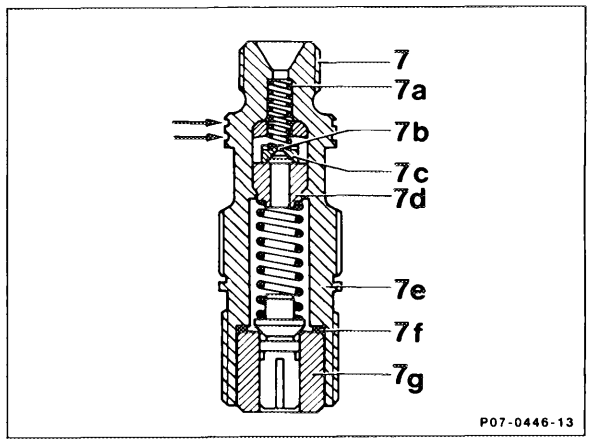
G. Start of injection adjusting equipment

An adjusting device (arrow) is attached to the injection pump flange in order enabling adjustment of the start of delivery while the engine is running.



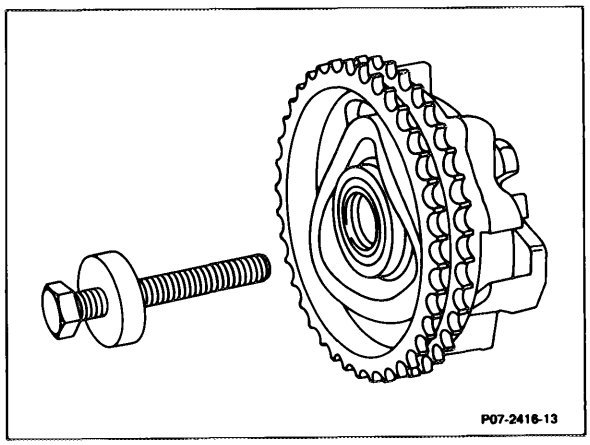
H. Reverse flow damping valve in delivery valve holder

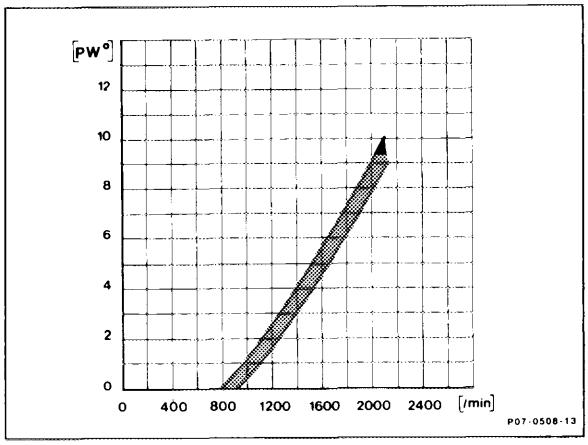
Reverse flow damping valves (7b) are installed in the delivery valve holders (7) of the injection pump in order to reduce the hydrocarbon content in the exhaust gas through prevention of afterspraying of the injection nozzles.
Two annular grooves act as identification marks on the delivery valve holder (7) (arrows). The reverse flow damping valve (7b) is a disc valve (7c) opening in the direction of the injection nozzle with a restriction orifice of 0.5 mm dia.. The valve seat (7d) is riveted into the delivery valve holder.



I. Timing device

The time device is mounted on the injection pump shaft and is attached with a central bolt having a **left-hand thread**.





Timing device adjustment curve
n = rpm of injection pump
PW° = Adjustment angle of injection pump

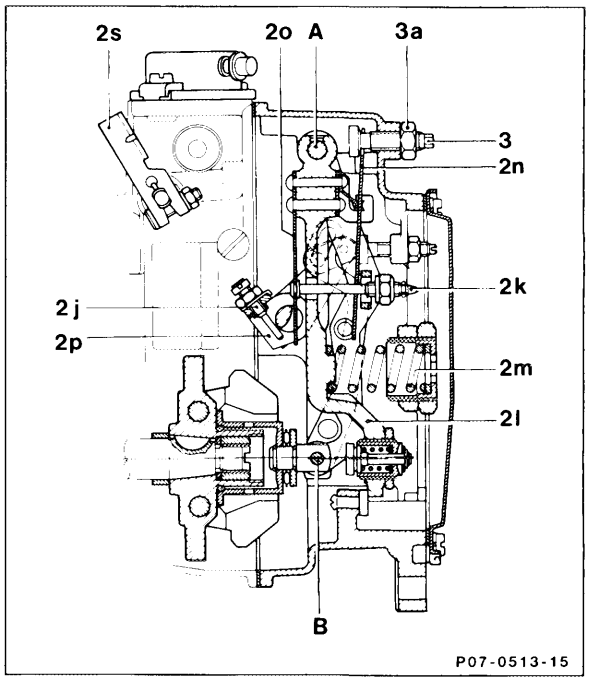
J. RSF governor

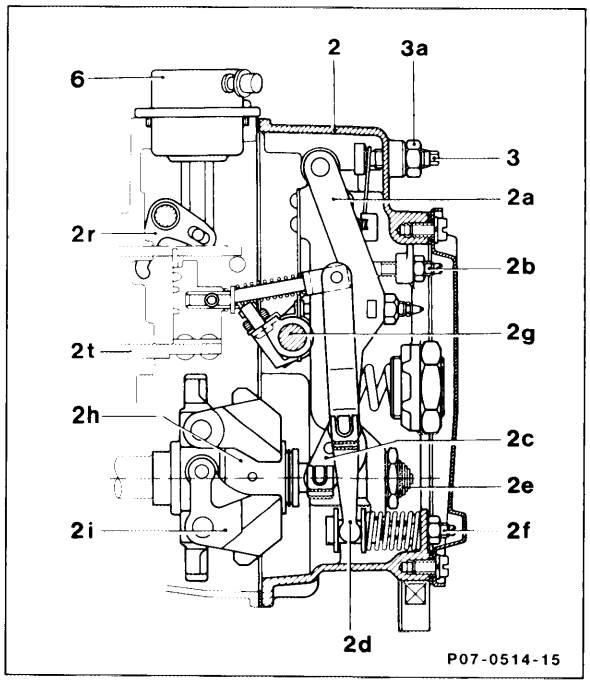
a) Design and operating principle

The governor is a minimum/maximum speed governor. Its governor spring (2m) is sized and set in such a way that it does not govern in the part load range, with the exception of torque control (refer to "Control when starting and at full load").

In the part load and full load range, the control rod (2t) of the injection pump is operated only from the accelerator pedal, which is connected through the accelerator control linkage to the control lever (2g) of the governor.

The position spring (2n) is pretensioned and the position speed set by the adjusting screw (3).





2 Governor
2a Guide lever
2b Stop screw for position quantity
2c Relay lever
2d Fulcrum lever
2e Spring retainer (torque control)
2f Full load adjusting screw
2g Control lever
2h Sliding sleeve
2i Flyweights (pump governor group)
2j Position auxiliary spring cutoff
2k Adjusting screw for position auxiliary spring (position stabilizer)
2l Tensioning lever
2m Governor spring
2n Position spring
2o Position auxiliary spring (position stabilizer)
2p Steering arm
2r Stop lever
2s Emergency stop lever
2t Control rod
3 Adjusting screw for position speed
3a Locking nut
6 Vacuum unit (stop)

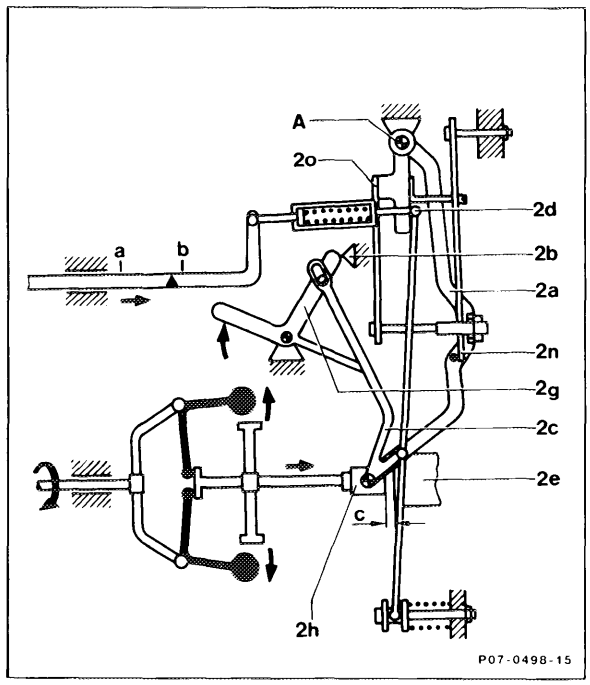
b) Control positions

Control lever (2g) rests against the idle stop screw (2b). As the engine speed increases, the sliding sleeve (2h) passes through the idle position. Guide lever (2a) swivels around the pivot point "A" and thus operates against the idle spring (2n).

At a certain engine speed, the guide lever (2a) moves against the adjusting nut of the idle auxiliary spring (2o). The movement of the sliding sleeve (2h) is transmitted through the relay lever (2c) and fulcrum (2d) in the same direction to the control rod of the injection pump.

After passing through the idle position, the sliding sleeve (2h) moves against the spring retainer (2e).

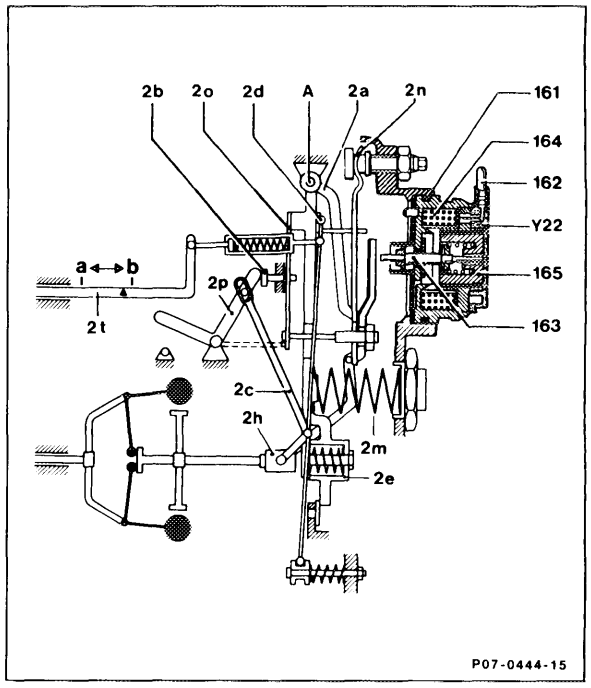
If the engine speed increases further (e.g. deceleration), above a certain engine speed, the spring retainer (2e) is over-compressed followed by the governor spring (2m) . The control rod is thus brought into the "stop position" (deceleration fuel cutoff).



a Start
b Stop
c Position stage

c) Control with actuator

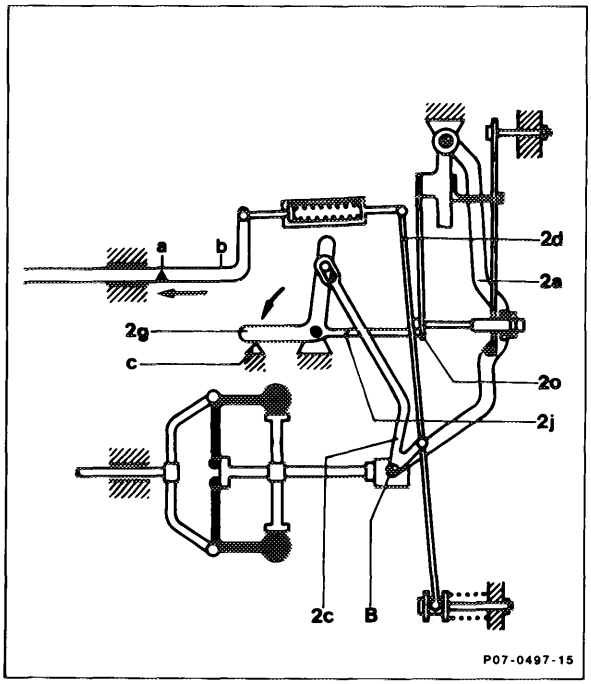
The lift rod (163) rests against the guide lever (2a). The actuator (Y22) is supplied by the electronic idle speed control unit with a clocked D.C. voltage in the frequency range of approx. 50 Hz. If engine speed drops (e.g. drive position engaged or power steering turned to full lock), the actuator is energized with a higher voltage. This causes the lift rod (163) to press against the guide lever (2a) and the control rod (2t) to move in the direction "a" **increased quantity.** As soon as the engine speed increases, the voltage is reduced and the control rod (2t) moves in the direction of "b" **reduced quantity.**



161 Seal
162 Electrical connection
163 Lift rod
164 Solenoid coil

d) Start position

If the control lever (2g) is moved against the full load stop (c) (fixed stop on governor housing) when the engine is not running, the relay lever (2c) moves around pivot point "B" and moves the fulcrum lever (2d) with it in the direction of Start. When the control lever is in the full load position (2g "Full throttle") the idle auxiliary spring (2o idle stabilizer) is pressed away from the guide lever by the idle cutoff auxiliary spring (2j). This enables a more rapid cutoff from the start position of the governor.



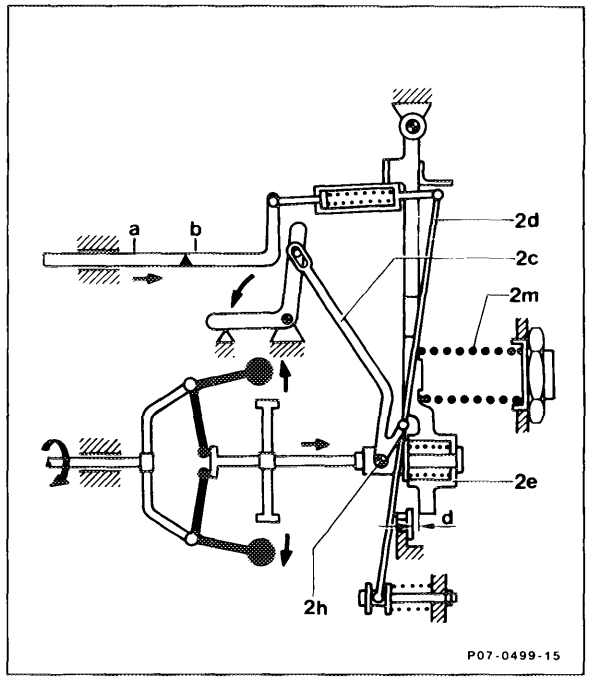
a Start
b Stop

e) Full load speed regulation / compensation

After passing through the idle step (c) (refer to ill. of control when at idle) the governor sleeve (2h) moves against the spring retainer (2e). This causes the relay lever (2c) and fulcrum lever (2d) to move the control rod of the injection pump into the full load position.

When a certain engine speed is reached, the spring retainer (2e) is over-compressed by a certain distance (d) (compensation).

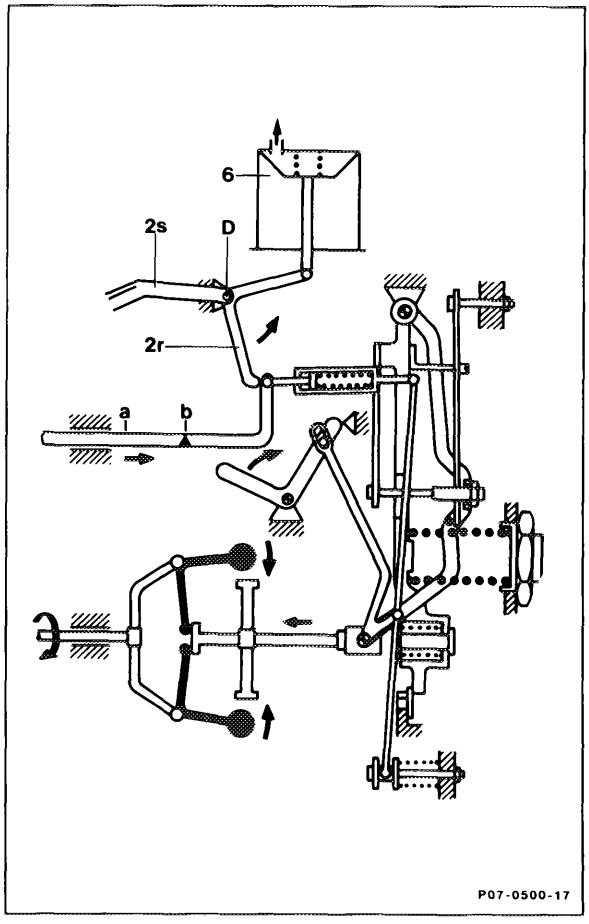
If the engine speed continues to rise, the force of the flyweights is sufficient to over-compress the governor spring (2m) (full load speed regulation). The start of cutoff depends on the preload of the governor spring (2m).



f) Engine stop

The vacuum unit (6) is pressurized with vacuum from the vacuum pump through the glow start switch of the vehicle. This causes the diaphragm of the vacuum unit to move against the compression spring.

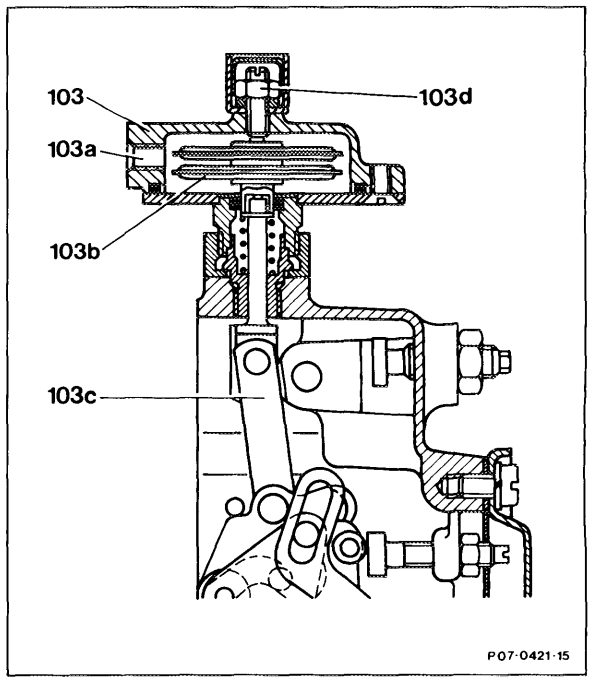
The vacuum unit (6) is connected to a stop lever (2r), which swivels about the pivot point "D", pulling the control rod of the injection pump into "Stop" position. This causes the deflecting spring of the fulcrum lever to be over-compressed. The control rod can be pulled into the "Stop" position from the outer side of the governor in the same way by means of the emergency stop lever (2s).



a Start
b Stop

K. Intake manifold pressure compensator (ALDA)

The intake manifold pressure compensator (ALDA device) is comprised of a housing (103) with barometer unit (103b). The absolute pressure acts upon the barometer units through a port (103a) to the charge air pipe of the engine. Accordingly, the barometer units react to each pressure change with a change of length. All movements are transmitted to the compound lever of the governor and to the control rod. As the absolute pressure drops, the barometer units expand. The correction linkage (103c) of the units is pressed downwards and acts on the compound lever to move the control rod in the direction of "reduced quantity". As the absolute pressure rises, caused by a higher air and/or charge pressure, the movement is performed in the opposite direction - i.e. in the direction of "increased quantity". As the effect of the ALDA device diminishes, the more the control lever is moved in the idle direction. When the control lever is in the idle position, the effect is approximately zero.

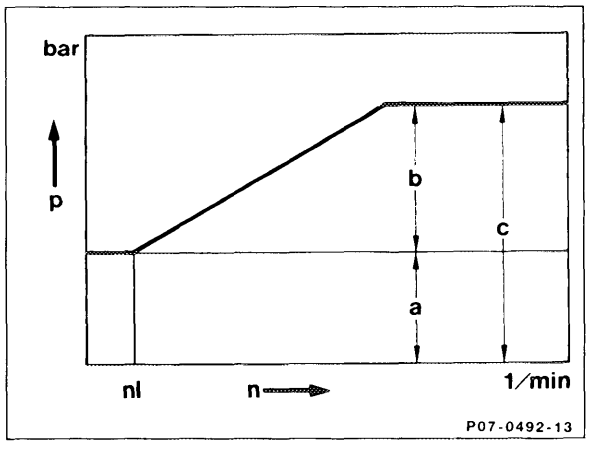


103d Adjusting screw
(factory-set by manufacturer)

Absolute pressure with charge operation

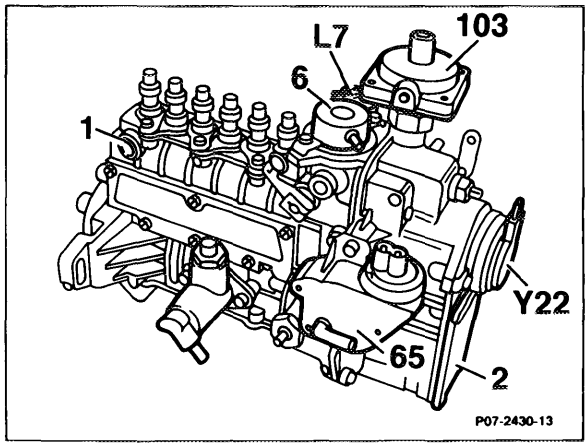
The intake air under atmospheric pressure is further compressed by the turbocharger. Atmospheric and charge pressure together produce the absolute pressure prevailing in the charge air pipe of the engine.

- nl Speed at the start of charge operation
- a Atmospheric pressure, corresponding to suction quantity
- b Charge pressure
- c Absolute pressure, corresponding to charge quantity
- n Engine speed
- p Pressure in bar



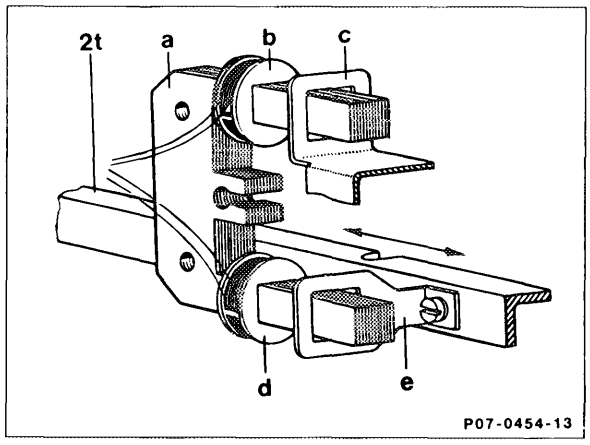
L. Control rod travel sensor (L7)

The control rod travel sensor is installed in the governor of the injection pump. It consists of an iron core, two coils (measured value and fixed value coil) and two short-circuit rings. It is connected to the electronic control unit by a 3-pin plug.
The coils (b) and (d) are attached to the iron core (a) which is fixed in the housing. The short-circuit ring (e) is connected to the control rod (2t) and is displaced with the control rod without touching on the bottom leg of the iron core. The fixed value coil (b) and the short-circuit ring (c) are attached to the top leg.



Function

The fixed value coil (b) with the short-circuit ring (c) represents a constant inductance. Depending on the change in position of the control rod (2t), the distance between the short-circuit ring (e) and measuring coil (d) changes. The variable inductance produced is then compared to the constant inductance. From this the electronic unit determines the control rod travel.



M. Reference impulse verification (RIV)

Two signals are required for checking start of delivery when the engine is running (dynamic).

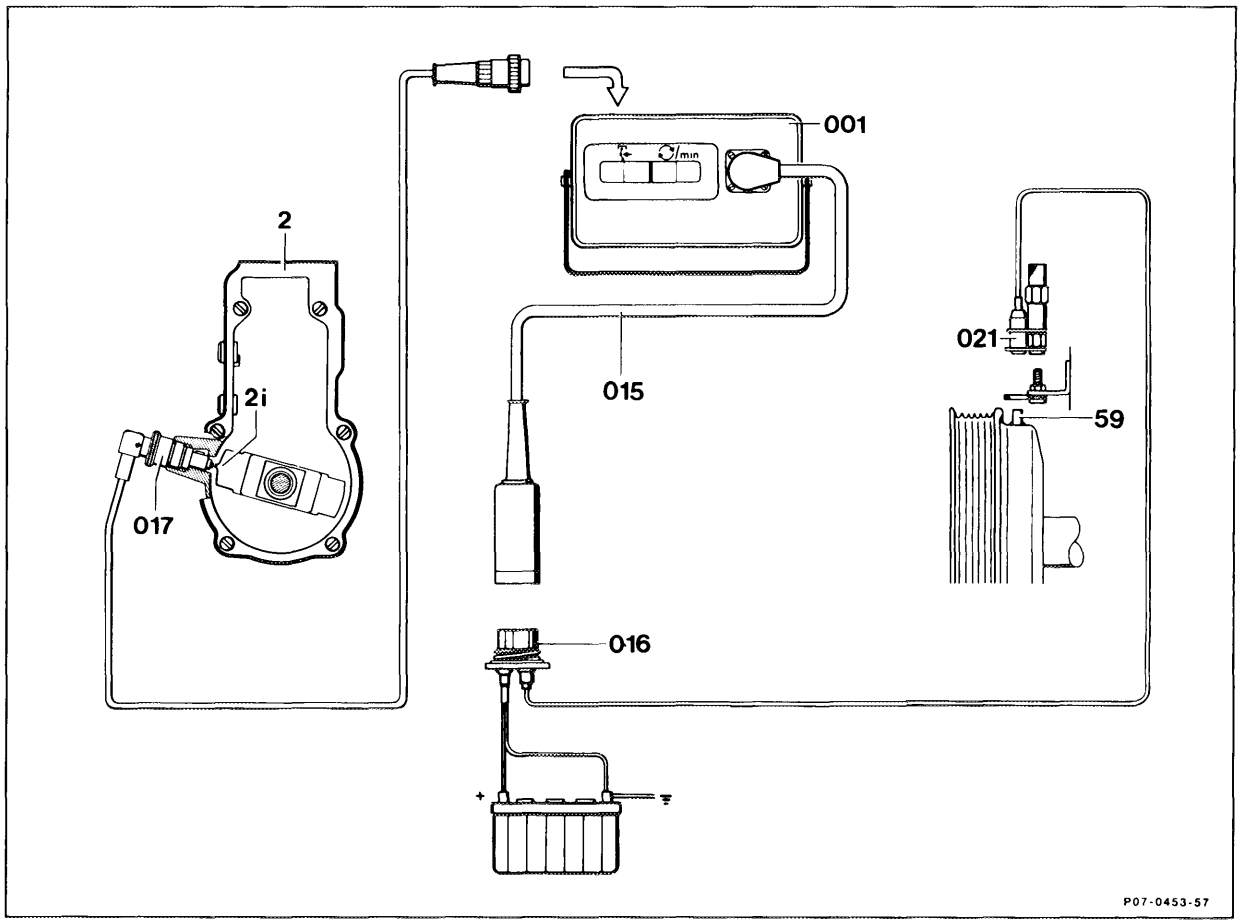
- TDC pulse from the crankshaft
- Reference impulse from the injection pump

Both pulses are supplied by pulse generators. To obtain a signal, the generator pins must be moved past the pulse generators at a minimum rate (position speed).

A measuring instrument measures the time gap of the two pulses and converts the result into an angular value, which is then indicated.

Note

The position sensor can be used, as for naturally aspirated engines, for checking the start of delivery when the engine is not running (stationary).



001	Digital tester	016	Diagnostic socket
2	Governor (injection pump)	017	RI generator
2i	Flyweight with RI generator pin	021	TDC generator
015	Test cable	59	TDC generator pin

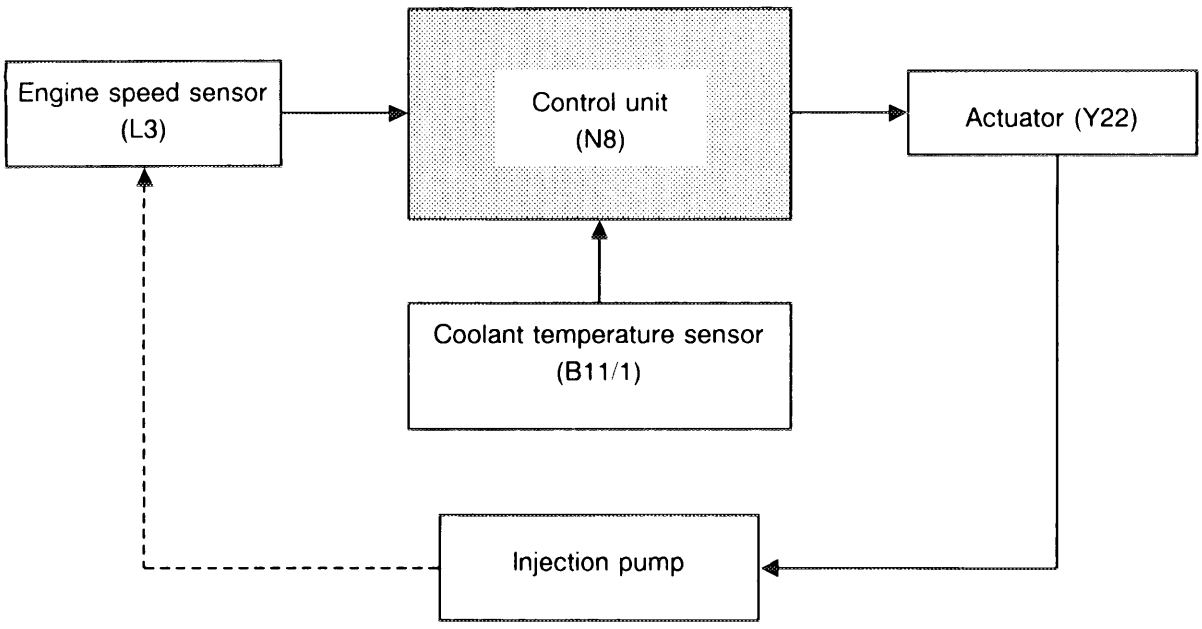
N. Electronic position speed control (ELR)

Function

The engine speed sensor (L3) detects engine speed (144 pulses/revolution) and passes this to the control unit (N8) in the form of an alternating voltage.

This processes the speed signal and performs a set/actual value comparison. Position speed is maintained at a constant level by the actuator (Y22) irrespective of engine load.

Set position speed is raised in accordance with a specified characteristic curve by the temperature sensor (B11/1) at coolant temperatures < 60 °C.



System diagnostics (Engine 602)
The ELR system can be tested by means of the self-test routine integrated into the control unit. A signal can be retrieved with the test connector (X92 or X11/4), which provides concrete information regarding a component fault. The number of signals indicates whether and which component is faulty, or whether the components in the control loop are faulty.

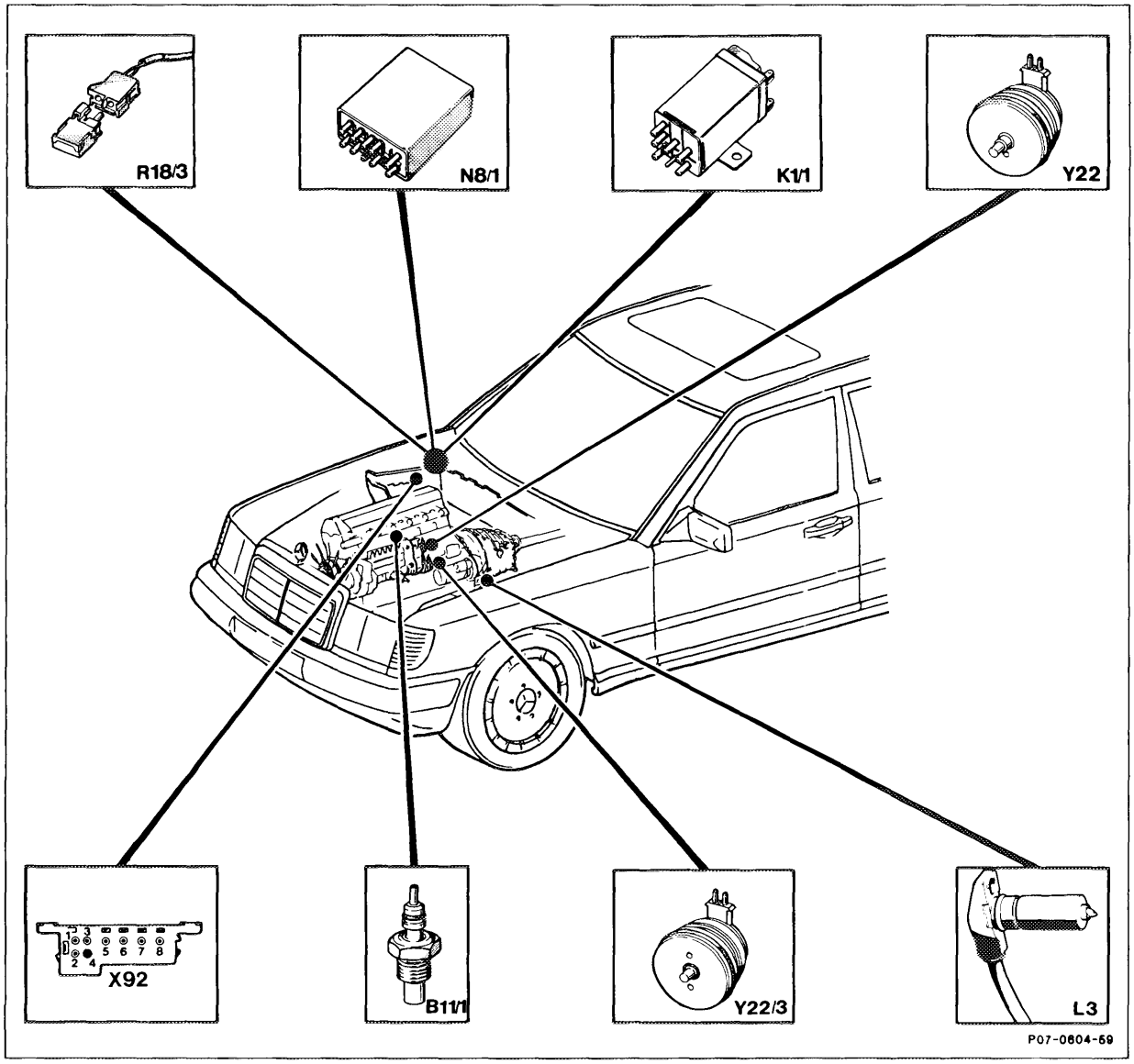
Note
Engine 603 is fitted with the control unit having system diagnostics as of a later date.

Production breakpoint:
Control unit with "**RO2**" 05/88.

Pulse read out	Component
1	All functions "in order"
2	Engine speed signal "fault"
3	Coolant temperature "fault"
6	ELR control loop "fault" [1])

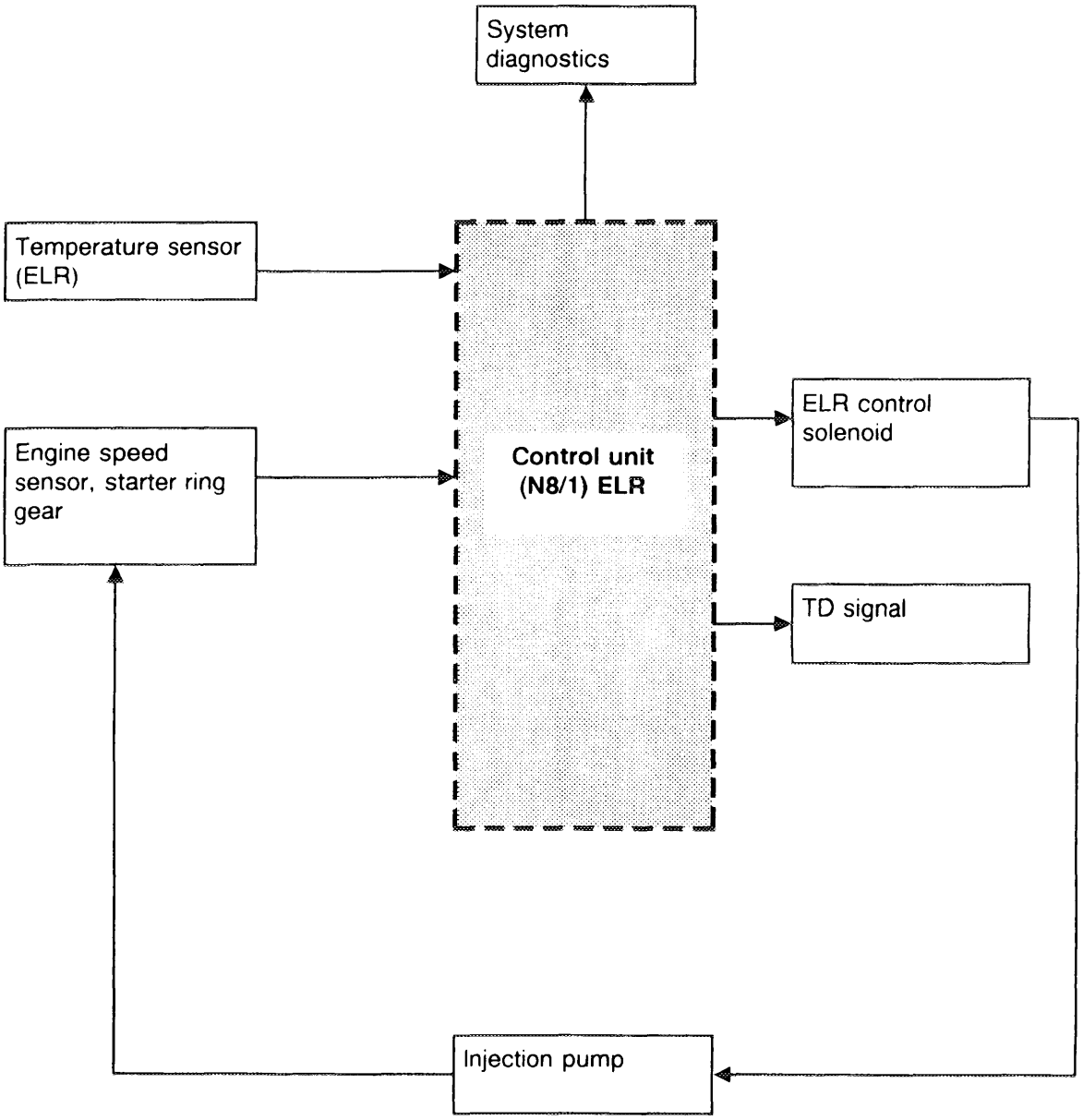
[1]) Only short-circuit faults are detected on control units with the designation "RO1". Control units with "RO2" also detect interrupt.

Location of components



B11/1	Coolant temperature sensor	N8/1	ELR control unit
K1/1	Overvoltage protection	X92	Test connector
L3	Engine speed sensor	Y22	ELR actuator
L3x	Engine speed sensor plug connection		

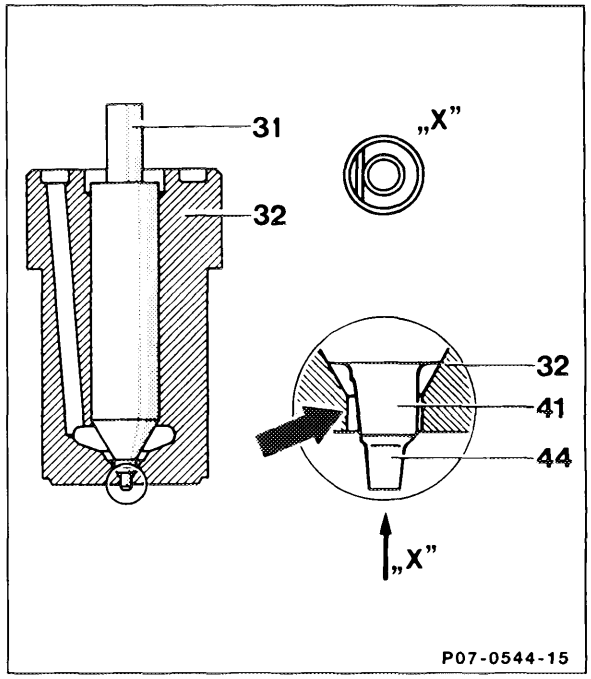
ELR block diagram



O. Facet pintle nozzle

Bosch Designation DN 0 SD 265

The facet pintle nozzle differs from the pintle nozzle in having an oblique face angled at approx. 6° (arrow) on the throttling pintle (41), which improves the throttling effect.

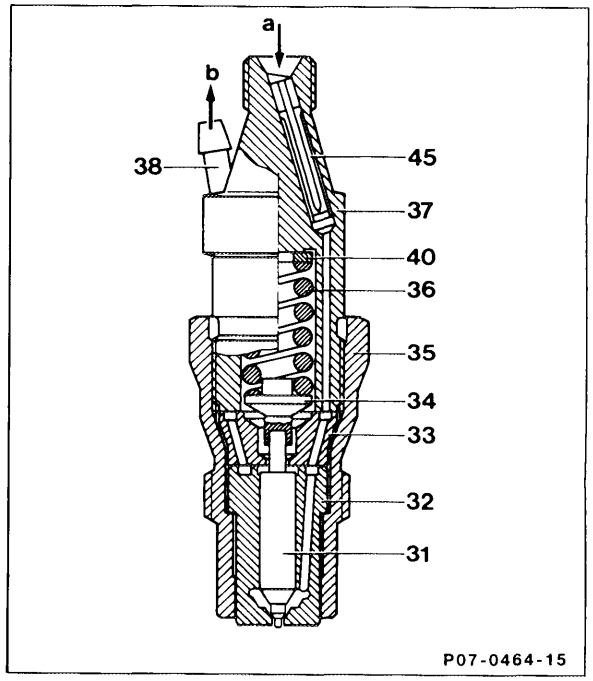


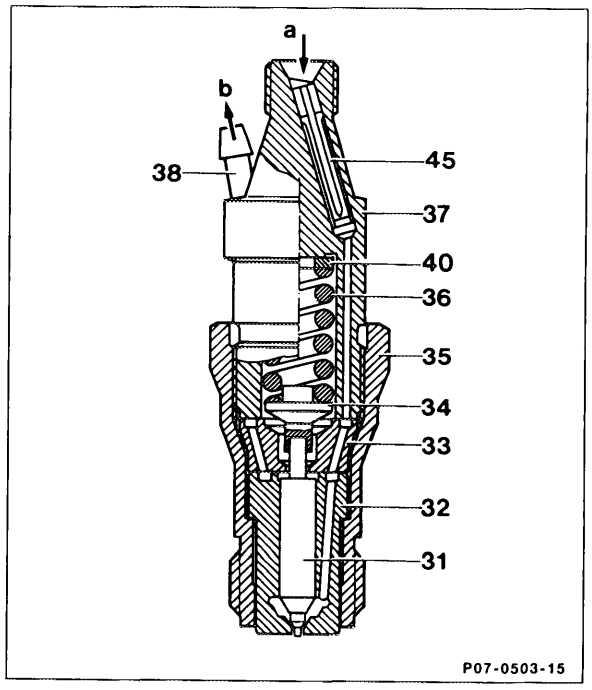
31 Nozzle needle
32 Nozzle body
41 Throttling pintle
44 Spray pintle

P. Nozzle holder

Bosch Designation:
KCA 27 S 55, for oblique injection
KCA 30 S 44, for vertical injection

The thickness of shim (40) determines the pre-load of the compression spring (36) and thus the opening pressure of the injection nozzle. The opening pressure can be set by fitting shims of different thicknesses. The fuel flows to the nozzle seat through the respective inlet orifice (a) in the holder (37), intermediate disk (33) and injection nozzle. During the injection process, the injection pressure raises the nozzle needle, and fuel flows through the annular orifice at the throttling pintle into the pre-chamber. Once the injection pressure drops, the compression spring (36) pushes the nozzle needle (31) back down onto its seat; the injection process is completed.



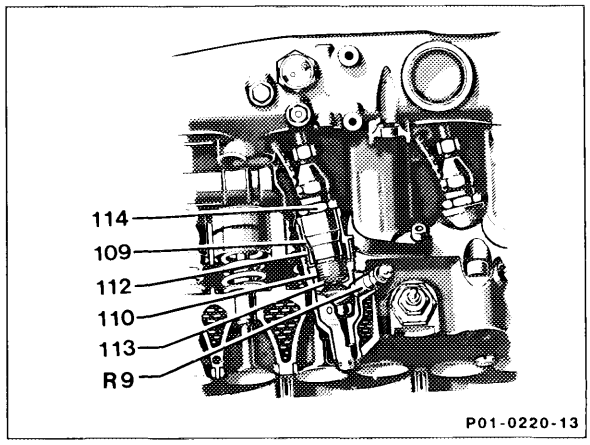


Nozzle holder KCA 27 S 55
(for oblique injection)

31	Nozzle needle
32	Nozzle body
33	Intermediate disk
34	Pressure pin
35	Nozzle tensioning nut
36	Compression spring
37	Holder
38	Fuel bypass port
40	Shim
45	Inlet orifice
a	Fuel inlet
b	Leak fuel (return)

Q. Oblique injection

The nozzle holder combination is fastened to the top section of the prechamber tilted at 5° relative to the longitudinal axis of the prechamber. This oblique injection produces a more intensive mixing of air and fuel.



R9	Glow plug
109	Sealing sleeve
110	Prechamber
112	Threaded ring
113	Sealing shim
114	Nozzle holder

Together with the prechamber modification, the following additional benefits result:

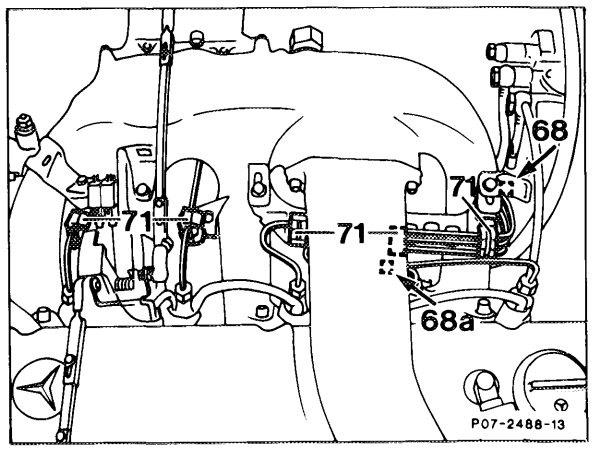
- Improved cold start
- More favorable air/fuel mixing as a result of shorter glow plug (now 23 mm was previously 25 and 27 mm) in combination with recess and the concave in the ball pin.
- Particle reduction and improvement in the emission of hydrocarbons and carbon monoxide.

R. Injection lines

The injection lines are designed so as to allow the injection pump to swivel when the engine is running.

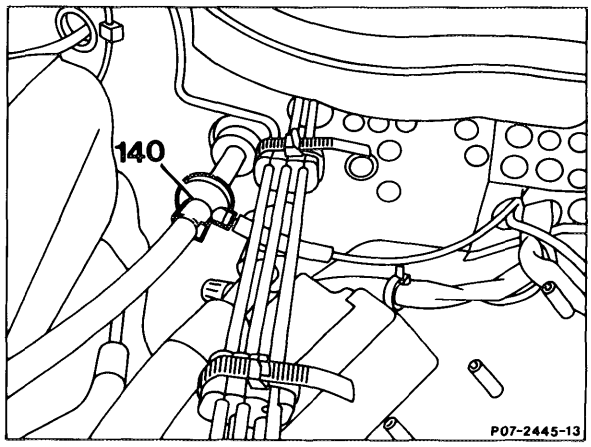
Note

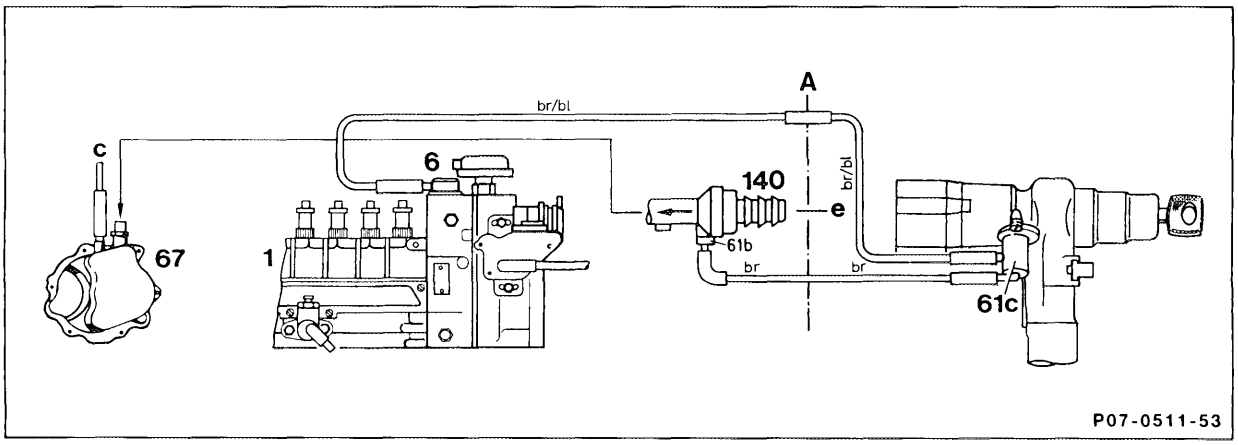
The plastic clips (68 and 68a) must be fitted as close as possible to the radius of the injection lines (arrows). The plastic clips (71) must be locked in place.



S. Vacuum engine stop with car key (glow start switch)

The vacuum for the key-operated engine stop is supplied by the check valve (140) of the main vacuum line.





Vacuum line routing

1	Injection pump	A	Intermediate panel
6	Vacuum unit (stop)	c	Other ancillaries
61c	Valve, glow start switch	e	To brake booster
67	Vacuum pump		
140	Check valve/main vacuum line		

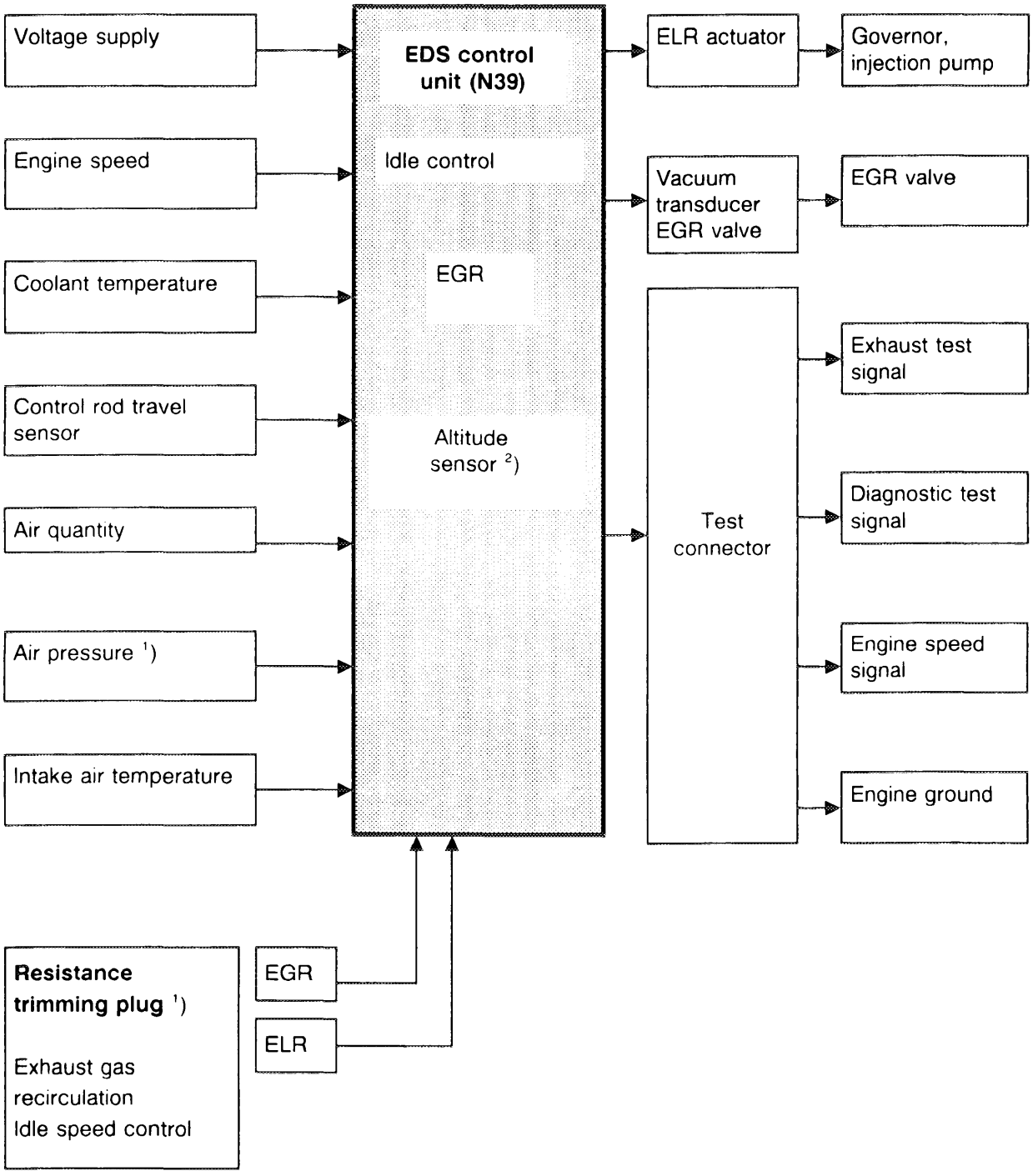
T. Electronic diesel system (EDS)

The electronic control unit processes the following functions:

a) Electronic idle speed control (ELR)
b) Exhaust gas recirculation (EGR)
c) Recirculating air control for trap oxidizer, (California Engine 603.96 Model Year 1986/87 only).
d) Charge pressure control (P2 control) Engine 602.962 from Model Year 1990.
e) System diagnostics

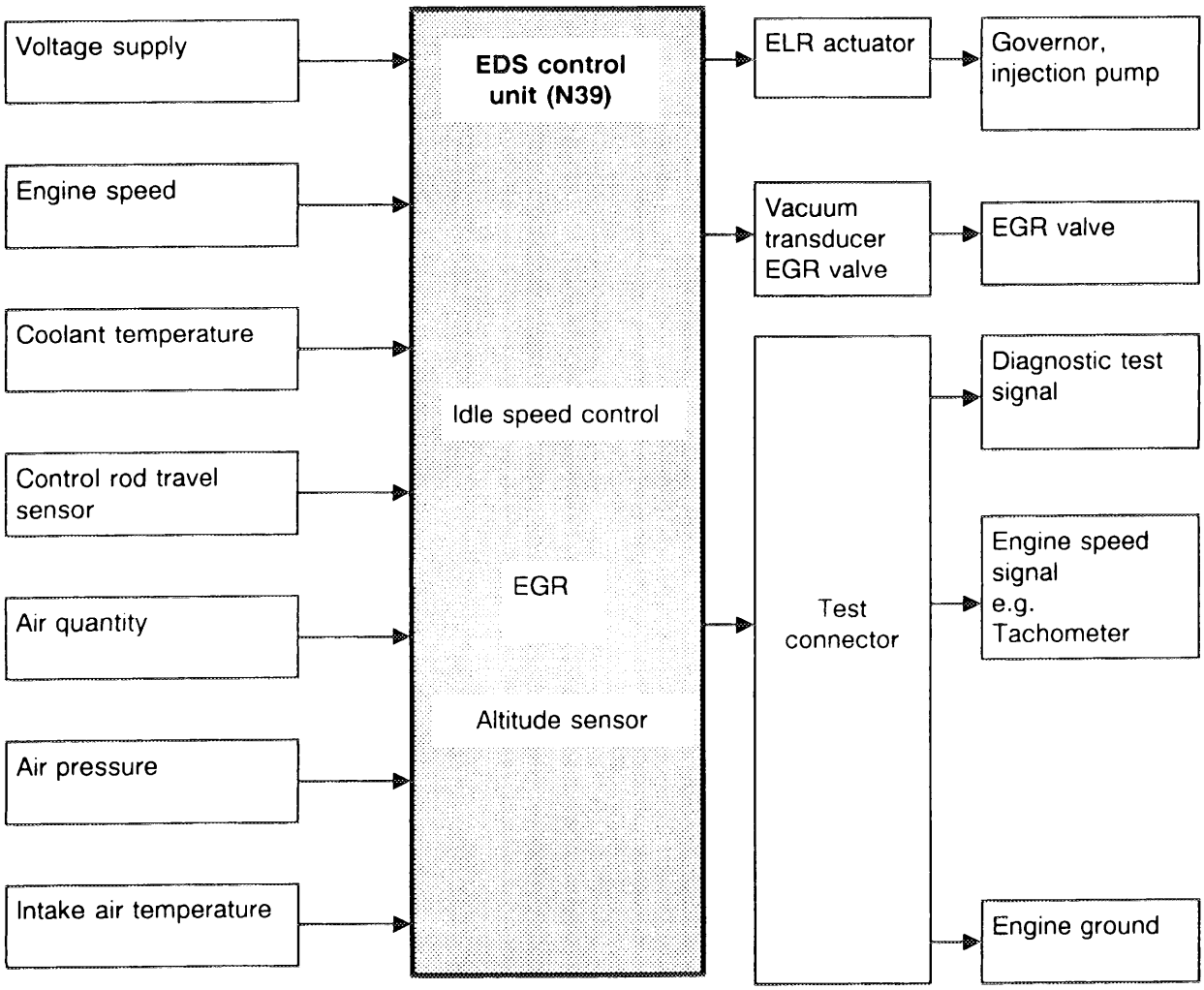
The control unit processes the incoming signals and supplies a current (mA) to the vacuum transducer, as well as to the actuator of the injection pump. The entire system is tested by means of a signal to other outlets, which merge into a test connector.

Influencing variables of Electronic Diesel System (EDS) Engine 602.96 and 603.96

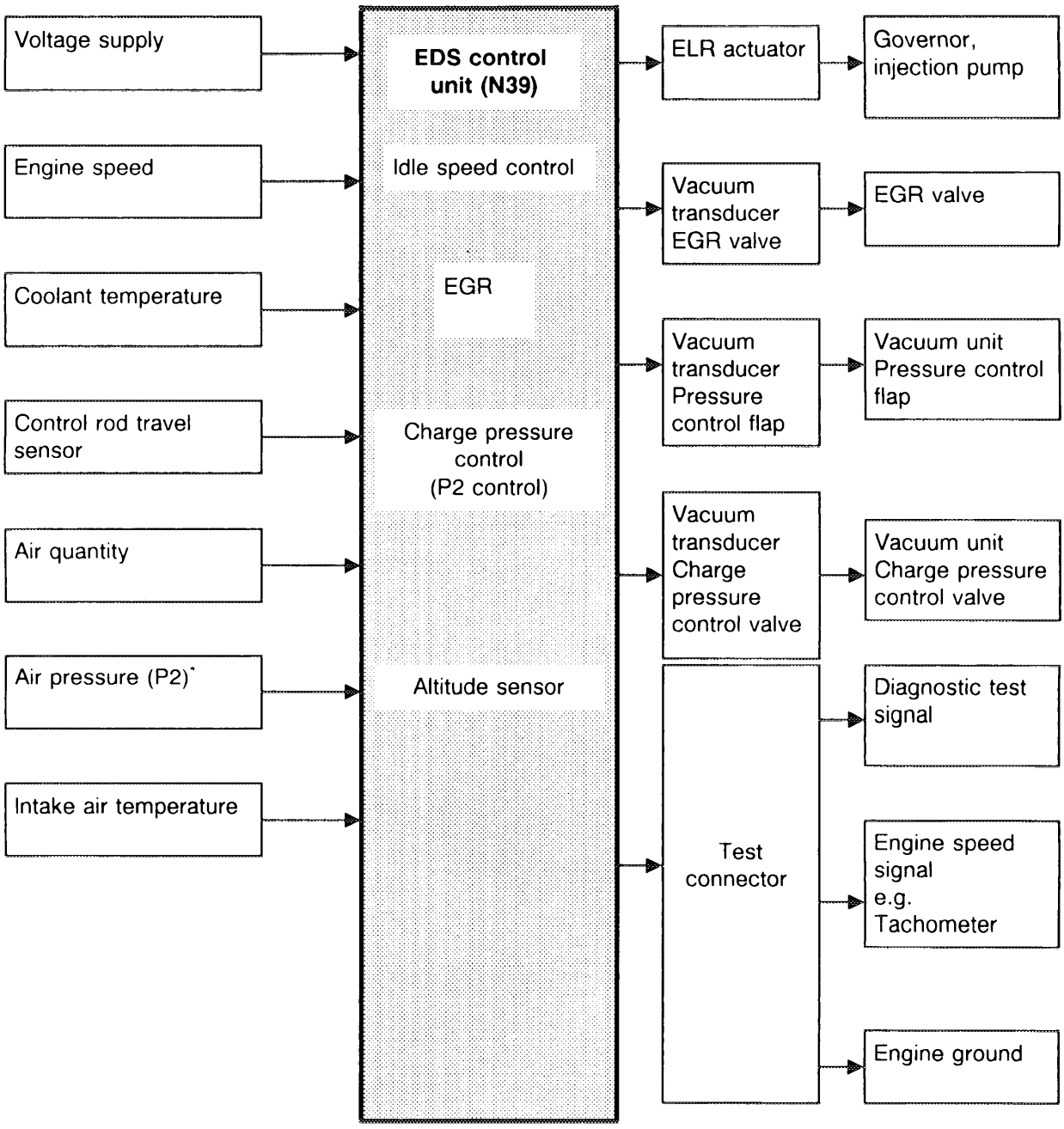


1) Model Year 1986/87 only
2) Effective Model Year 1988 integrated in control unit.

Influencing variables of electronic diesel system (EDS) Engine 603.970 from Model Year 1990



Influencing variables of Electronic Diesel System (EDS) Engine 602.962 from Model Year 1990

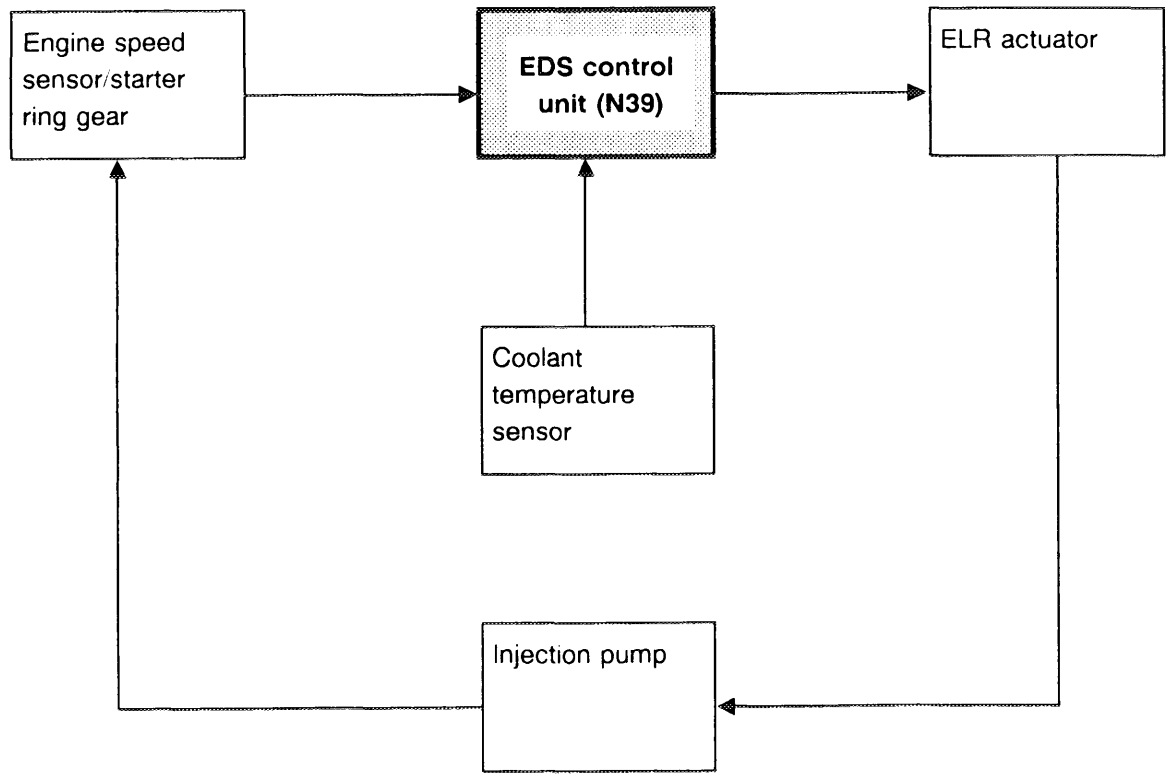


* Pressure in front of inlet valves

a) Electronic idle speed control (ELR)

A speed sensor detects the engine speed (144 pulses/revolution) and passes it on to the EDS control unit in the form of an alternating voltage. The EDS control unit processes the speed signal and performs the set value/actual value comparison. This enables idle speed to be maintained at a constant level by the actuator irrespective of engine load. Set idle speed is raised in accordance with a fixed characteristic curve by the temperature sensor at coolant temperatures < 60°C.

Block diagram of idle speed control (ELR)



b) Exhaust gas recirculation (EGR)

Exhaust gas recirculation is initiated as soon as the following conditions are met:

- Coolant temperature between 60°C and 110°C
- Engine speed between idle and 2800 rpm or 3500 rpm on Engine 602.962 from Model Year 1990
- Control rod travel less than 9 mm
- Battery voltage 11-14 Volts

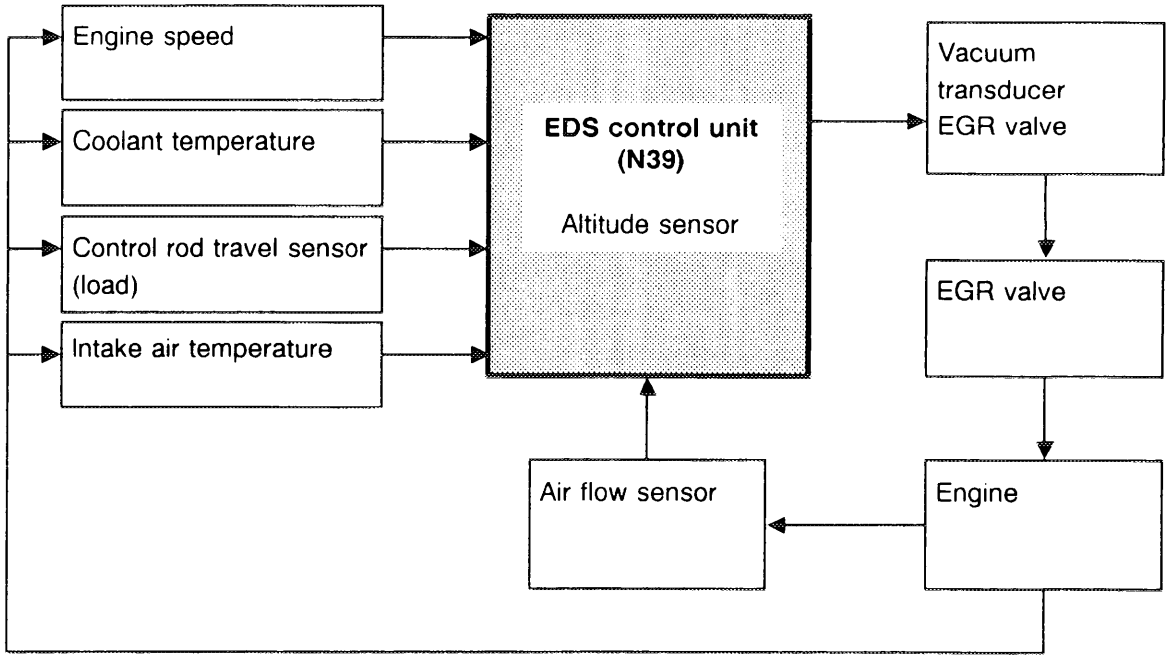
Depending on the input signals of the sensors e.g. control rod travel, engine speed etc., the EDS control unit determines the matching quantity of recirculated exhaust gas for each operating state. The vacuum transducer is energized and supplies the corresponding vacuum to the EGR valve.

The EGR quantity is reduced as engine load and speed increase. This means
Increase in the control current = increase in EGR quantity.
Reduction in control current = reduction in EGR quantity.

Note

Temperature and engine speed are dependent on the control unit version. Refer to test routine for exact data.

Block diagram EGR



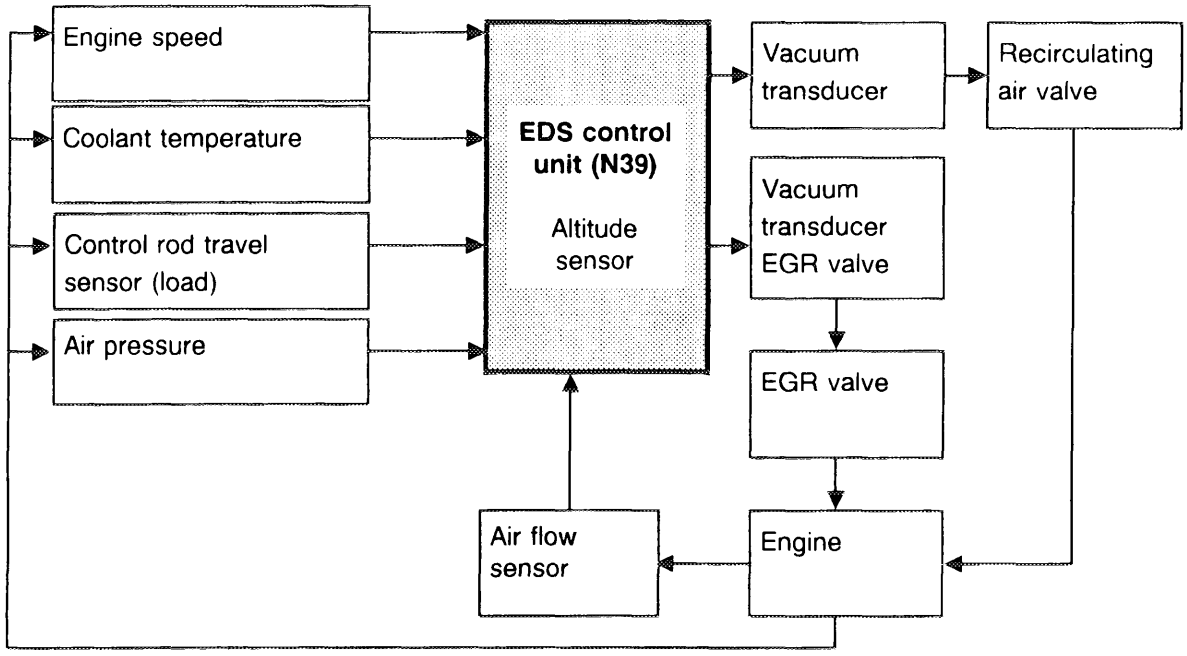
The EGR system with EGR valve, vacuum transducer, air flow sensor and EDS control unit operates as a closed control loop.

c) Recirculating air control for trap oxidizer (California Engine 603.96 Model Year 1986/87 only)

In order to achieve improved combustion conditions for the trap oxidizer, the recirculating air valve is continuously opened or closed according to a performance characteristic map.

Following the closing operation, a residual vacuum of approx. 30 mbar is retained at the recirculating air valve. The recirculating air valve is open between 1000 and 3400 rpm. The control rod travel must be less than 9 mm.

Block diagram recirculating air control



d) Charge pressure control (P2 control) Engine 602.962 from Model Year 1990

A **"characteristic map"** (P2 control) is stored in the EDS control unit. The pressure values obtained as a function of injection quantity and engine speed produce an optimum engine operation with respect to **performance**, **NO_x**, **HC** and **particle emissions.**

Function

Particle emissions are lowered by reducing the pressure (P2) in front of the intake valves under part load conditions.

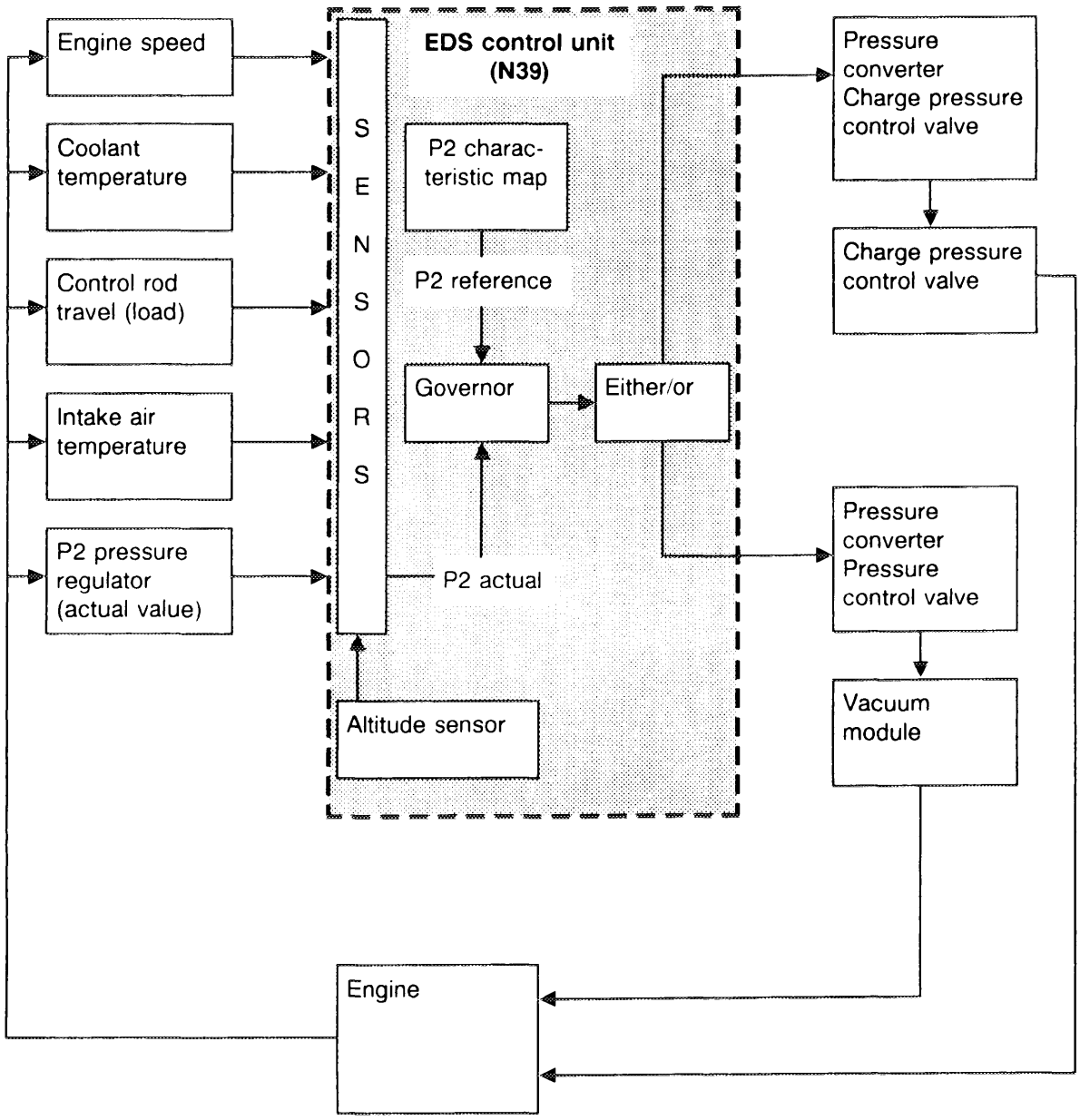
A control circuit exists in the EDS control unit through which a pressure comparison of **"P2 actual" and "P2 reference"** is performed (refer to block diagram).

Any pressure difference is compensated for by the charge pressure control valve or by the pressure control flap.
These pressure actuators are operated by the vacuum transducers by means of an electronically adjustable vacuum.

Charge pressure control is dependent on:

- Coolant temperature
- Intake air temperature
- Intake air pressure
- Engine speed
- Position of control rod (control rod travel)

Block diagram charge pressure control (P2 control), Engine 602.962 Model Year 1990



e) System diagnostics

The "electronic diesel system" can be checked for component faults respectively and stored by means of the self-test routine integrated in the EDS control unit.
Temporary faults, which last longer than 4 seconds, are also stored.
E.g. sensor faults with the exception of speed sensors are memorized, as well as short-circuits in the actuators or their lines.
The pulse display can be tapped via the test connector (X11/4), socket 4 and the individual faults evaluated with the aid of a pulse counter.
Depending on the readout, the defective component or its leads can be determined.

Model Year 1986/87
EDS control unit **with** fault detection.
Only permanently occurring faults are detected.

f) Location and function of components

Model Year 1986/87
Test connector (X92) is used for diagnostics.
The diagnostic test signal can be taken from the test connector.

Models 124 and 201 in component compartment right

Modul 13 Format 1.0 (77 × 58 mm)

Bild-Motiv

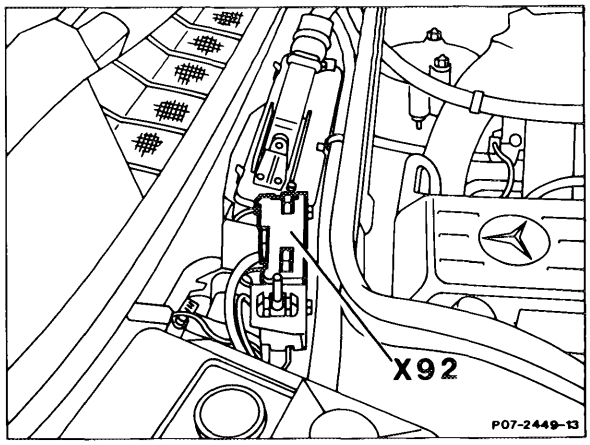
Foto/Zg-Nr.

Abgabe

Korrektur

Freigabe

Bild-Nr. **P07-2467-13**

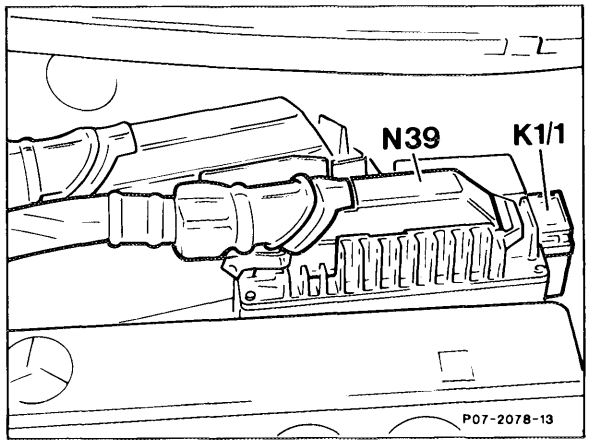


Model 126

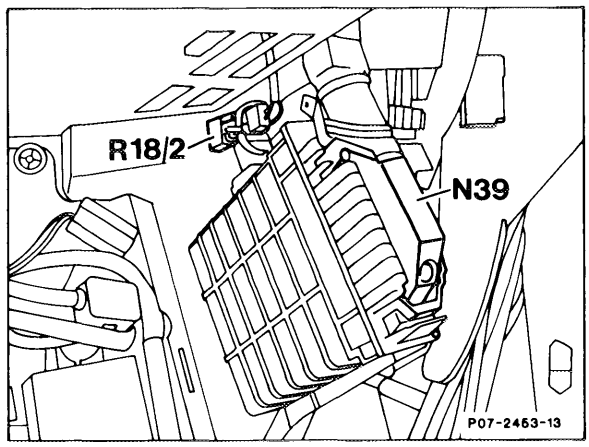
Function of components

Control unit (N39)

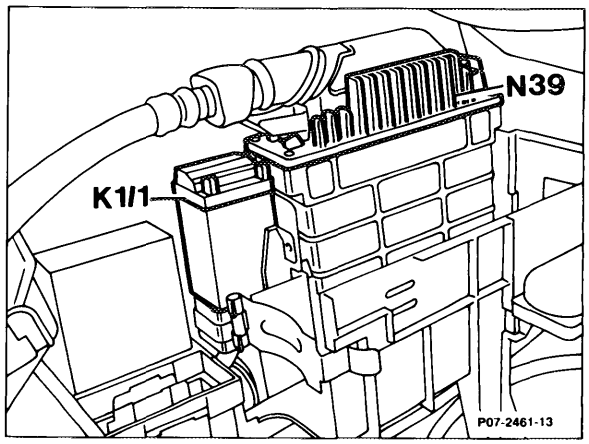
The control unit processes the incoming signals and supplies a current (mA) to the pressure converter, EGR switchover valves, as well as to the actuator of the injection pump. The entire system can be tested by means of a signal passed through four other outlets merging into a test connector.



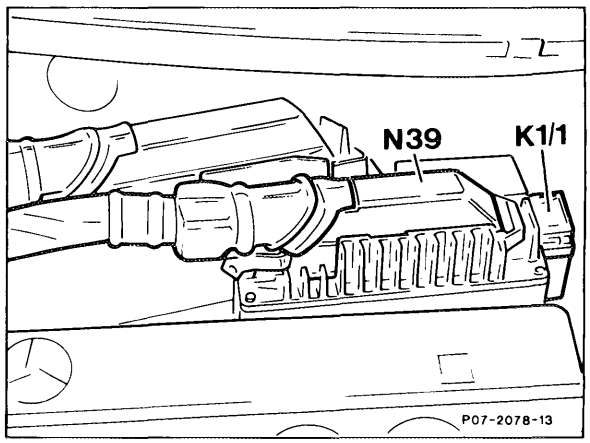
Model 124 behind battery in component compartment



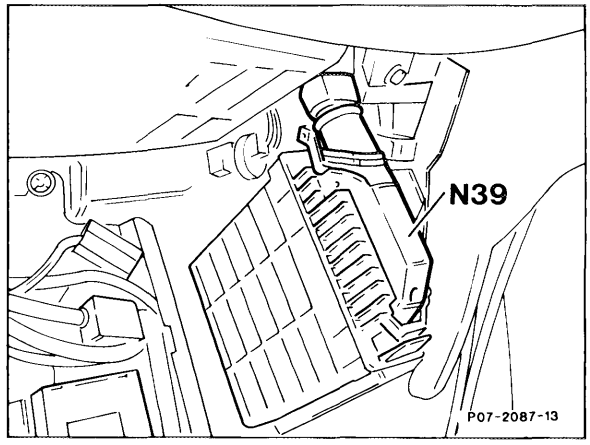
Model 126 in right foot well behind side panelling



Model 201 behind the battery in components compartment



Model 124.128
(Engine 602.962)



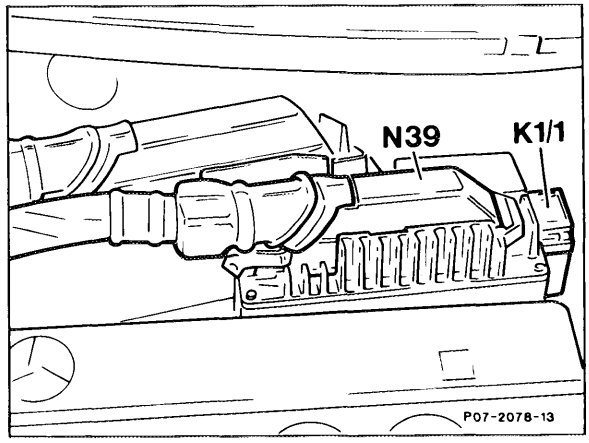
Model 126.13
(Engine 603.970)
Installed on the right in the passenger compartment

Altitude sensor (integrated in control unit) from Model Year 1990

The quantity of recirculated exhaust gas is influenced by the atmospheric pressure sensor as a function of altitude or air pressure. The altitude sensor supplies a voltage signal to the control unit which drops as air pressure drops (increasing altitude). The control unit matches the quantity of exhaust gas recirculated to the respective air pressure by reducing the pressure converter current.

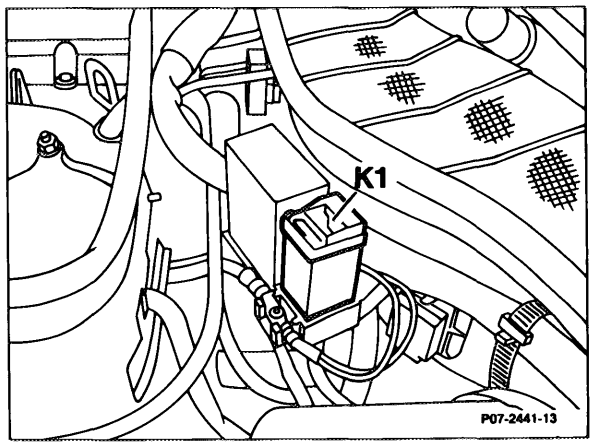
Over-voltage protection (K1 or K1/1)

The power for the electronic control units is supplied through the over-voltage protection relay.



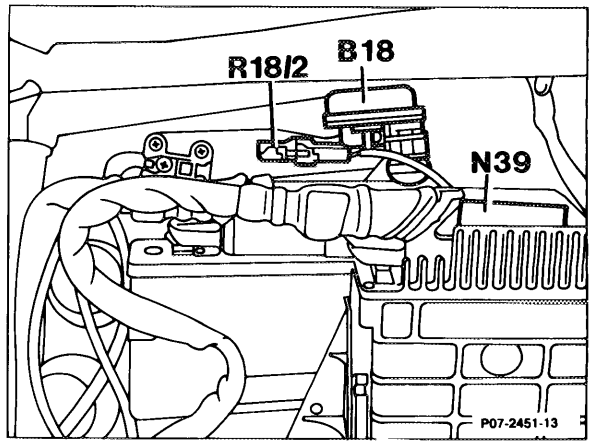
Models 124, 201 behind the battery in the component compartment

The battery voltage is supplied constantly to terminal 30. A 10A fuse is fitted between terminal 30 and 30a. The fault memory is constantly energized through terminal 30a. When the ignition is switched on, the relays are actuated through terminal 15 by an electronic unit. The EDS control unit is thus energized through terminal 87E and other ancillaries through terminal 87. The over-voltage protection is achieved by means of a 22 volt Zener diode. Voltage peaks in excess of 22 volts occurring ahead of the over-voltage protection are switched directly to ground by the Zener diode. An overload is prevented by a fuse. Terminals 87E and 87L are protected separately.

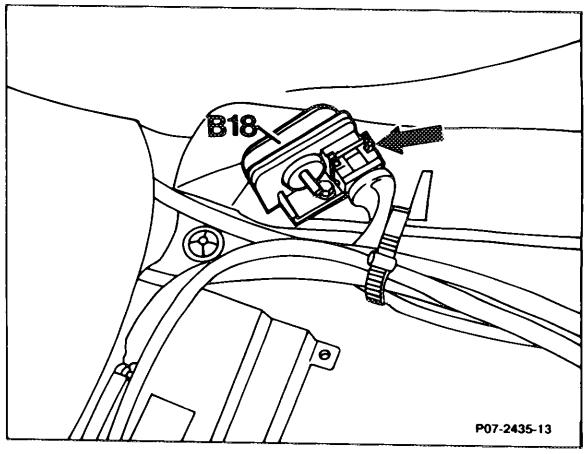


Model 126 in component compartment next to ABS control unit

Altitude sensor (B18)
Model year 1986/87
The quantity of exhaust gas recirculated is influenced by the altitude correction sensor as a function of altitude or air pressure. The sensor supplies a voltage signal to the control unit which drops as air pressure drops (increase in altitude). The control unit matches the quantity of exhaust gas recirculated to the air pressure by reducing the pressure converter current.

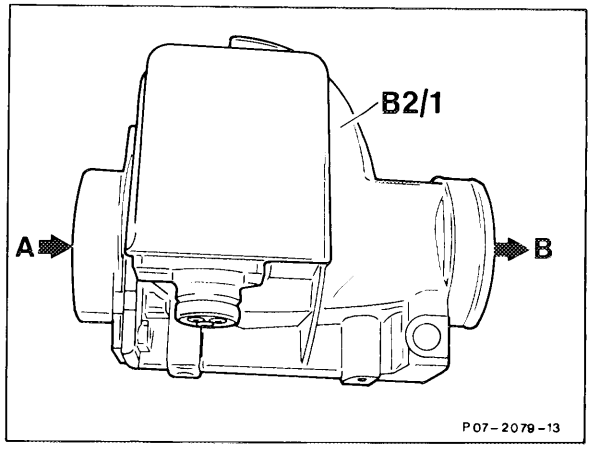


Model 124, 201 in component compartment



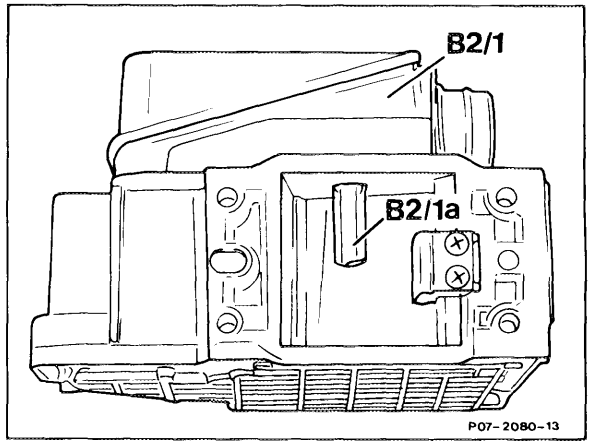
Model 126 in right footwell

Air flow sensor potentiometer (B2/1)
Fitted in the air flow between air filter and exhaust gas turbocharger.



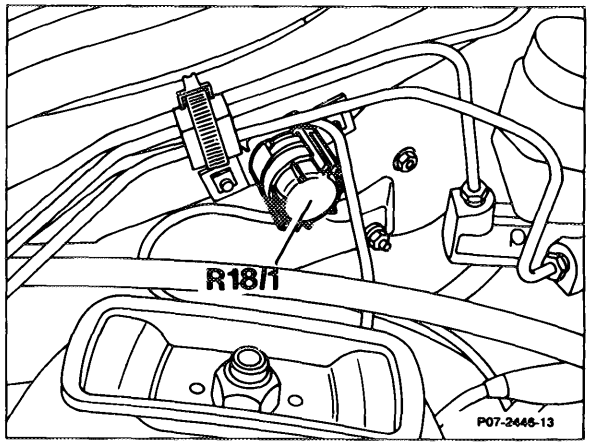
A from air filter
B to exhaust gas turbocharger

The intake air deflects the air flow sensor flap against the restoring force of a spring into a defined angular position. The position is measured by means of a potentiometer, and converted into a voltage.
The intake air temperature is detected by a temperature sensor (B2/1a) in the air flow sensor.

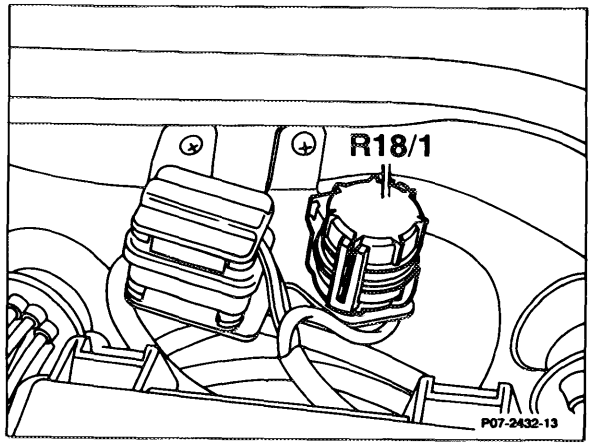


Air flow sensor
Model 201 without round flange

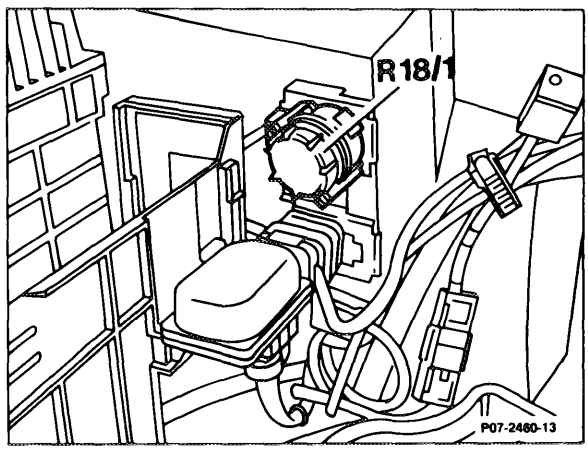
Resistance trimming plug (R18/1) for idle speed
For setting the idle speed.
Specification: 630 ± 20 rpm



Model 124



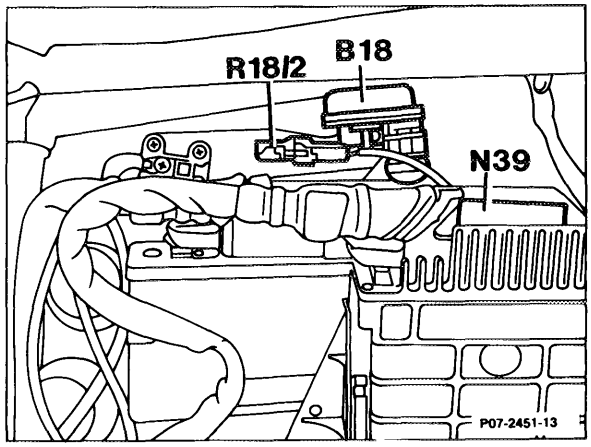
Model 126



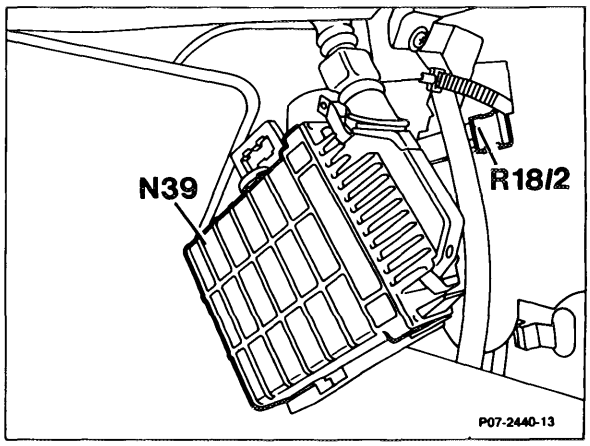
Model 201

Reference resistor (R18/2) for exhaust gas recirculation

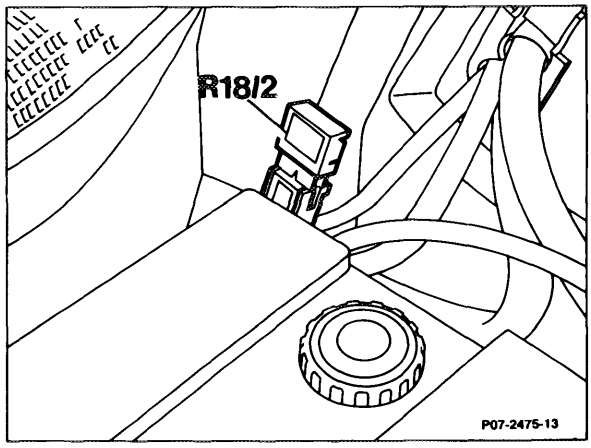
Model 124 in components compartment



Model 126 at right of car interior next to control unit (N39)

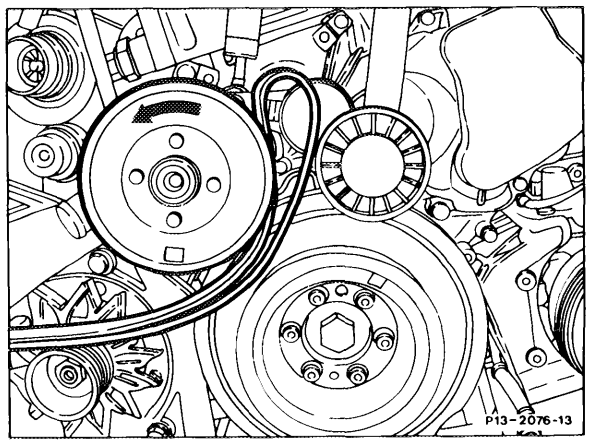


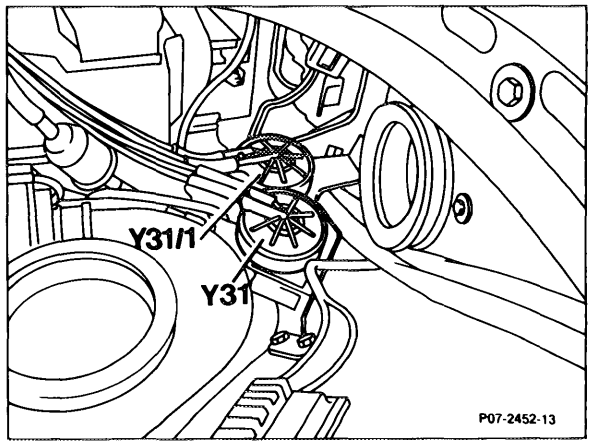
Model 201 in component compartment next to battery



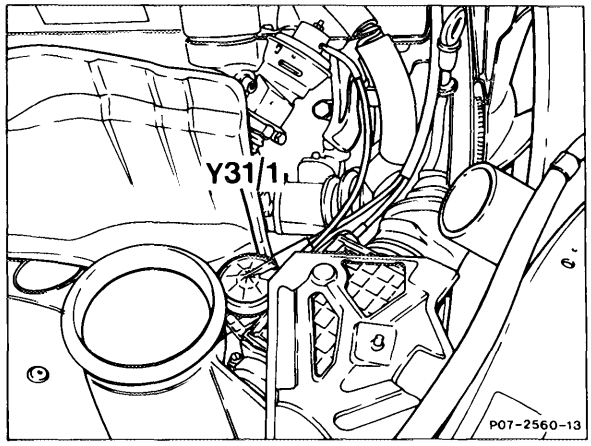
Vacuum transducer (Y31/1, Y31/2 and Y31/3)
The vacuum transducers are supplied with a control current as an input signal depending on the operating state. The pressure converter then supplies the matching vacuum for the actuators.

Engine 602.962 Model Year 1990
Y31/1 Vacuum transducer - EGR valve
Y31/2 Vacuum transducer - pressure control flap
Y31/3 Vacuum transducer - charge pressure control

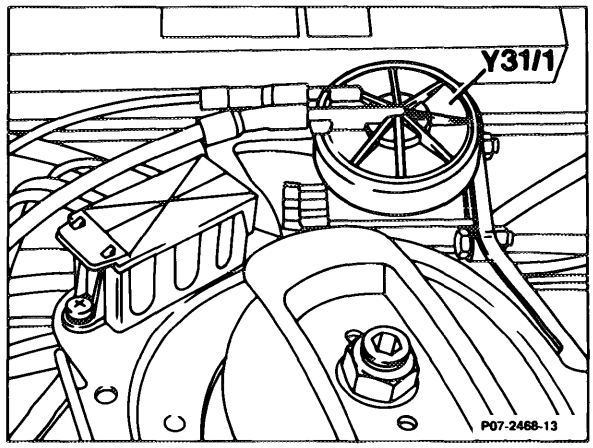




Engine 603.96 in Model 124

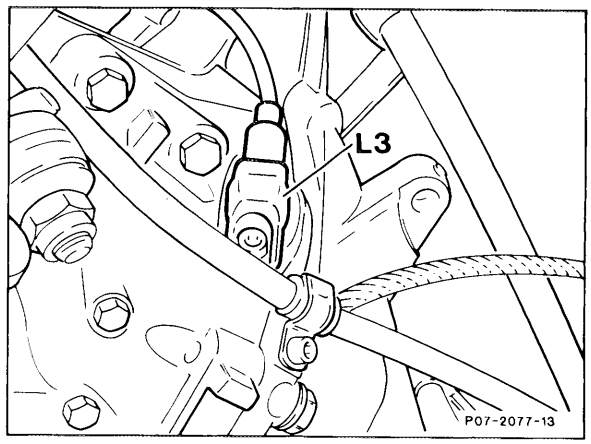


Engine 603.96/97
Y31/1 Vacuum transducer EGR valve in Model 126



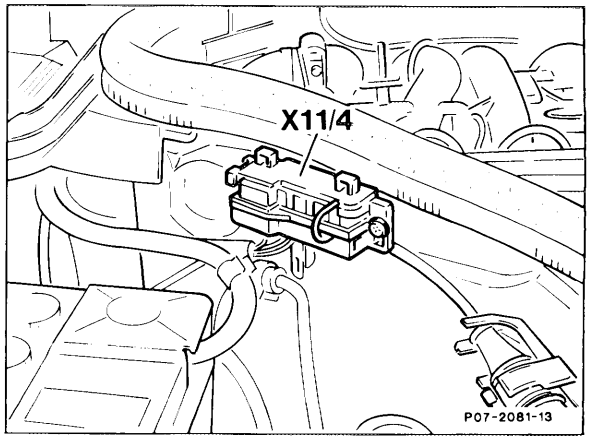
Engine 602.96 in Model 201

Engine speed sensor (L3)
It detects engine speed at the starter ring gear (144 pulses/revolution) and sends it to the control unit in the form of an alternating voltage.

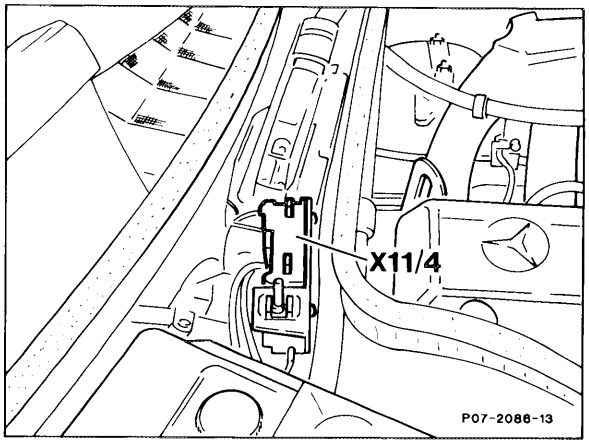


Test connector (X11/4)
The pulse display can be tapped by the test connector.

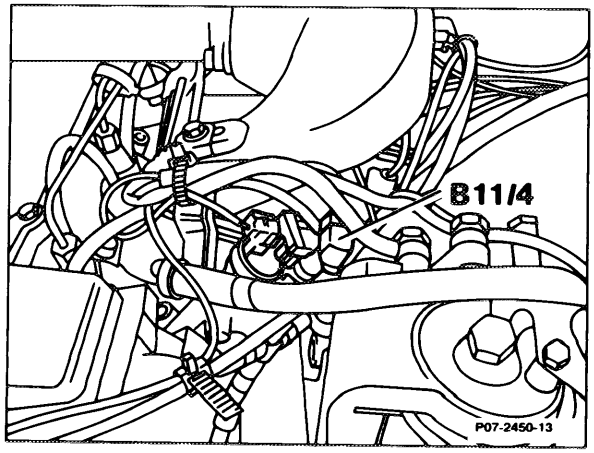
Model 124



Model 126

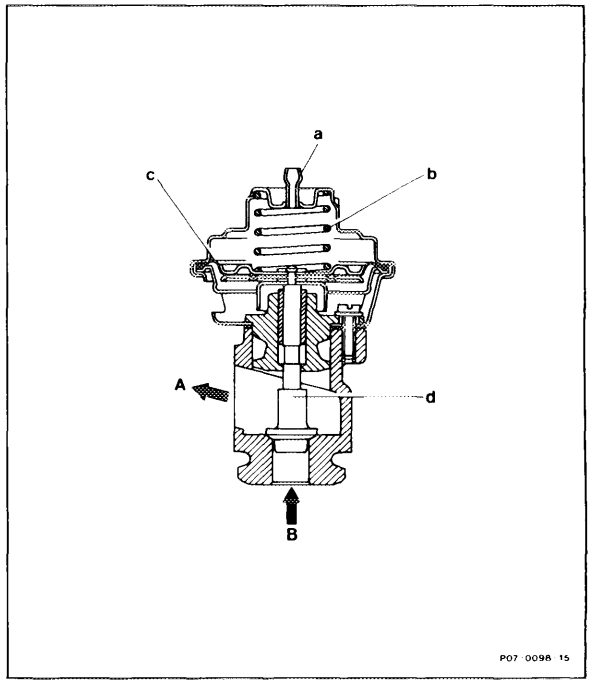


Coolant temperature sensor EDS (B11/4)
The coolant temperature is detected by the temperature sensor (EDS) (B11/4) and is actuated by the EDS control unit.
The resistance of a coolant temperature sensor EDS varies as a function of coolant temperature.



EGR valve

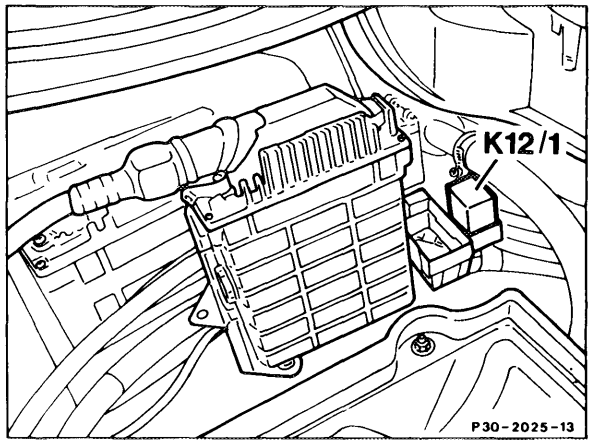
The EGR valve is bolted to the mixing pipe on the side of the cylinder head. It is connected to the exhaust manifold, charge air distribution pipe and a corrugated pipe. The EGR valve is opened by means of a controlled vacuum from the vacuum transducer.



A Exhaust gas to charge air distribution pipe
B Exhaust gas from exhaust manifold
a Vacuum connection
b Spring
c Diaphragm
d Valve

Cruise control (Tempomat), Model Year 1990

In order not to influence the control of the cruise control in the part load area, the charge pressure is rendered inoperative by the cruise cont./charge pressure relay (K12/1) during cruise control operation.

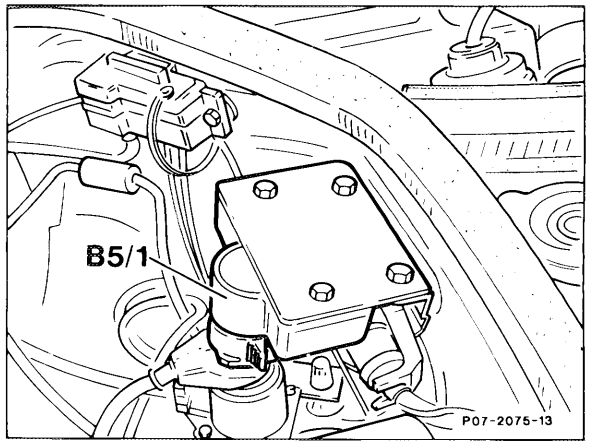


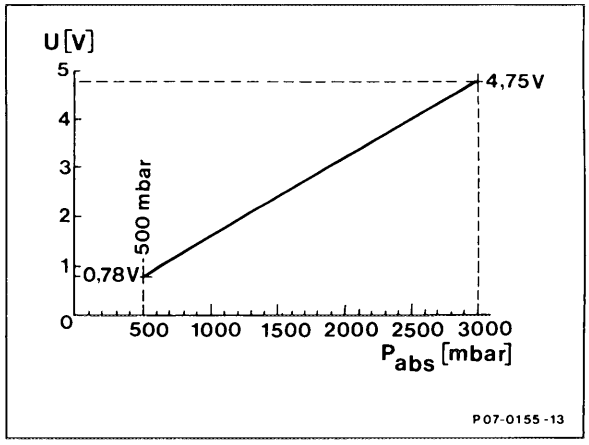
Model 124
K12/1 Cruise control/charge pressure shutoff relay

Model 201
K12/1 Cruise control/charge pressure shutoff relay

Pressure sensor (B5/1) Engine 602.962

Fitted right behind the bulkhead in the direction of travel. The pressure sensor detects the pressure and converts it into a voltage, which is processed by the EDS control.

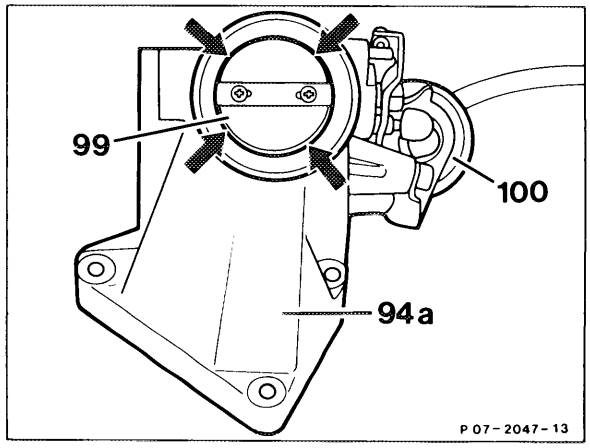


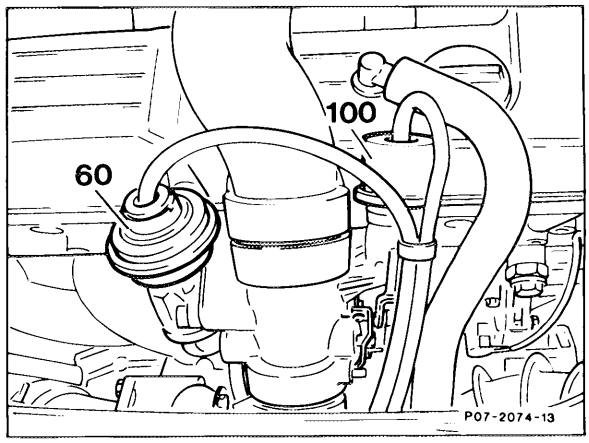


Absolute pressure characteristic (Pabs in mbar) with 5 V voltage supply

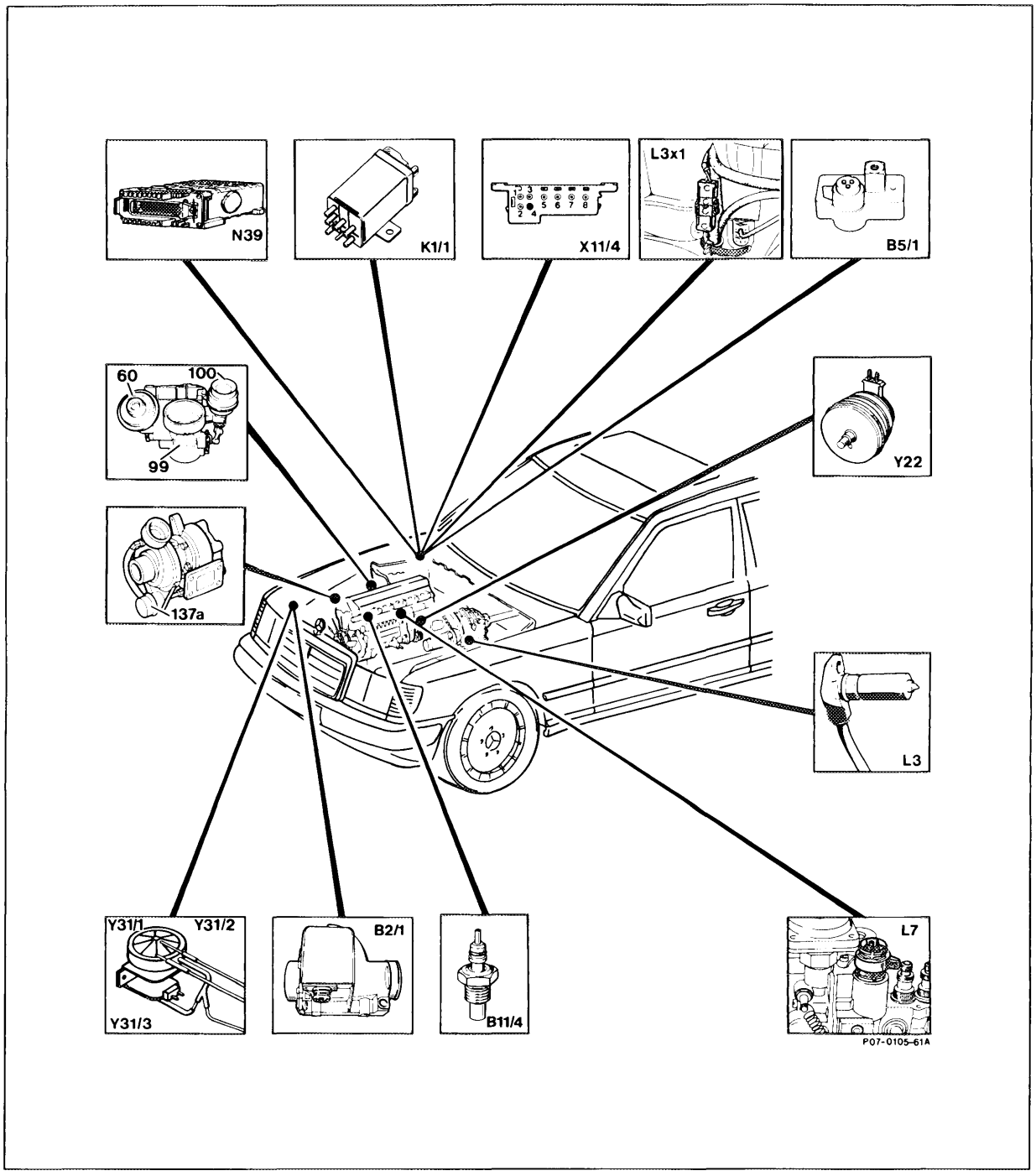
Mixture housing (94a) with pressure control flap (99) and vacuum unit (100) (Engine 602.962 only) from Model Year 1990

In order to increase the vacuum in the charge air distribution pipe, a pneumatically operated pressure control flap is fitted to the mixture housing. The pressure control flap closes the fresh air port during engine operation with EGR. A minimum opening (arrows) between the pressure control flap and the mixture housing is maintained. The vacuum unit (100) is actuated by the pressure convertor pressure control flap (refer to function diagram).



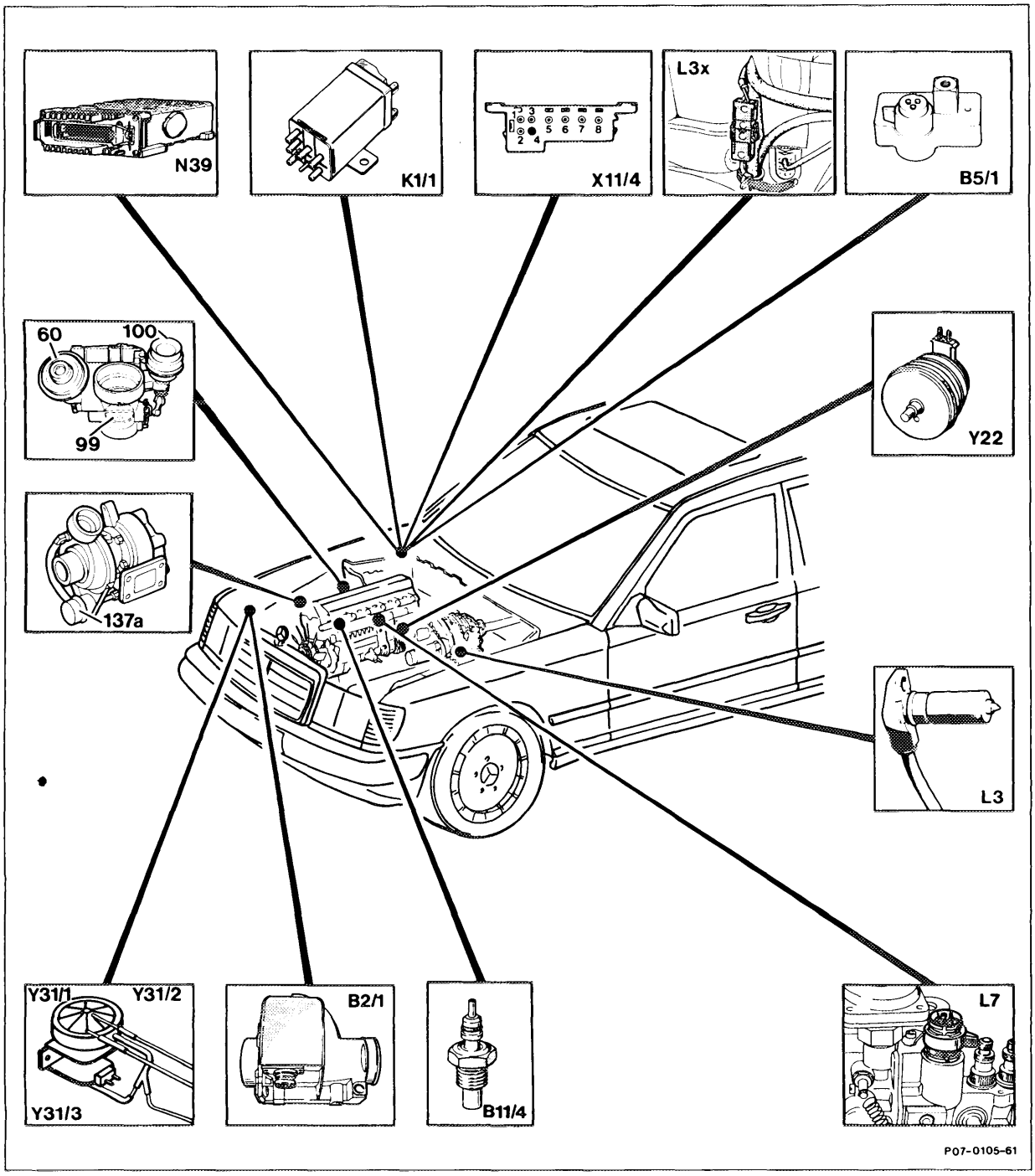


60 EGR valve
100 Vacuum unit



Model Year 1990, Engine 602.962

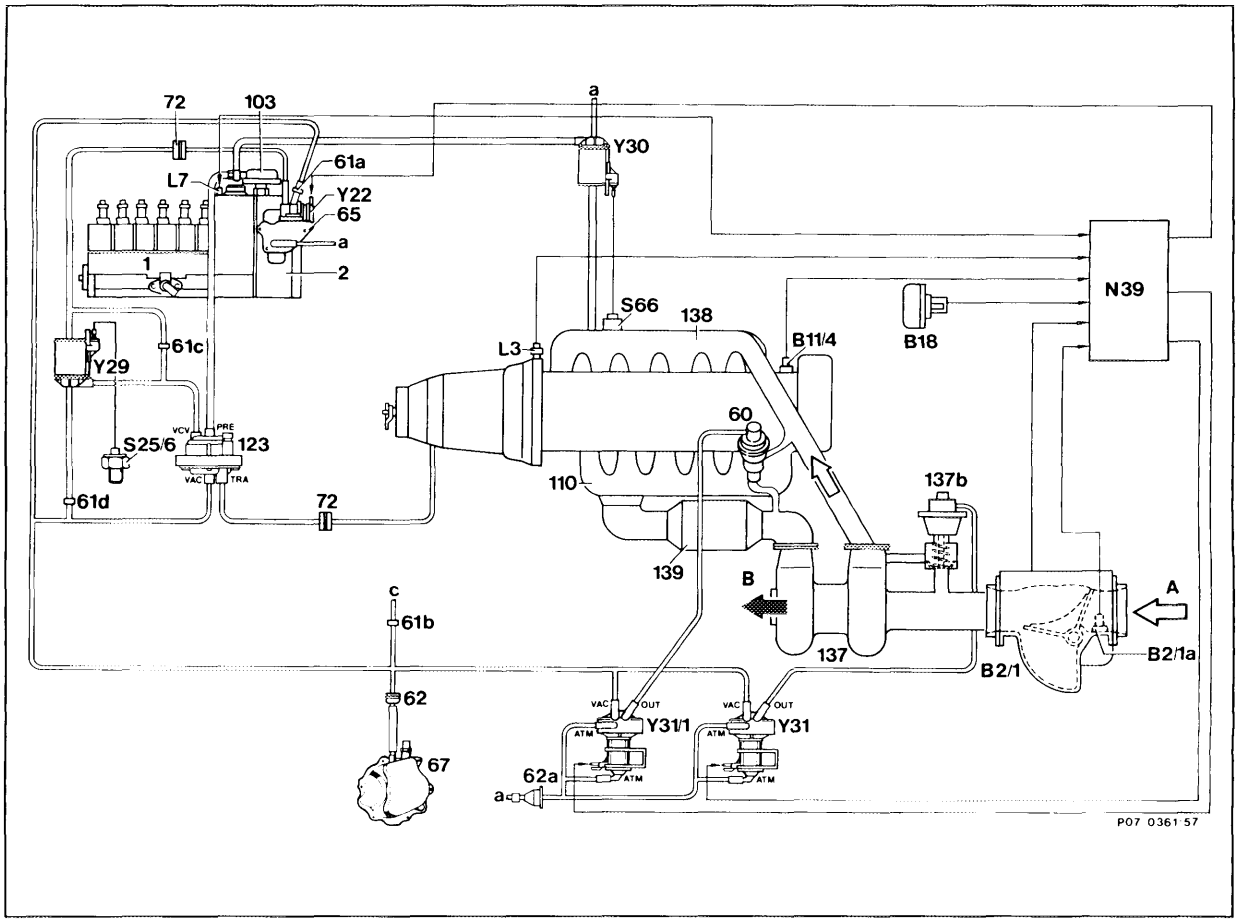
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS
B5/1	Pressure sensor (EDS)
B11/4	Coolant temperature sensor
K1/1	Over-voltage protection relay
L3	Engine speed sensor - starter ring gear
L3x1	Plug connector, engine speed sensor - starter ring gear
L7	Control rod travel sensor
X11/4	Test connector
Y22	ELR actuator
Y31/1	EGR vacuum transducer
Y31/2	Pressure convertor - pressure control flap
Y31/3	Pressure convertor - charge pressure control
60	EGR valve
99	Pressure control flap in mixture housing
100	Vacuum unit, pressure control flap
137a	Vacuum unit, charge pressure control valve



Model Year 1990, Engine 603.970

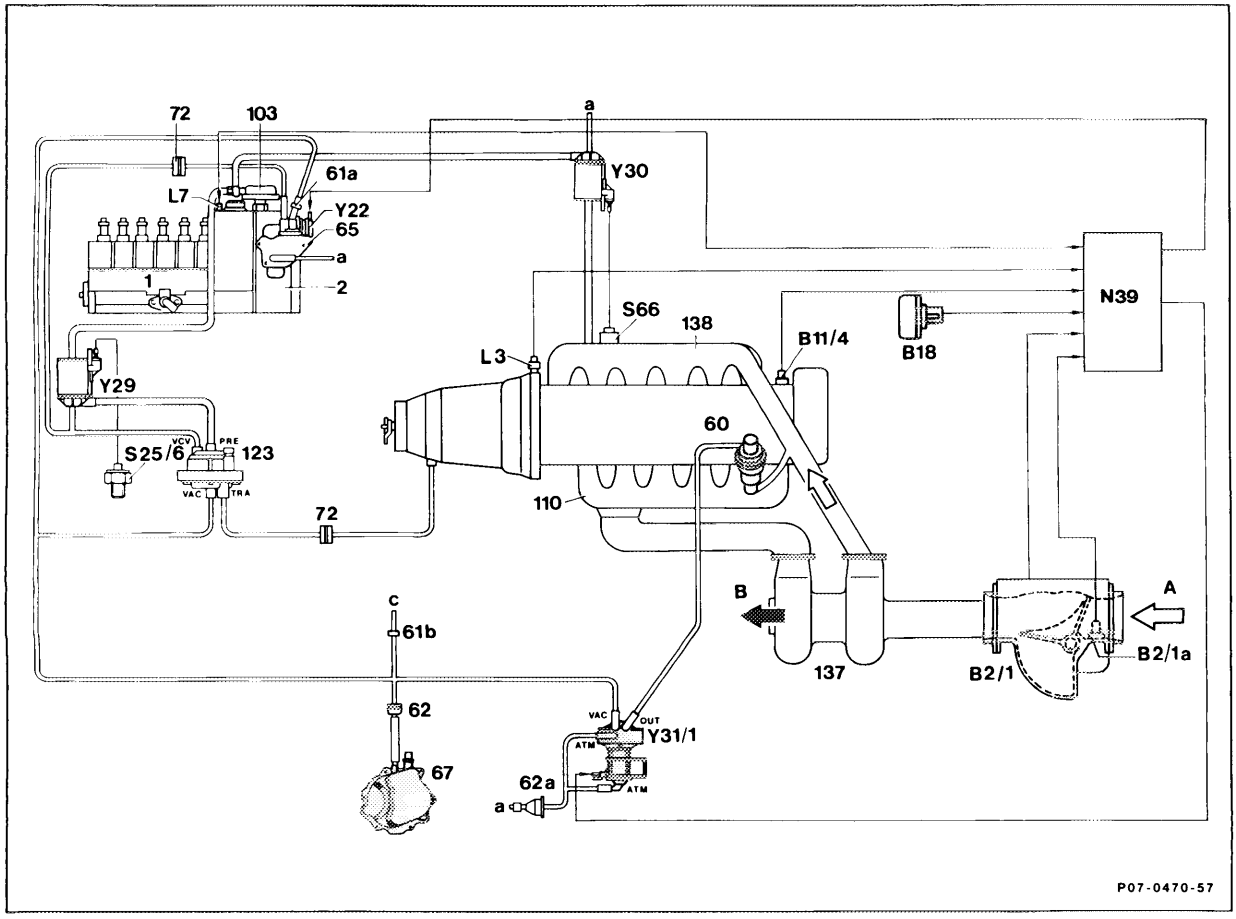
B2/1	Air flow sensor potentiometer	N39	EDS control unit
B5/1	EDS pressure sensor	X11/4	Test connector
B11/4	Coolant temperature sensor	Y22	ELR actuator
K1/1	Over-voltage protection relay	Y31/1	EGR vacuum transducer
L3	Engine speed sensor - starter ring gear	Y31/2	Vacuum transducer - pressure control flap
L3x	Plug connector, engine speed sensor - starter ring gear	Y31/3	Vacuum transducer - charge pressure control
L7	Control rod travel sensor	60	EGR valve

g) Overall function diagrams (EDS)



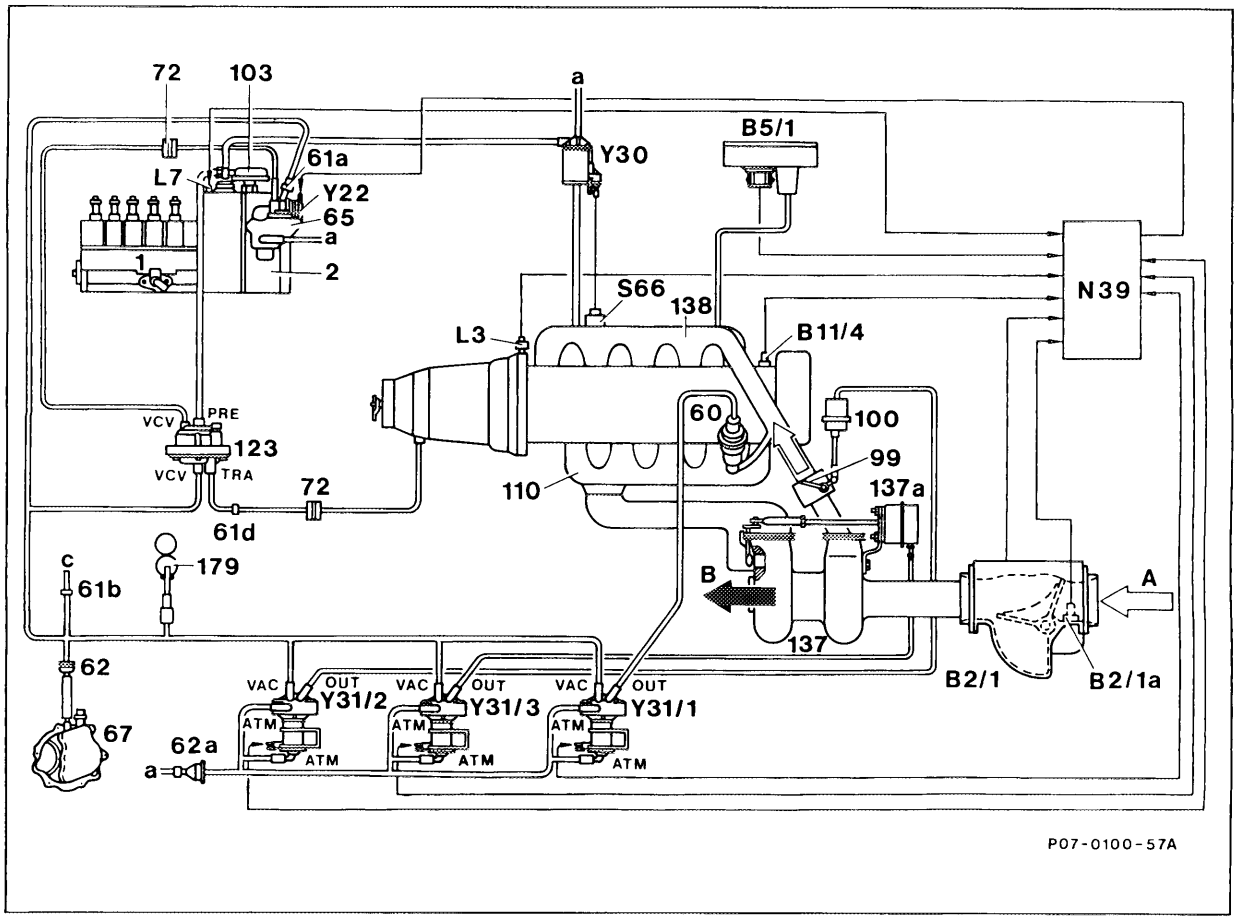
Engine 603.96 in Model 124 Federal and California from Model Year 1987 with Trap Oxidizer
Engine 603.96 in Model 126 California from Model Year 1986 with Trap Oxidizer

1	Injection pump
2	Governor
60	EGR valve
61a	Restriction, blue
61b	Restriction, orange
61c	Restriction
61d	Restriction
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
103	ALDA unit
110	Exhaust manifold
123	Vacuum amplifier
137	Exhaust gas turbocharger
137b	Recirculating air valve (California only)
138	Charge air distribution pipe
139	Trap oxidizer (California only)
B2/1	Air flow sensor potentiometer
B2/1a	Intake air temperature sensor
B11/4	Coolant temperature sensor
B18	Altitude sensor
L3	Engine speed sensor - starter ring gear
L7	Control rod travel sensor
N39	EDS control unit
S25/6	Temperature switch 50 °C
S66	Switch, engine overload protection
Y22	Actuator
Y29	Switch-over valve, vacuum amplifier
Y30	Switch-over valve, engine overload protection
Y31	Vacuum transducer, recirculating air valve
Y31/1	Vacuum transducer, exhaust gas recirculating valve
a	Fresh air flow to car interior
A	Intake air
B	Exhaust gas
	Pressure and vacuum connections at vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit of automatic transmission
VAC	Vacuum from vacuum pump
VCV	To vacuum control valve
ATM	Fresh air flow to car interior
OUT	Exhaust gas recirculation to exhaust gas recirculating valve or recirculating air valve



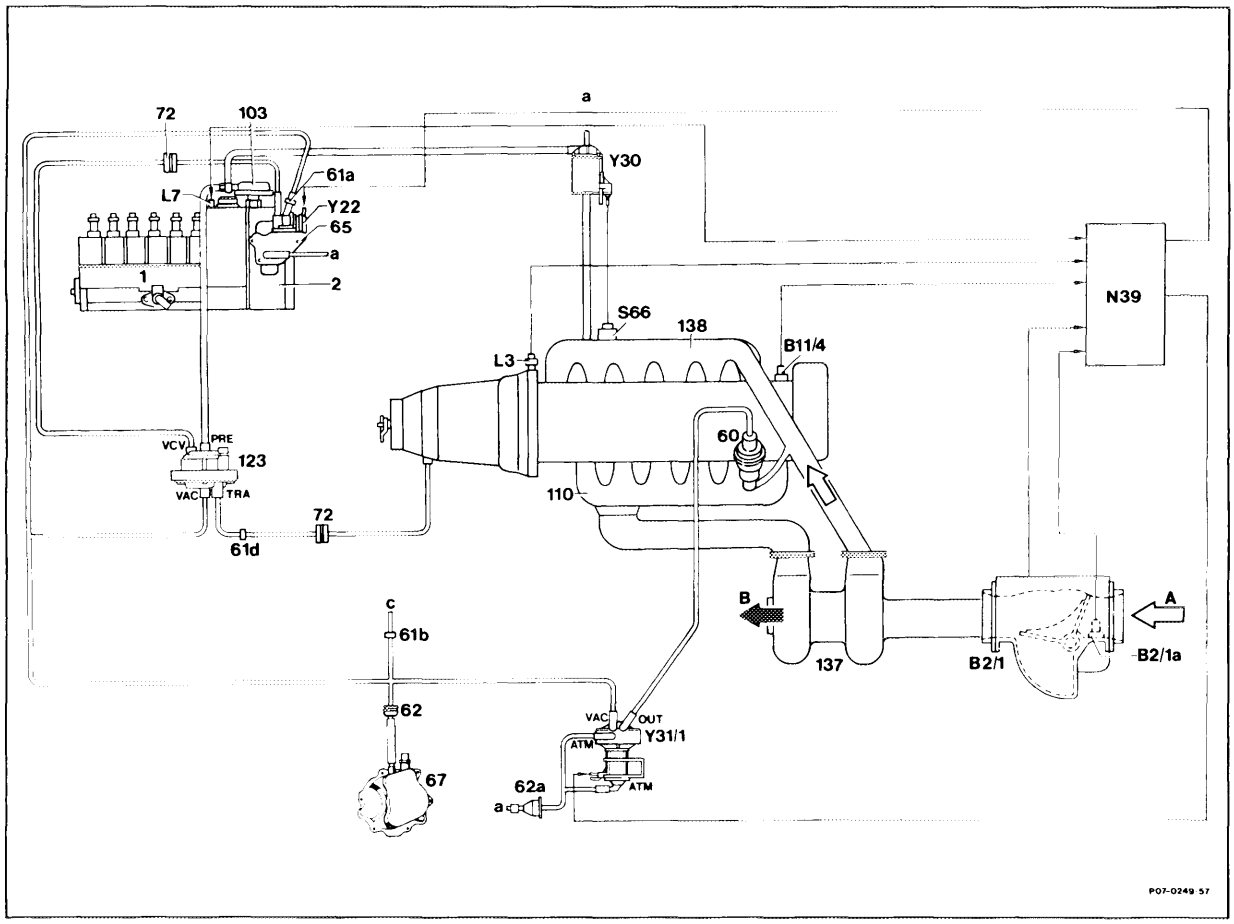
Engine 603.960 in Model 126, Model Year 1986 Federal
Engine 602.961 in Model 201, Model Year 1987 Federal

1	Injection pump
2	Governor
60	EGR valve
61a	Restriction, blue
61b	Restriction, orange
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
103	ALDA unit
110	Exhaust manifold
123	Vacuum amplifier
137	Exhaust gas turbocharger
138	Charge air distribution pipe
B2/1	Air flow sensor potentiometer
B2/1a	Intake air temperature sensor
B11/4	Coolant temperature sensor
B18	Altitude sensor
L3	Engine speed sensor, starter ring gear
L7	Control rod travel sensor
N39	EDS control unit
S25/6	Temperature switch 50 °C
S66	Switch, engine overload protection
Y22	Actuator
Y29	Switch-over valve, vacuum amplifier
Y30	Switch-over valve, engine overload protection
Y31/1	Vacuum transducer, exhaust gas recirculating valve
a	Fresh air flow to car interior
A	Intake air
B	Exhaust gas
	Pressure and vacuum connections at vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit of automatic transmission
VAC	Vacuum from vacuum pump
VCV	To vacuum control valve
ATM	Fresh air flow to car interior
OUT	Exhaust gas recirculation to exhaust gas recirculating valve or recirculating air valve



Engine 602.962, Model Year 1990

1	Injection pump
2	Governor
60	Exhaust gas recirculating valve
61a	Restriction
61b	Restriction
61d	Connector (without restriction)
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
99	Pressure control flap in mixture housing
100	Vacuum unit, pressure control flap
103	ALDA unit
110	Exhaust manifold
123	Vacuum amplifier
137	Exhaust gas turbocharger
137a	Vacuum unit, charge pressure control valve
138	Charge air distribution pipe
179	Vacuum reservoir
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS
B2/1a	Intake air temperature sensor
B5/1	EDS pressure sensor
B11/4	EDS coolant temperature sensor
L3	Engine speed sensor, starter ring gear
L7	Control rod travel sensor
N39	EDS control unit
S66	Switch, engine overload protection
Y22	ELR actuator
Y30	Switch-over valve, engine overload protection
Y31/1	Vacuum transducer, exhaust gas recirculating valve
Y31/2	Vacuum transducer, pressure control flap
Y31/3	Vacuum transducer, charge pressure control
a	Fresh air flow to car interior
c	Other ancillaries
A	Intake air
B	Exhaust air
	Pressure and vacuum connections at vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit of automatic transmission
VAC	Vacuum from vacuum pump
VCV	To vacuum control valve
ATM	Fresh air flow to car interior
OUT	Output from vacuum transducer Y31/1 to EGR valve
OUT	Output from vacuum transducer Y31/2 to vacuum unit of pressure control flap
OUT	Output from vacuum transducer Y31/3 to vacuum unit of charge pressure control valve

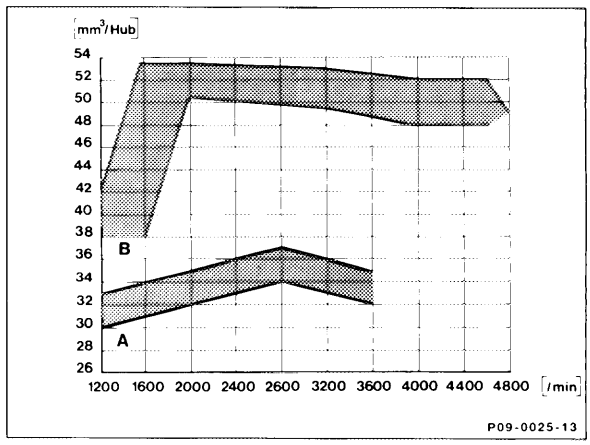


Engine 603.970, Model Year 1990

1	Injection pump
2	Controller
60	Exhaust gas recirculating valve
61a	Restriction
61b	Restriction
61d	Connector (without restriction)
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
103	ALDA unit
110	Exhaust manifold
123	Vacuum amplifier
137	Exhaust gas turbocharger
138	Charge air distribution pipe
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS
B2/1a	Intake air temperature sensor
B11/4	EDS coolant temperature sensor
L3	Engine speed sensor, starter ring gear
L7	Control rod travel sensor
N39	EDS control unit
S66	Switch, engine overload protection
Y22	ELR actuator
Y30	Switch-over valve, engine overload protection
Y31/1	vacuum transducer, exhaust gas recirculating valve
a	Fresh air flow to car interior
c	Other ancillaries
A	Intake air
B	Exhaust air
	Pressure and vacuum connections at vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit of automatic transmission
VAC	Vacuum from vacuum pump
VCV	To vacuum control valve
ATM	Fresh air flow to car interior
OUT	Exhaust gas recirculation to exhaust gas recirculating valve or recirculating air valve

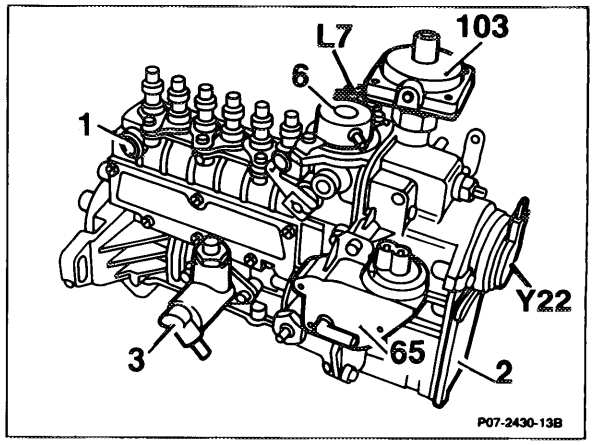
V. Engine overload protection

A pressure switch is fitted in the charge air pipe for overload protection of mechanical parts in the engine. If the charge pressure rises above 1.1 ± 0.15 bar gauge pressure, air is admitted to the ALDA unit through the switchover valve and the quantity of fuel is limited to that of a naturally aspirated engine.

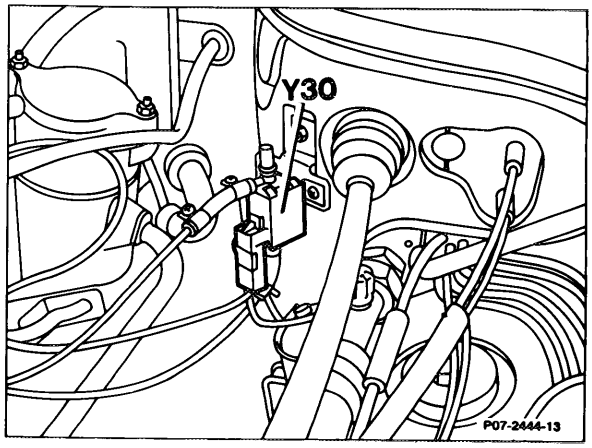


A Full load quantity without charge pressure (P = 1050 mbar)
B Full load quantity with charge pressure

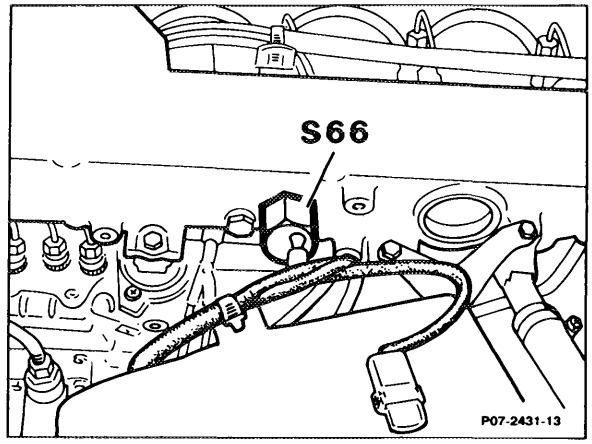
Location of components



1 Injection pump
2 Governor
3 Fuel pump
6 Stop unit
103 ALDA unit
Y22 Actuator



Y30 Switchover valve, engine overload protection



S66 Switch, engine overload protection

W. Handling electronic control units after accident repair

It is necessary to change electronic control units after an accident if at least one of the following conditions is met:

1. The housing is recognizably deformed or damaged.
2. The supporting surface or console is deformed; the outside of the unit exhibits no damage.
3. The plug connector is damaged or corroded by moisture.
4. The functional check or the self-test of the equipment indicates faults.
   When electrical components, e.g. ELR control unit, have been removed for repair work and then used again, these are to be checked in accordance with the existing documents after assembly.