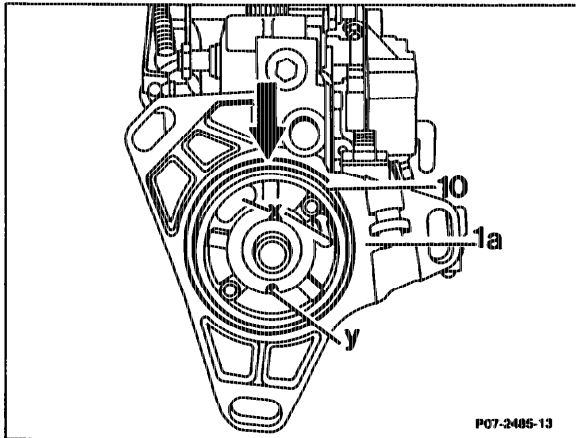


A. Lubrication of injection pump

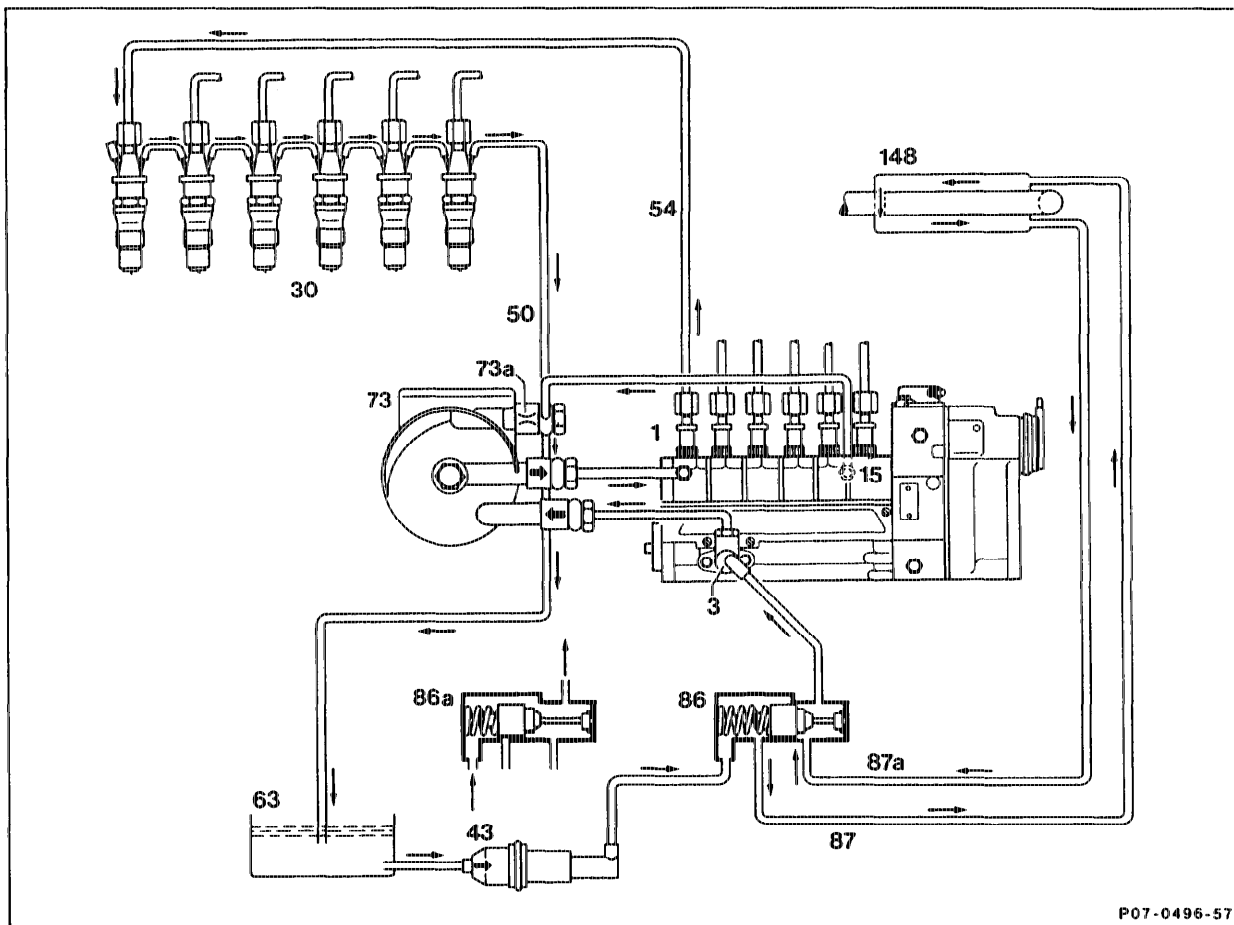


The injection pump is connected through an oil bore (arrow) to the engine oil circuit. The oil flows back into the crankcase through the annular gap (x) between bearing and housing.

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

B. Fuel circuit

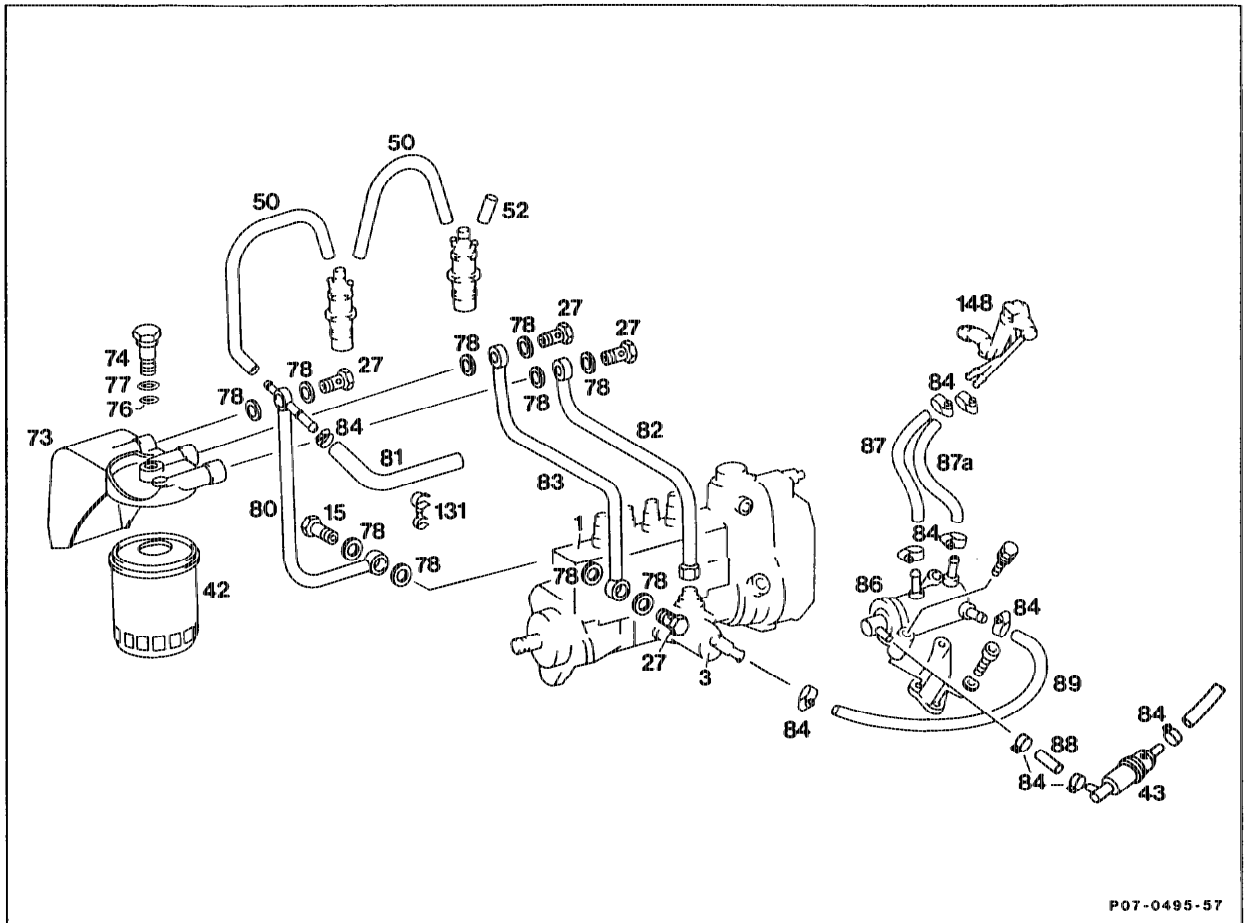
a) Fuel circuit diagram



P07-0496-57

1	Injection pump	73a	Restriction orifice in fuel filter top section dia. 0.8 mm
3	Fuel pump	86	Fuel thermostat open, position up to + 8 °C, fuel is preheated
15	Bypass valve with restriction dia. 1.5 mm	86a	Fuel thermostat closed, position as 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	Leak oil hose	148	Heater inlet pipe with fuel heat exchanger
54	Injection line, No. 1 cylinder		
63	Fuel tank		
73	Fuel filter top section		

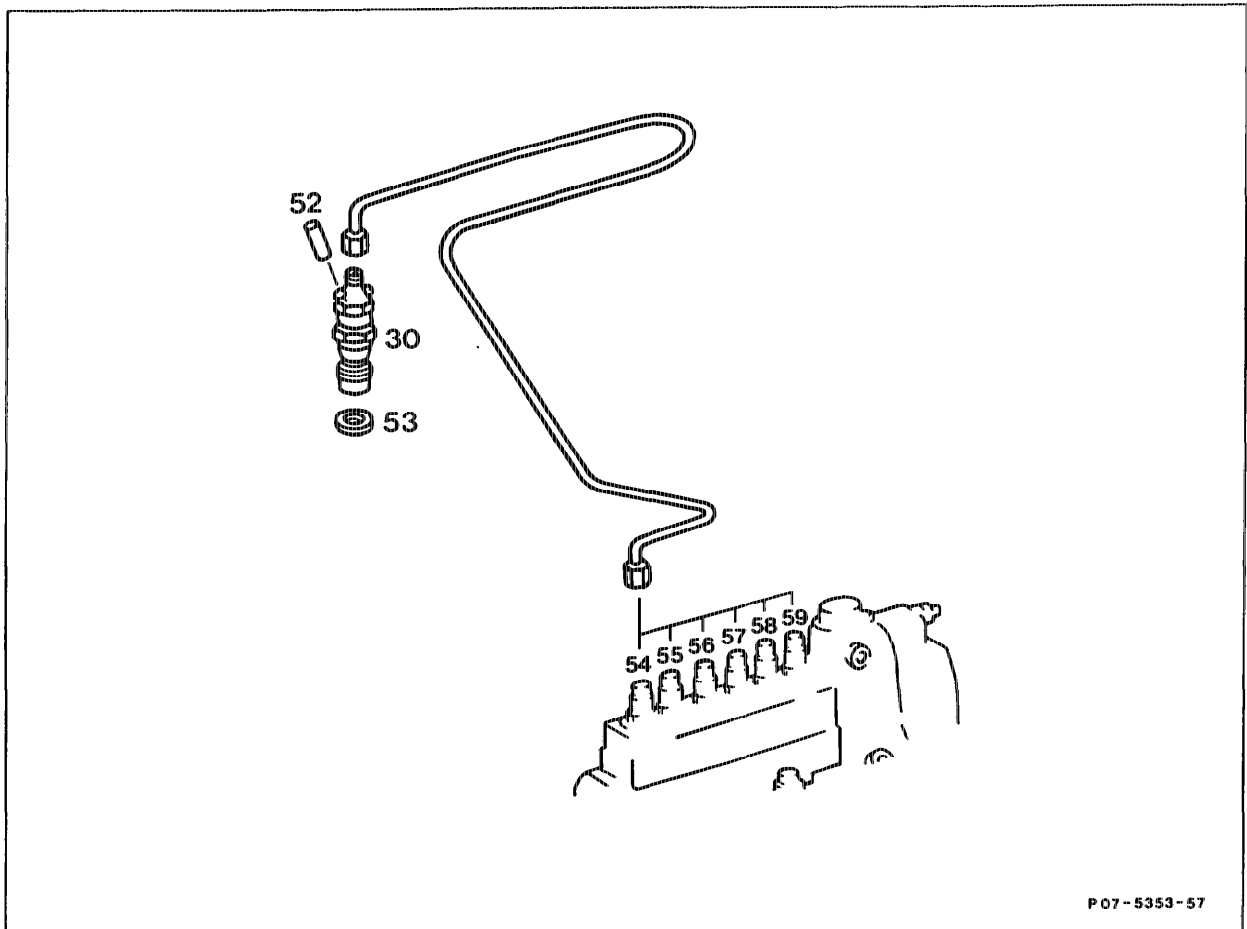
b) Low-pressure side



P07-0495-57

1	Injection pump	80	Return line
3	Fuel pump	81	Fuel hose return line
15	Bypass valve with restriction dia. 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	Leak oil 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	56	Injection line 3
52	Plug	57	Injection line 4
53	Nozzle shim	58	Injection line 5
54	Injection line 1	59	Injection line 6
55	Injection line 2		

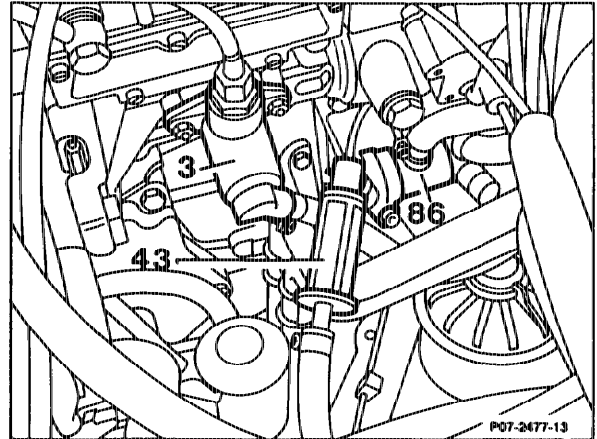
Note

Injection lines of 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 made of a transparent plastic.

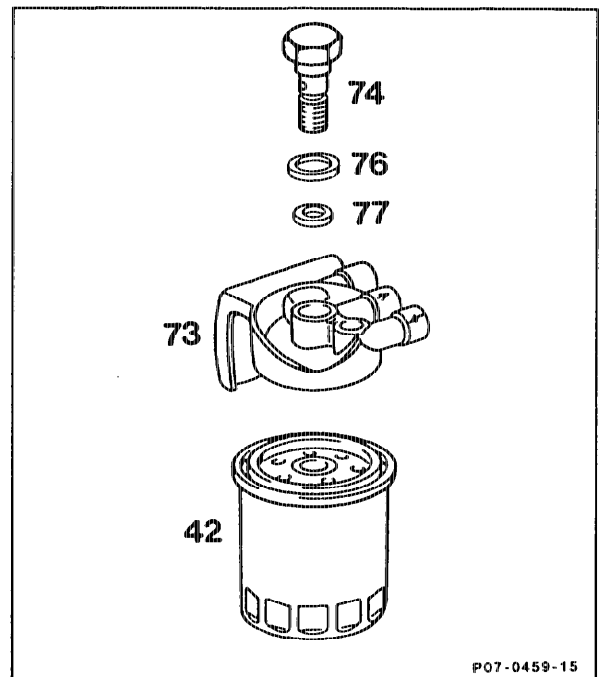
The mesh size is 600 μm (0.6 mm).



D. Fuel filter (42)

Installed in the pressure line between fuel pump and injection pump.

The paper filter element is integrated in a metal housing. The paper element has an average pore size of 6–10 μm (0.006–0.01 mm).



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

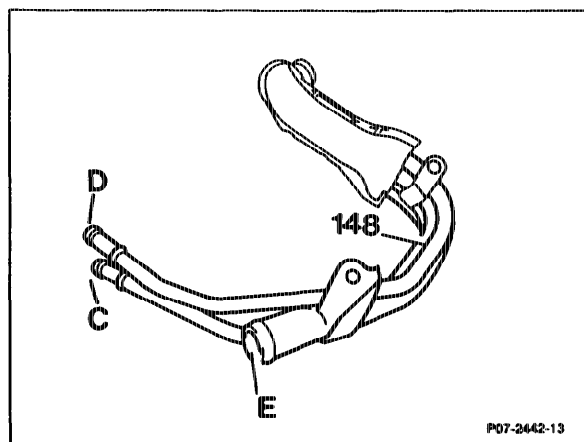
Note

When the engine is started, the fuel system is bled automatically as result of the greater delivery of the fuel pump and the restrictions in the filter top sections as well as at the injection pump.

E. Fuel preheater (148)

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

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



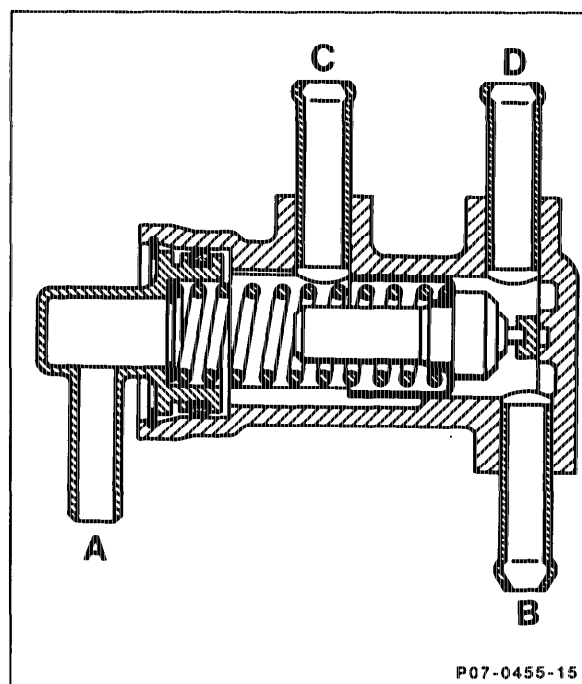
Function

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 up to + 25 °C mixed operation; the required fuel flows partially through the heat exchanger.

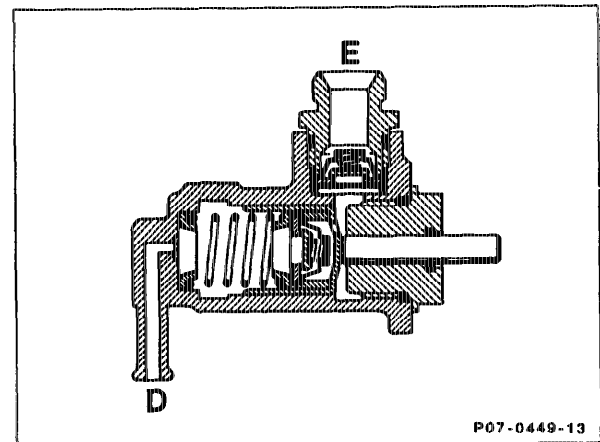
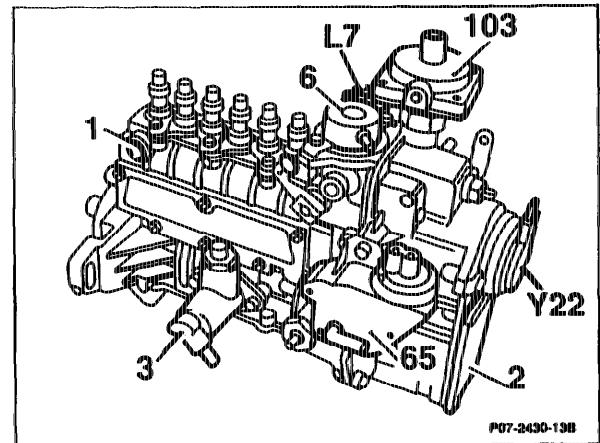
Above + 25 °C the heat exchanger is bypassed by the thermostat; the fuel is drawn in directly by the fuel pump. Fuel preheating ensures trouble-free operation with winter-grade diesel fuel as a rule down to approx. -25 °C ambient temperature.

Fuel thermostat
A Inlet line from fuel tank
B Suction line to fuel pump
C Inlet line 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 makes it possible to eliminate the hand priming pump.
Delivery $> 150 \text{ cm}^3/30 \text{ s}$,
at starting speed $> 150/\text{min}$, measured in fuel return line.

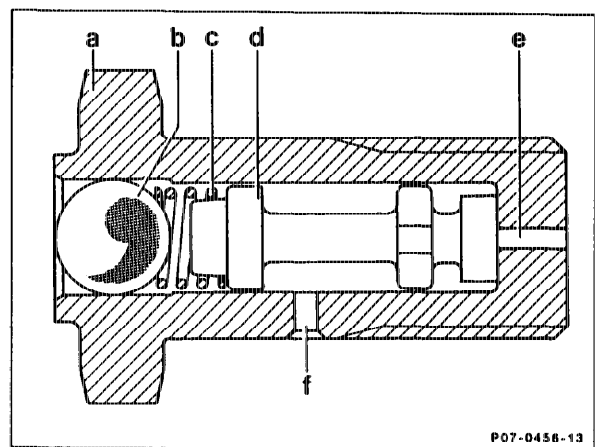
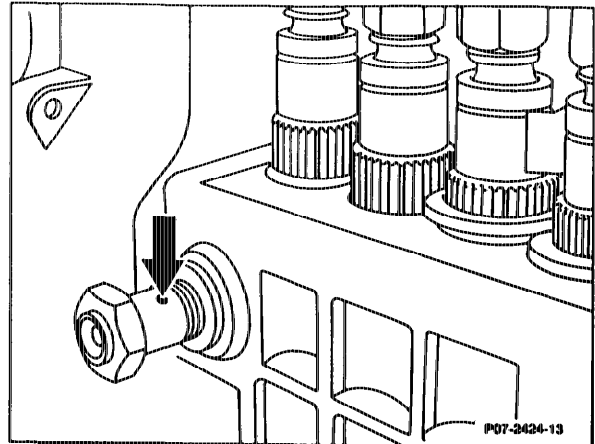


E Pressure side
D Suction side

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

Bypass valve with restriction dia. 1.5 mm (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).

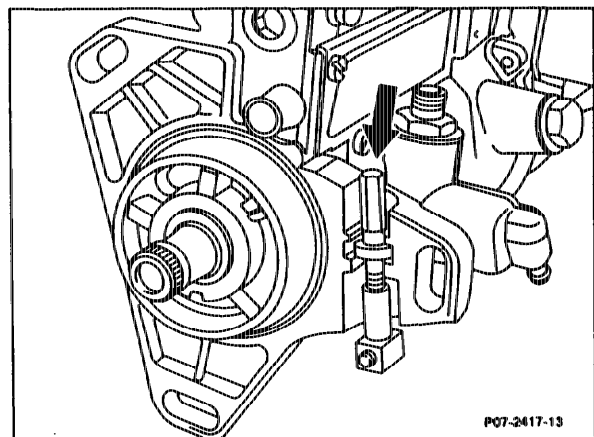


Restriction with bypass valve

- a Housing
- b Ball
- c Spring
- d Slide
- e Inlet
- f Restriction orifice dia. 1.5 mm

G. Start of delivery adjusting device

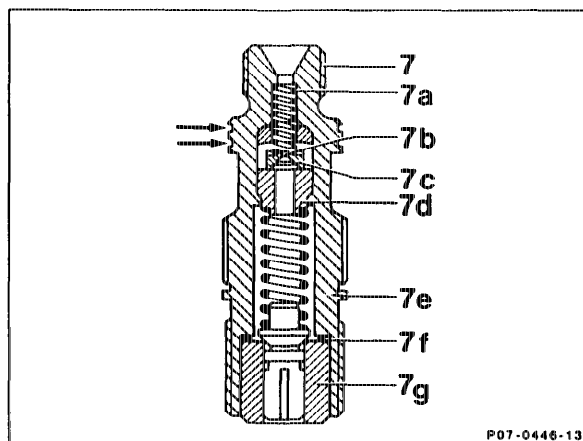
An adjusting device (arrow) is attached to the injection pump flange in order to be able to adjust the start of delivery when the engine is running.



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 portion in the exhaust gas. They prevent any after-spraying of the injection nozzles.

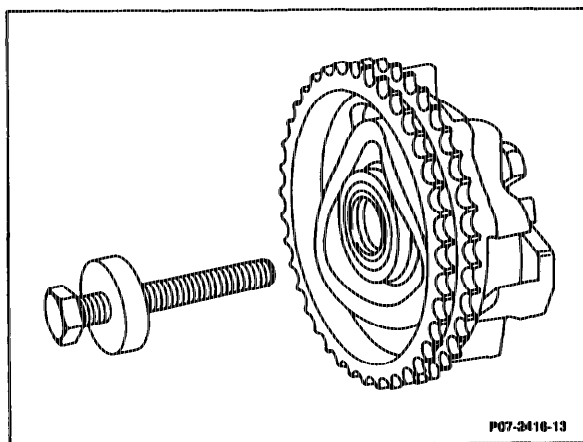
Two annular grooves act as identification marks on the delivery valve holder (7) (arrows). The reverse flow damping valve (7b) is a disc valve (7c) opening in the direction of the injection nozzle with a restriction orifice of 0.5 mm dia. The valve seat (7d) is riveted into the delivery valve holder.



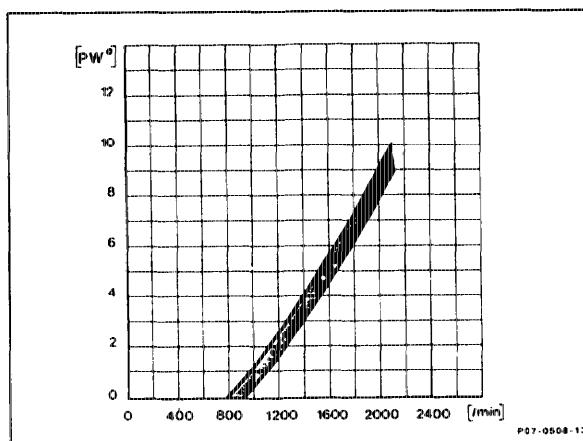
P07-0446-13

I. Injection timer

The injection timer is mounted on the injection pump shaft and is attached with a central bolt having a lefthand thread.



P07-3416-13



P07-0504-13

Injection timer adjustment curve

n = rpm of injection pump

PW° = adjustment angle of injection pump

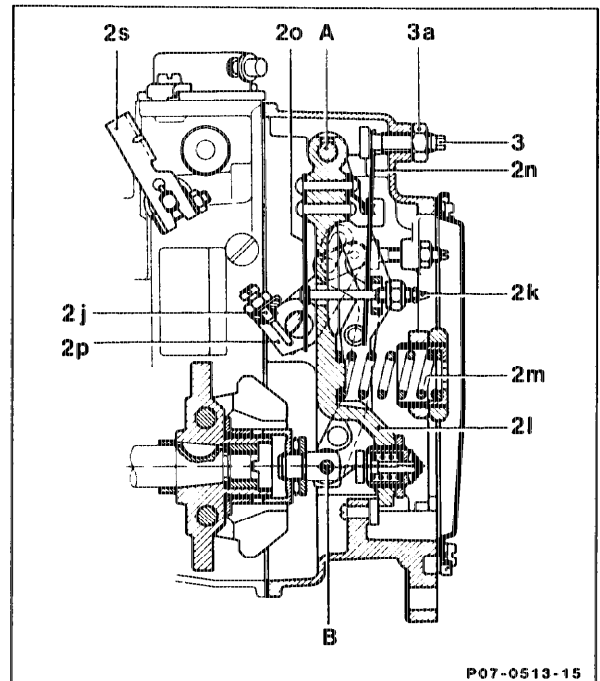


J. RSF Governor

a) Design and operating principle

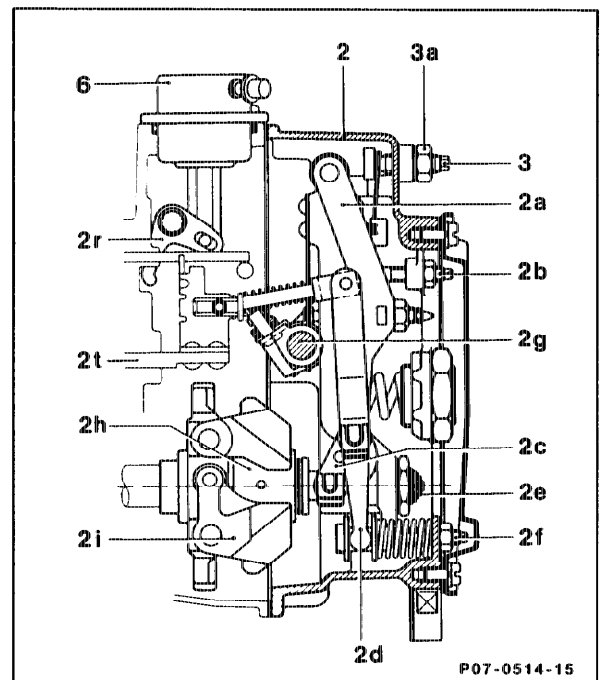
The governor is a minimum/maximum speed governor, the governor spring of which (2m) is sized and set in such way that it does not govern in the part load range, with the exception of torque control (refer to "Control when starting and at full load"). In the part load and full load range, the control 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 idling spring (2n) is pretensioned and the idle speed set by the adjusting screw (3).



P07-0513-15

- 2 Governor
- 2a Guide lever
- 2b Stop screw for idle 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 Idling auxiliary spring – cutoff
- 2k Adjusting screw for idling auxiliary spring (idling stabiliser)
- 2l Tensioning lever
- 2m Governor spring
- 2n Idling spring
- 2o Idling auxiliary spring (idling stabiliser)
- 2p Steering arm
- 2r Stop lever
- 2s Emergency stop lever
- 2t Control rod
- 3 Adjusting screw for idle speed
- 3a Locking nut
- 6 Vacuum unit (stop)



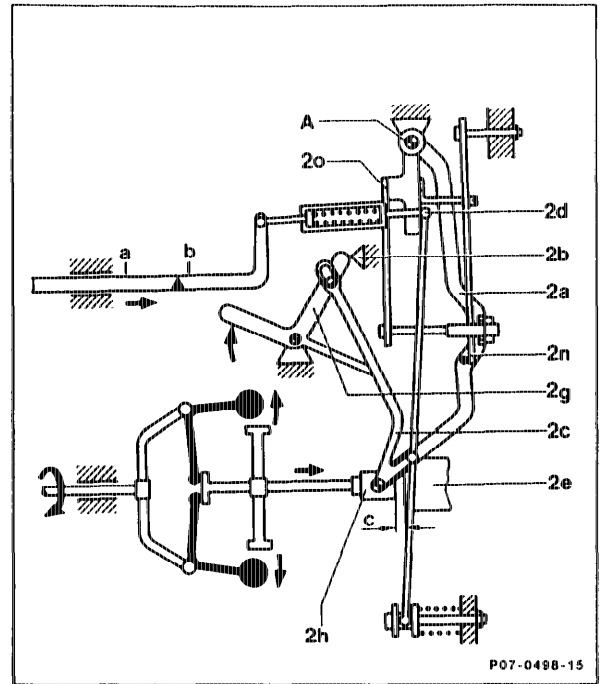
P07-0514-15

b) Control when idling

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

At a certain engine speed, the guide lever (2a) moves against the adjusting nut of the idling 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 idling stage, the sliding sleeve (2h) moves against the spring retainer (2e).

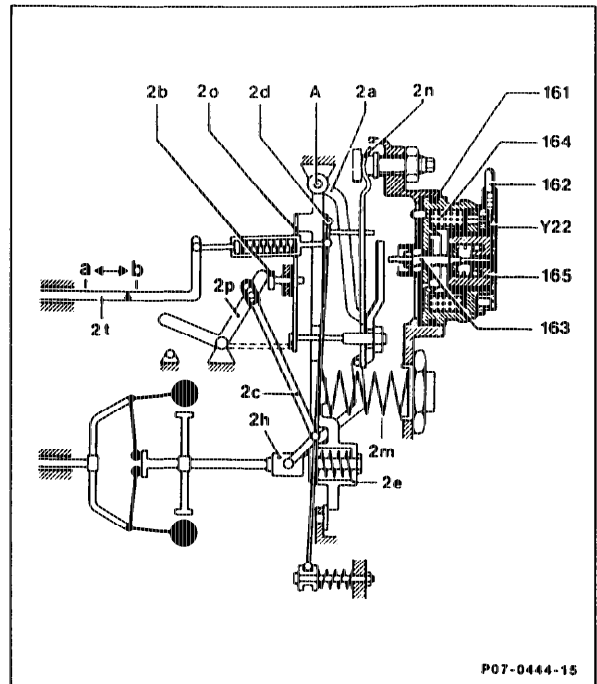
If the engine speed increases further (e.g. deceleration), from a certain engine speed on, first of all the spring retainer (2e) and then the governor spring (2m) is over-compressed. The control rod is thus brought into the "stop position" (deceleration fuel cutoff).



- a Start
- b Stop
- c Idling stage

c) Control with actuator

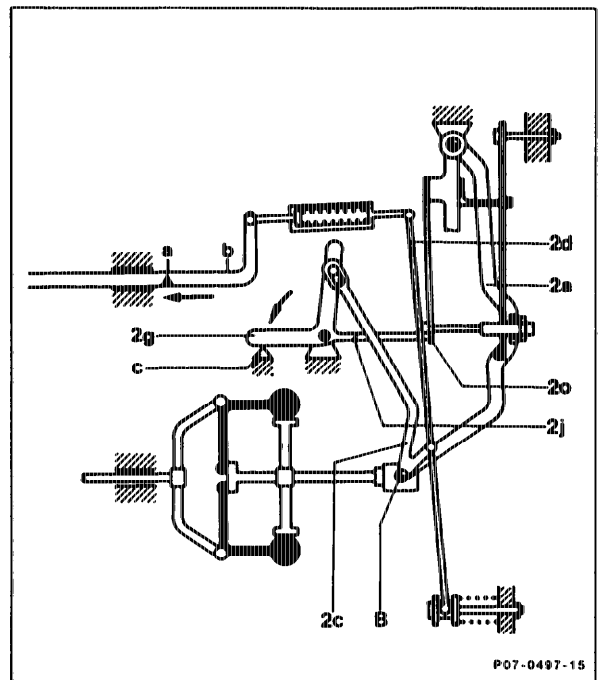
The lift rod (163) is resting against the guide lever (2a). The actuator (Y22) is fed by the control unit (electronic idle speed control) with a clocked D.C. voltage in the frequency range of approx. 50 Hz. If engine speed drops (e.g. drive position engaged or power steering turned to full lock), the 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) moves 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 the 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 idling auxiliary spring (2o idling stabiliser) is pressed away from the guide lever by the cutoff idling auxiliary spring (2j). This enables a more rapid cutoff from the start position of the governor.



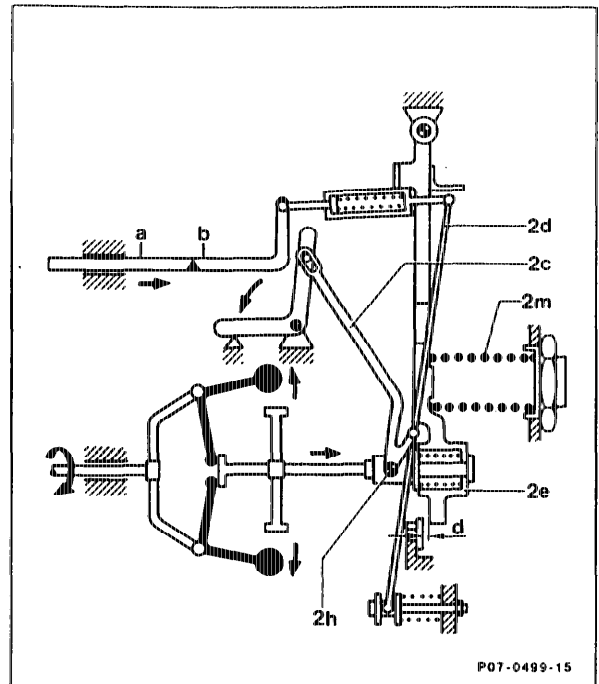
- a Start
- b Stop

e) Full load speed regulation/adaption

After passing through the idling stage (c) (refer to ill. of control when idling) 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) (adaption).

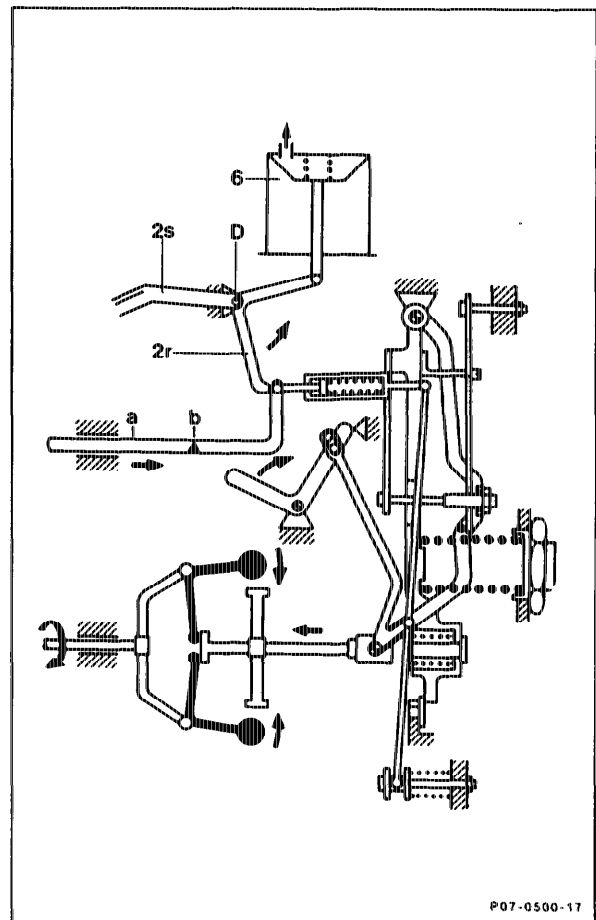
If the engine speed continues to rise, the force of the flyweights is sufficient to over-compress the governor spring (2m) (full load speed regulation). The start of cutoff depends on the preload of the governor spring (2m).



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.

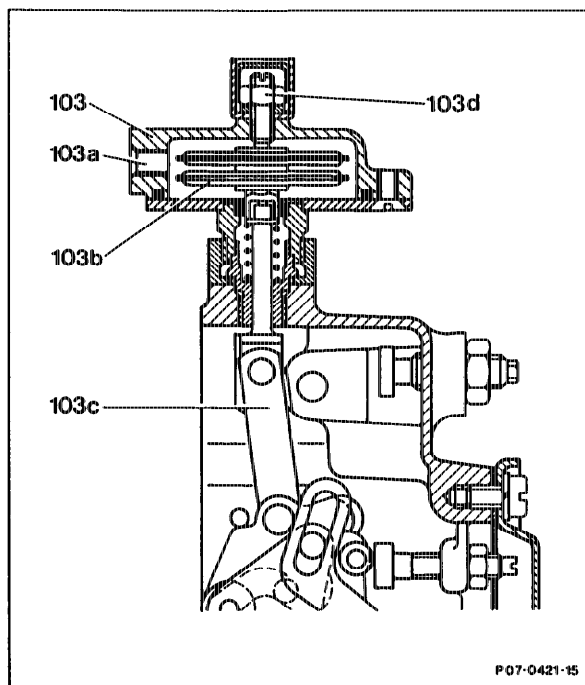
The vacuum unit (6) is connected to a stop lever (2r), which swivels about the pivot point "D", pulling the control rod of the injection pump into "Stop" position. This causes the deflecting spring of the fulcrum lever to be over-compressed. The control rod can be pulled into the "Stop" position from 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) comprises a housing (103) with barometer unit (103b). The absolute pressure can act on the barometer units by means of a port (103a) to the charge air pipe of the engine, and the barometer units thus react to every 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". The effect of the ALDA device diminishes, the more the control lever is moved in the direction of idling. When the control lever is in the idling position, the effect is approximately zero.

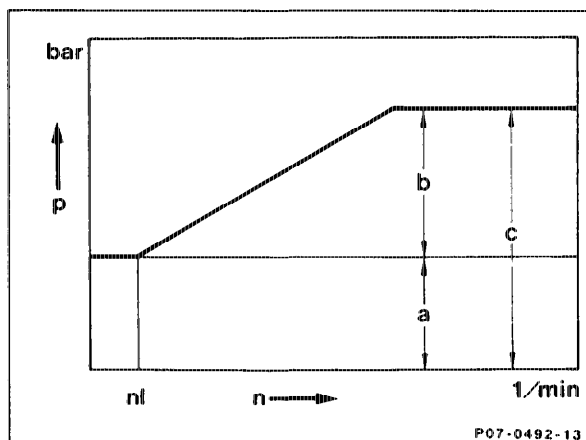


103d Adjusting screw
(factory-set by manufacturer)

Absolute pressure with charge operation

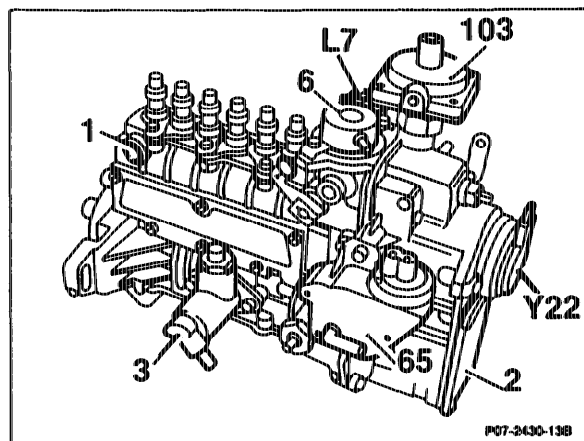
The intake air under atmospheric pressure is further compressed by the turbocharger. Atmospheric and charge pressure together produce the absolute pressure prevailing in the charge air pipe of the engine.

- 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



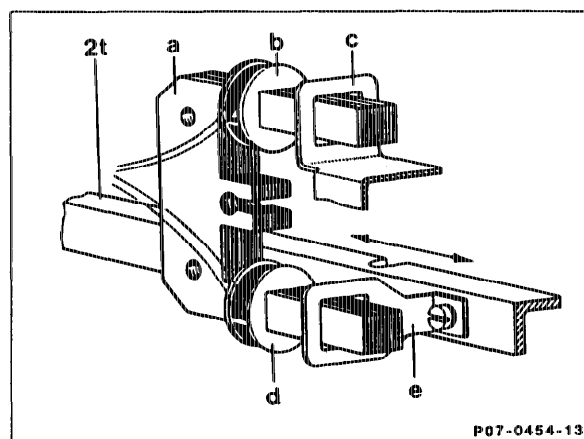
L. Control rod travel sensor (L7)

Installed in the governor of the injection pump. The control rod travel sensor consists of an iron core, two coils (measuring 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 latter 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) alters. The variable inductance which is thus produced is compared with 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).

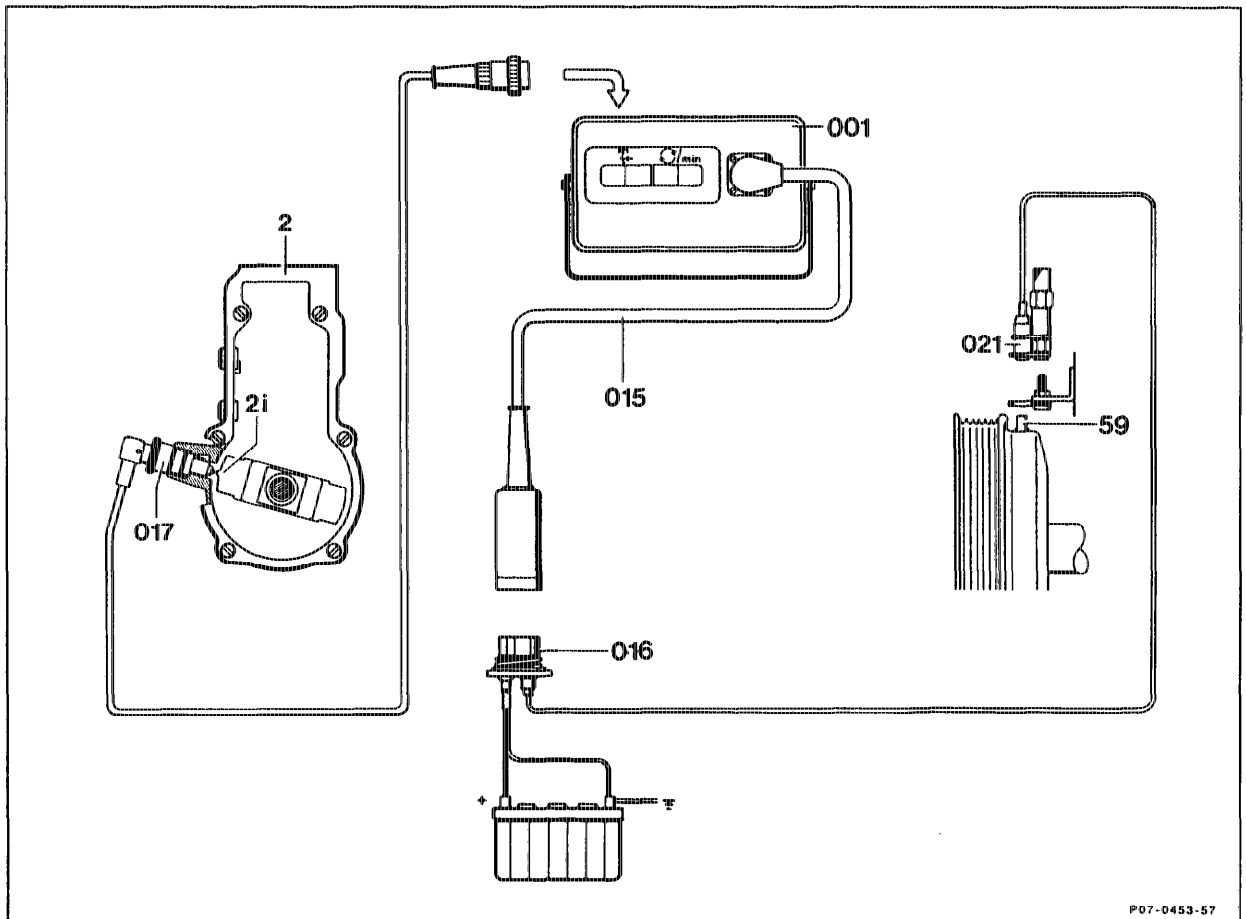
- TDC pulse from the crankshaft
- Reference impulse from the injection pump

Both pulses are supplied by pulse generators. To obtain a signal, the generator pins must be moved passing the pulse generators at a minimum rate (idling 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 start of delivery when the engine is not running (stationary).



P07-0453-57

001	Digital tester
2	Governor (injection pump)
2i	Flyweight with RI generator pin
015	Test cable

016	Diagnostic socket
017	RI generator
021	TDC generator
59	TDC generator pin

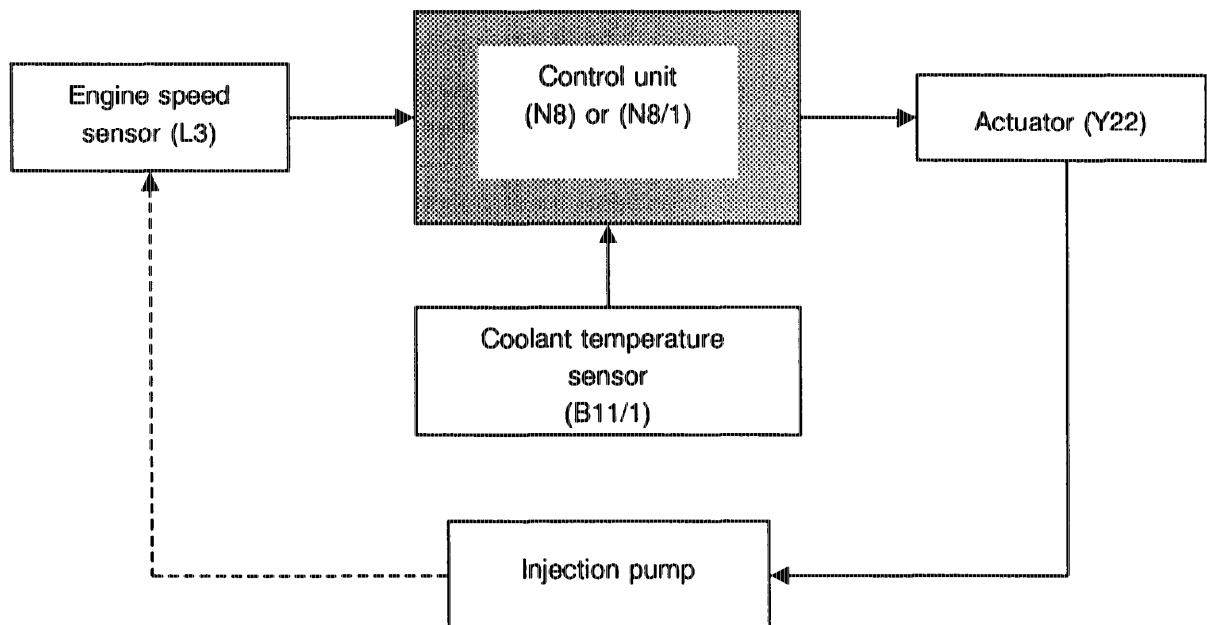
N. Electronic idle speed control (ELR)

Function

The starter ring gear speed sensor (L3) detects the engine speed (144 pulses/revolution) and passes these in the form of an alternating voltage to the electronic idle speed control unit (N8) or to the ELR/ARA control unit (N8/1).

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

Set idling speed is raised in accordance with a specified characteristic curve by the temperature sensor (B11/1) at coolant temperatures $< 60\text{ }^{\circ}\text{C}$.



System diagnostics

Engine 602

The ELR system can be tested by means of the self-test routine integrated in 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.

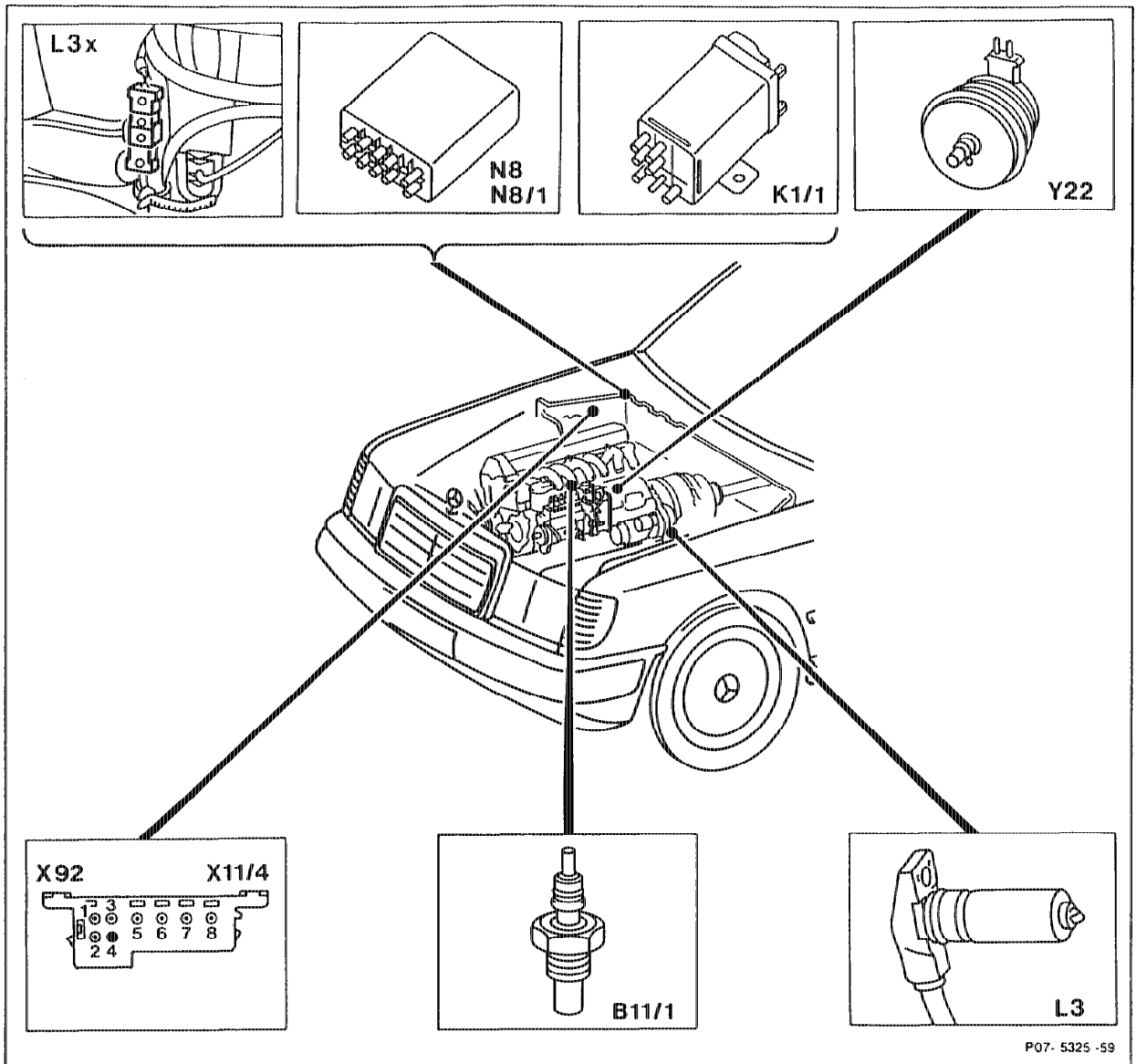
Engine 603

Engine 603 is fitted with a control unit with diagnostics as of 05/88. Control unit designation: RO2 (was RO1).

Pulse readout	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
K1/1 Overvoltage protection relay
L3 Engine speed sensor, starter ring gear
L3x Plug connection, engine speed sensor starter ring gear
N8 ELR control unit

N8/1 ELR/ARA control unit
N39 EDS control unit
X11/4 Test coupling for diagnosis, pulse signal (8-pin)
Y22 ELR actuator




O. Anti-jerk control (ARA), engine 602.96 with manual transmission

General

To damp the tendency to jerk on vehicles with manual transmission, a control solenoid has been fitted to the injection pump governor, which can reduce the injection quantity.

The control solenoid is actuated by an electronic control unit.

This function, as well as the former ELR function is performed by the control unit located in the place of the former ELR control unit.

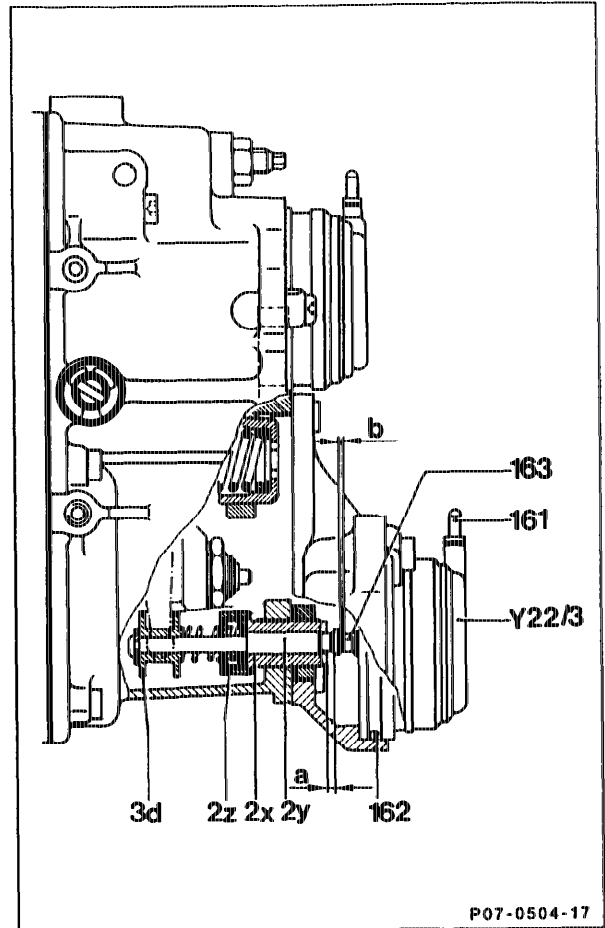
Engine 602.96 with manual transmission  model year 1991 and as of model year 1992   and basic version Code 62/0 are fitted with a separate ARA control unit without ELR function. The ELR function is integrated in the EDS control unit.

Function

The speed sensor (L3) detects the engine speed (144 pulses/revolution) and transmits this to the control unit (N8/1 or N8/2) in the form of an alternating voltage. Speed fluctuations or irregularities are recognised by the control unit (N8/1 or N8/2). The tendency to jerk is damped by briefly reducing the injection quantity. In order to achieve adequate damping when changing to overrun (no delivery), the overrun-jerking is minimised by a special damper.

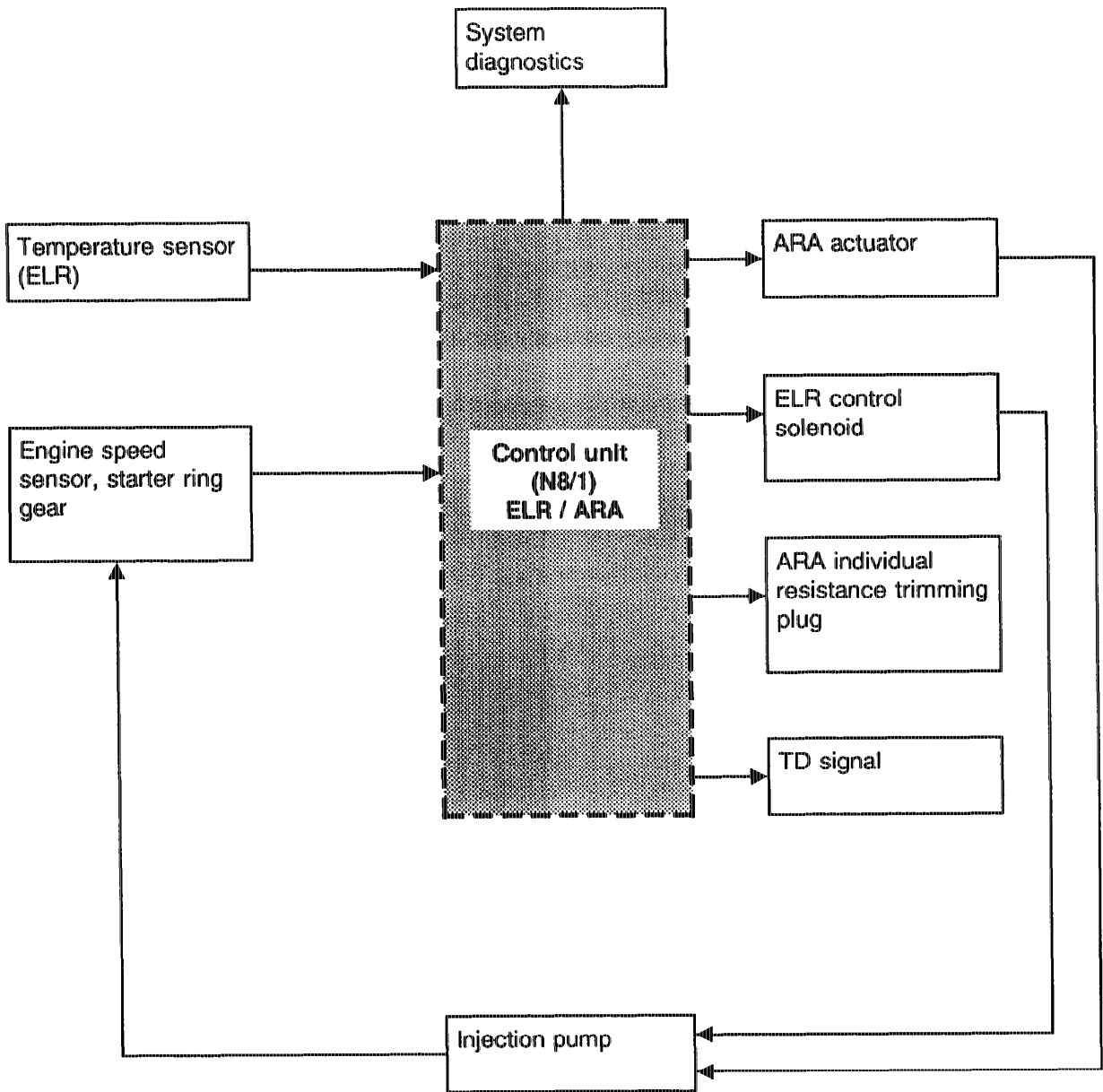
In addition the facility exists to influence the sensitivity of the control with a resistance trimming plug, in order to damp the tendency to jerk under particular operating conditions.

- 161 Electrical connection
- 162 O-ring
- 163 Lifter
- 2x ARA retainer
- 2y Sliding pin
- 2z Return spring
- 3d Orientation sleeve
- Y22/3 ARA control solenoid
- a Setting travel 0.9 ± 1 mm (retainer travel)
= Control rod travel 1.35–1.65 mm
- b Play at full load stop 0.1–1.0 mm



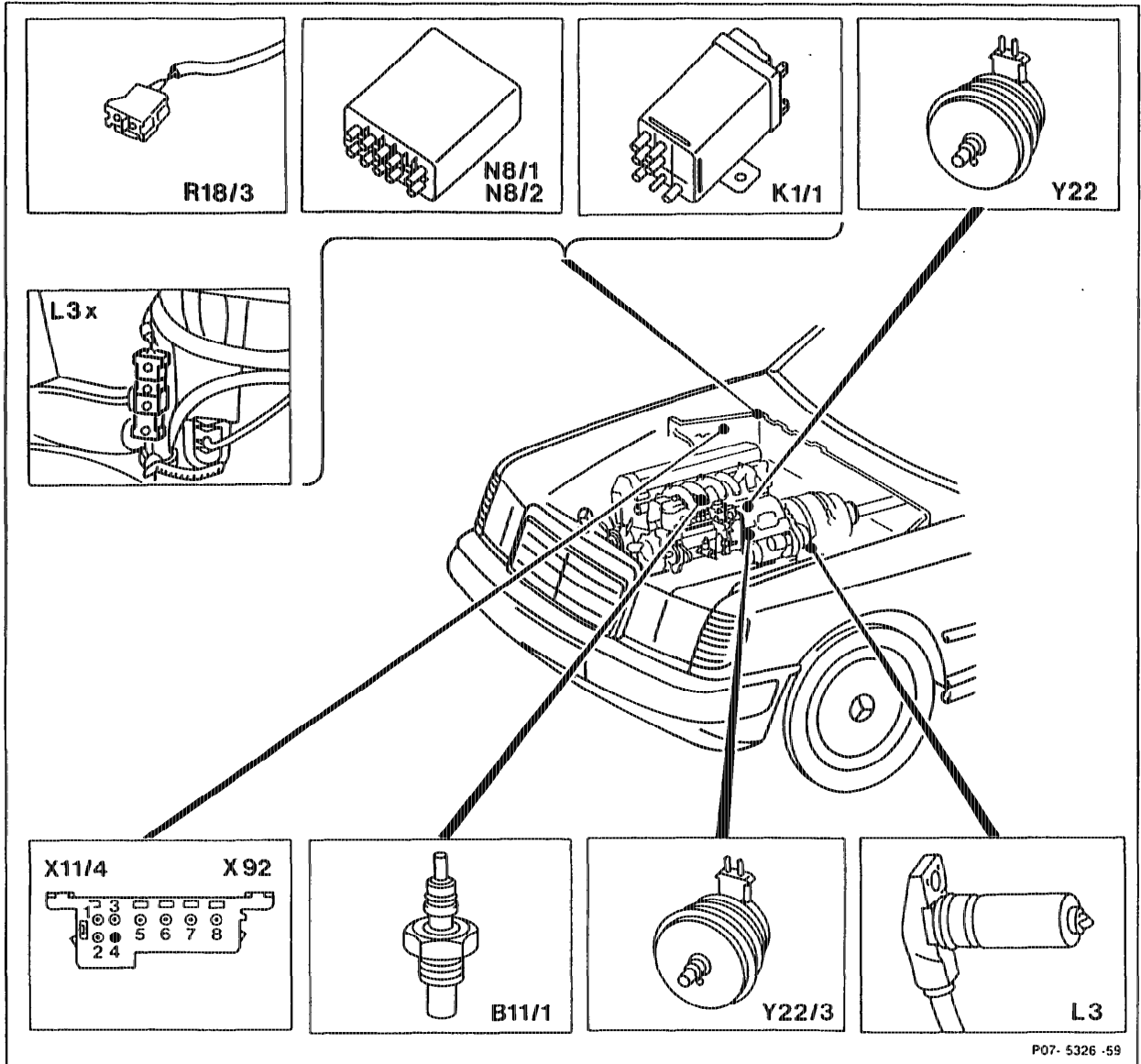
P07-0504-17

ARA/ELR block diagram



Location of components

Standard and (A), (FIN) version, Engine 602.96



P07- 5326 -59

B11/1	Coolant temperature sensor, electronic idle speed control (ELR)	R18/3	ARA individual resistance trimming plug
K1/1	Overvoltage protection relay 87E, 7-pin	X11/4	Test coupling for diagnostics, pulse signal (8-pin) or X92
L3	Engine speed sensor, starter ring gear	Y22	Actuator, electronic idle speed control
L3x	Plug connection, engine speed sensor, starter ring gear	Y22/3	ARA control solenoid
N8/1	ELR/ARA control unit (not with EDS)		
N8/2	ARA control unit (only with EDS)		



P. Facet pintle nozzle

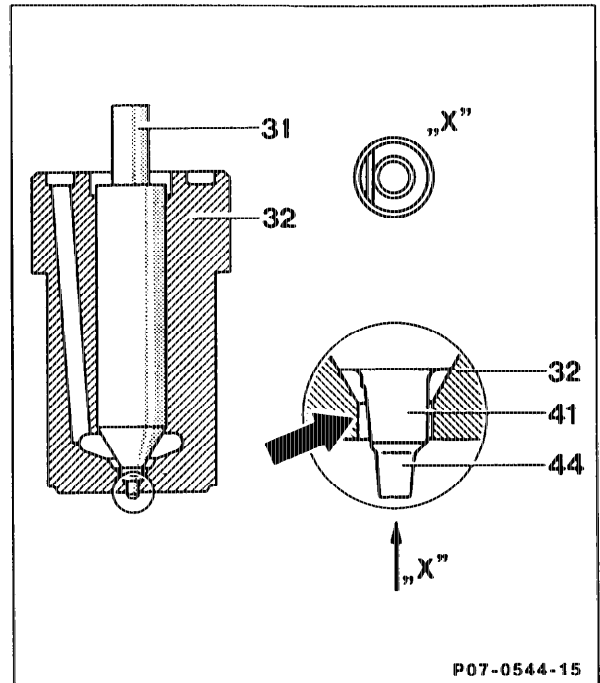
Bosch Designation DN 0 SD 265

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.

Bosch Designation DN 0 SD 314

Facet depth on spray pintle reduced in order to improve the throttling effect and thus the idling quality of the engine.

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



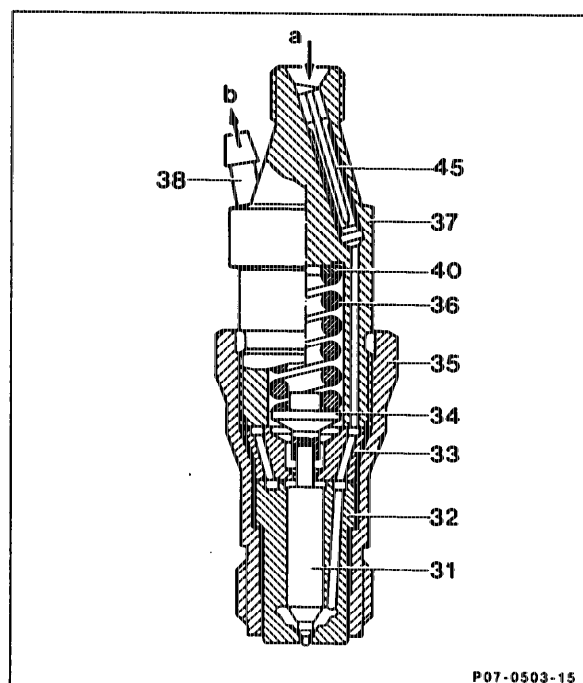
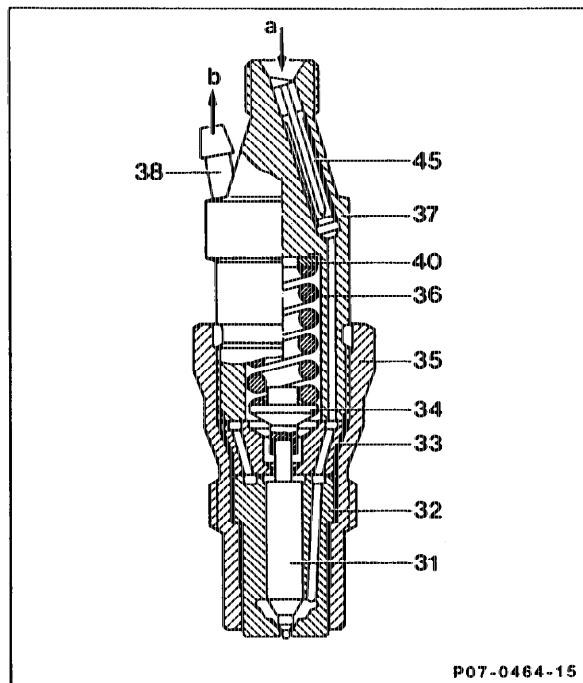
Q. Nozzle holder

Bosch Designation:

KCA 27 S 55, for oblique injection

KCA 30 S 44, for vertical injection

The thickness of the shim (40) determines the pre-load of the compression spring (36) and thus the opening pressure of the injection nozzle. The ejection 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)

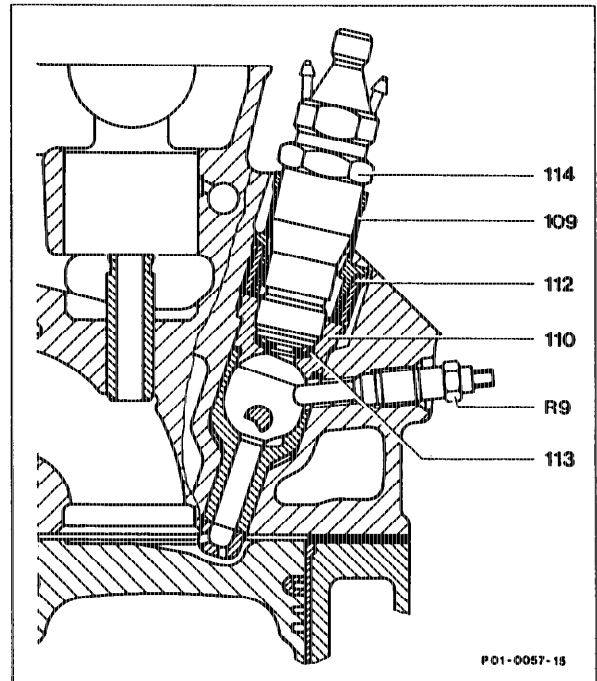
- 31 Nozzle needle
- 32 Nozzle body
- 33 Intermediate disk
- 34 Pressure pin
- 35 Nozzle tensing nut
- 36 Compression spring
- 37 Holder
- 38 Leak oil port
- 40 Shim
- 45 Inlet orifice
- a Fuel inlet
- b Leak fuel (return)



R. Oblique injection

The nozzle holder combination is screwed into the top section of the prechamber tilted by 5° relative to the longitudinal axis of prechamber. This oblique injection produces an even more intensive blending of air and fuel.

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



Together with the prechamber modification, this offers the following benefits:

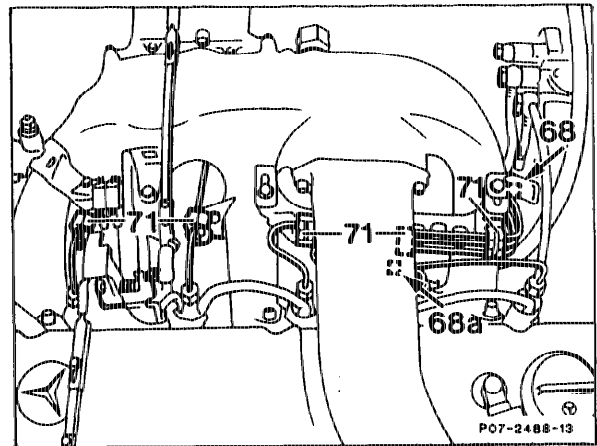
- Improved cold start
- More favourable air/fuel blending as a result of shorter glow plug (now 23 mm was previously 25 and 27 mm) in combination with recess and the concave in the ball pin.
- Particle reduction and improvement in hydrocarbons and carbon monoxide.

S. Injection lines

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

Note

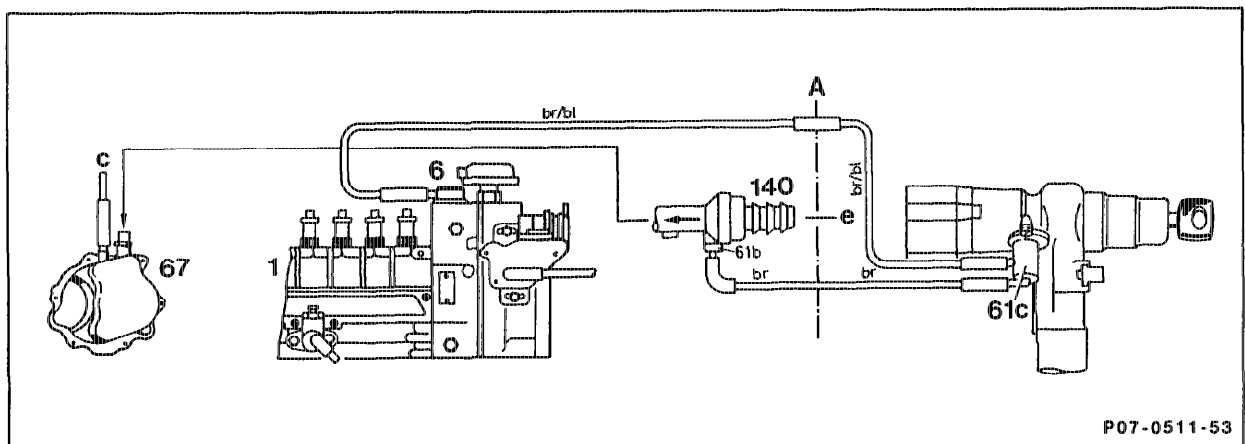
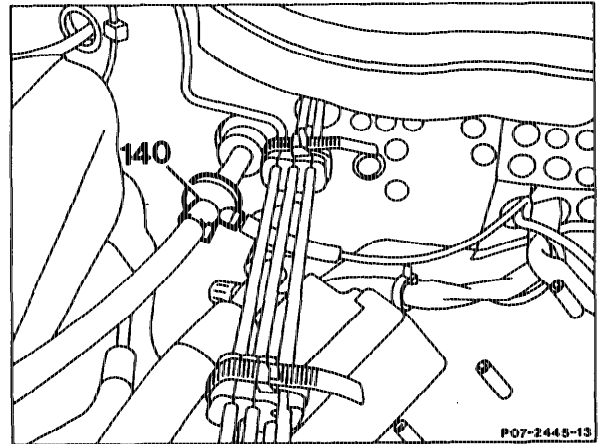
The plastic clips (68 and 68a) must be fitted as close as possible to the radius of the injection lines (arrows). The plastic clips (71) must be locked in place.



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

a) Models 124, 126, 201

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

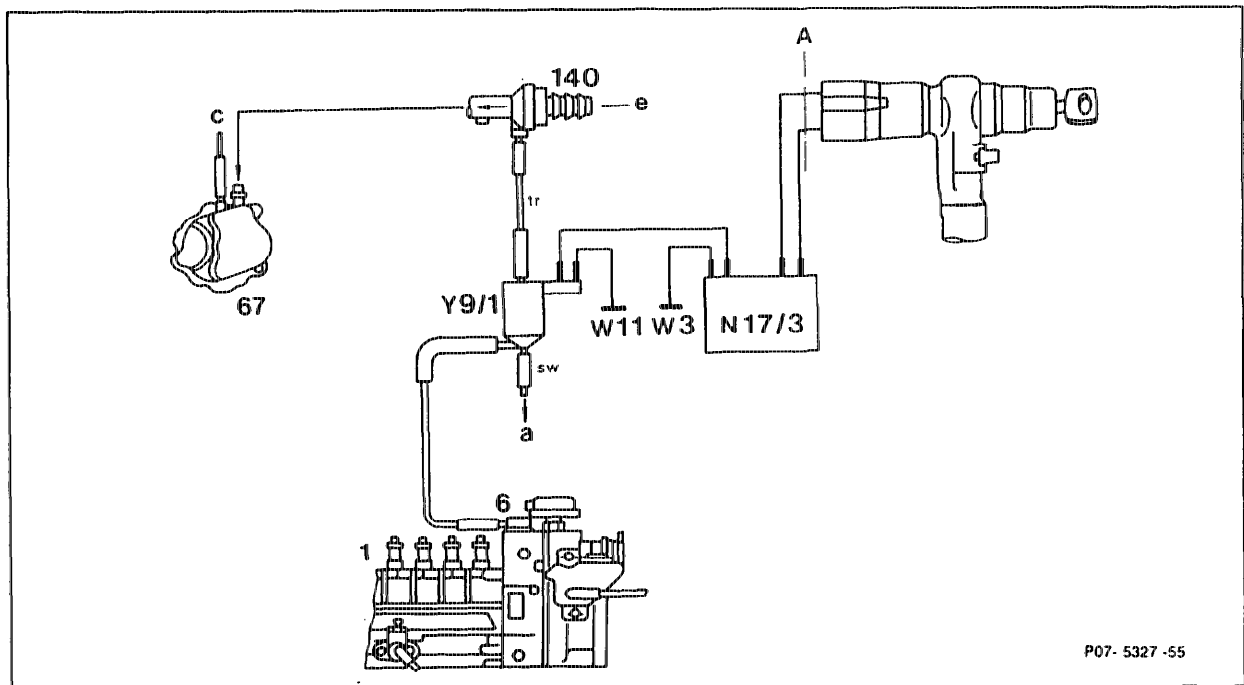


Vacuum line routing

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		

b) Model 140, engine 603.971 (USA) model year 1992

The key-operated engine stop is no longer actuated via the glow start switch valve (61c) but via an electric switchover valve (Y9/1) and via a relay (N17/3), which at the same time also switches off the fuel.



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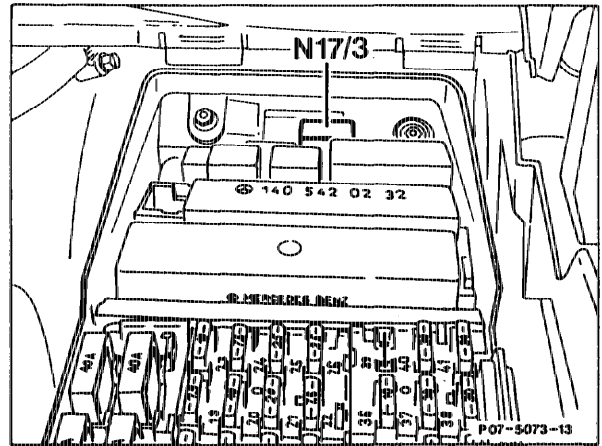
Vacuum line routing

1	Injection pump	Y9/1	Key-operated stop switchover valve
6	Stop unit	A	Intermediate panel
67	Vacuum pump	a	Air admission to vehicle interior
140	Check valve/main vacuum line	c	Other ancillaries
N17/3	Key-operated stop relay (fuel shutoff)	e	To brake booster
W3	Ground, front left wheelhouse		
W11	Ground, engine		

Key-operated engine stop relay (N17/3), key-operated engine stop switchover valve (Y9/1)

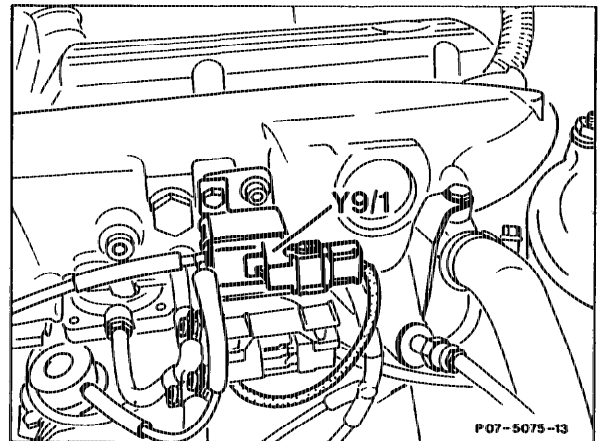
The key-operated engine stop relay (N17/3) is actuated for about 3 seconds after the engine is switched off and operates the key-operated engine stop switchover valve (Y9/1).

N17/3 Key-operated engine stop relay (fuel shutoff)



A vacuum of about 500 mbar exists at the key-operated engine stop switchover valve (Y9/1). After this valve is actuated, the vacuum which exists at the valve operates the stop unit at the injection pump pneumatically and moves the control rod into the stop position.

Y9/1 Key-operated engine stop switchover valve










U. Electronic diesel system (EDS)

a) General

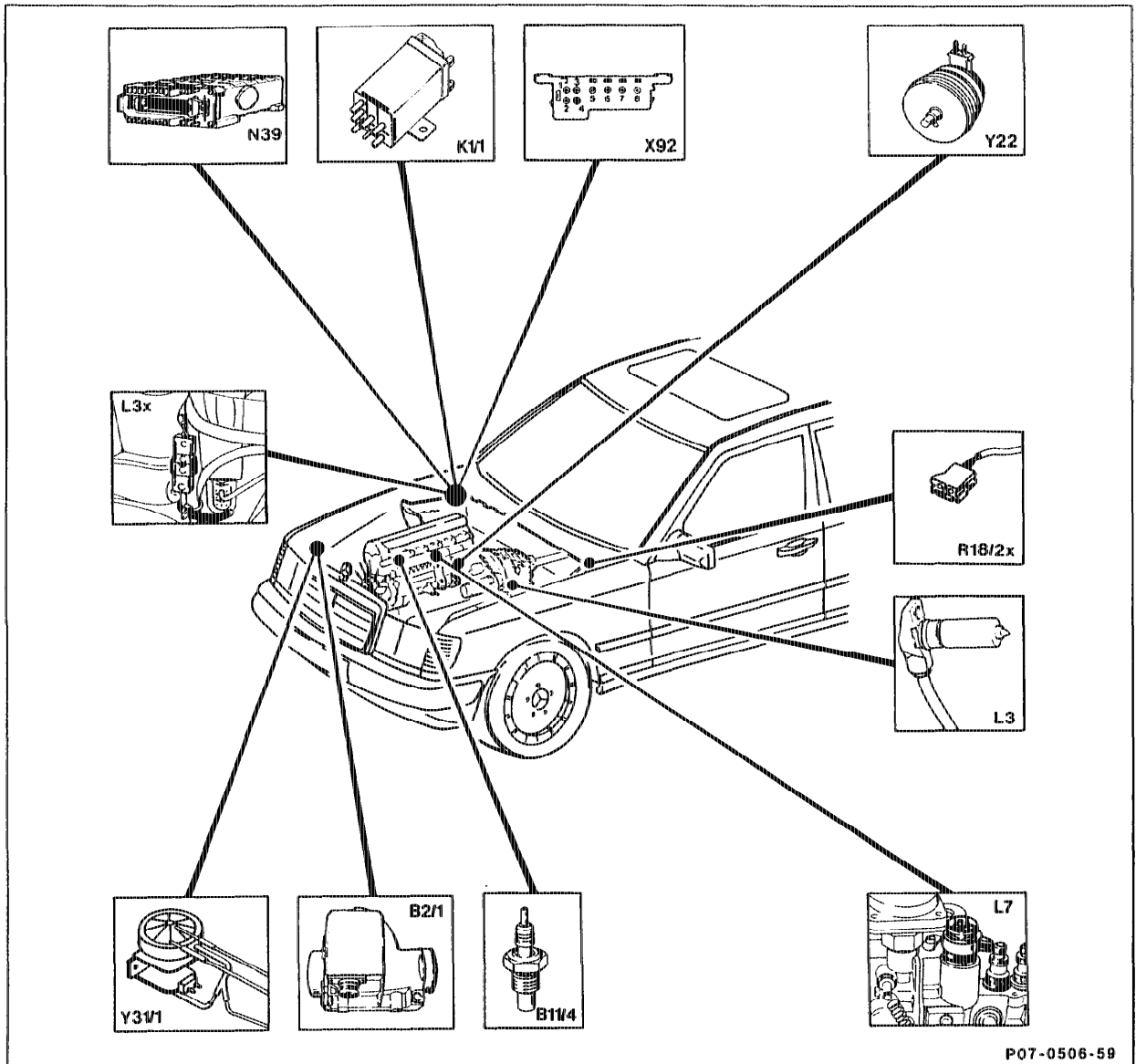
The EDS control unit (N39) processes the electronic idle speed control with exhaust gas recirculation and charge pressure control.

As a result of the integrated self-test program, faults are detected and stored which simplifies diagnostics.

Design and operating principle:

- Location of components
- Function diagrams
- Influencing variables of electronic diesel system (EDS)
- Electronic idle speed control (ELR)
- Exhaust gas recirculation (ARF)
- Recirculating air control for trap oxidizer (only  California engine 603.96 model year 1986/87).
- Charge pressure control (P2 control)
 - Engine 602.96
 - Basic version Code 62/0 as of 06/91
 -  as of model year 1990
 -   as of model year 1991
 -   as of model year 1992
 - Engine 603.971
 -  as of model year 1992
- System diagnostics

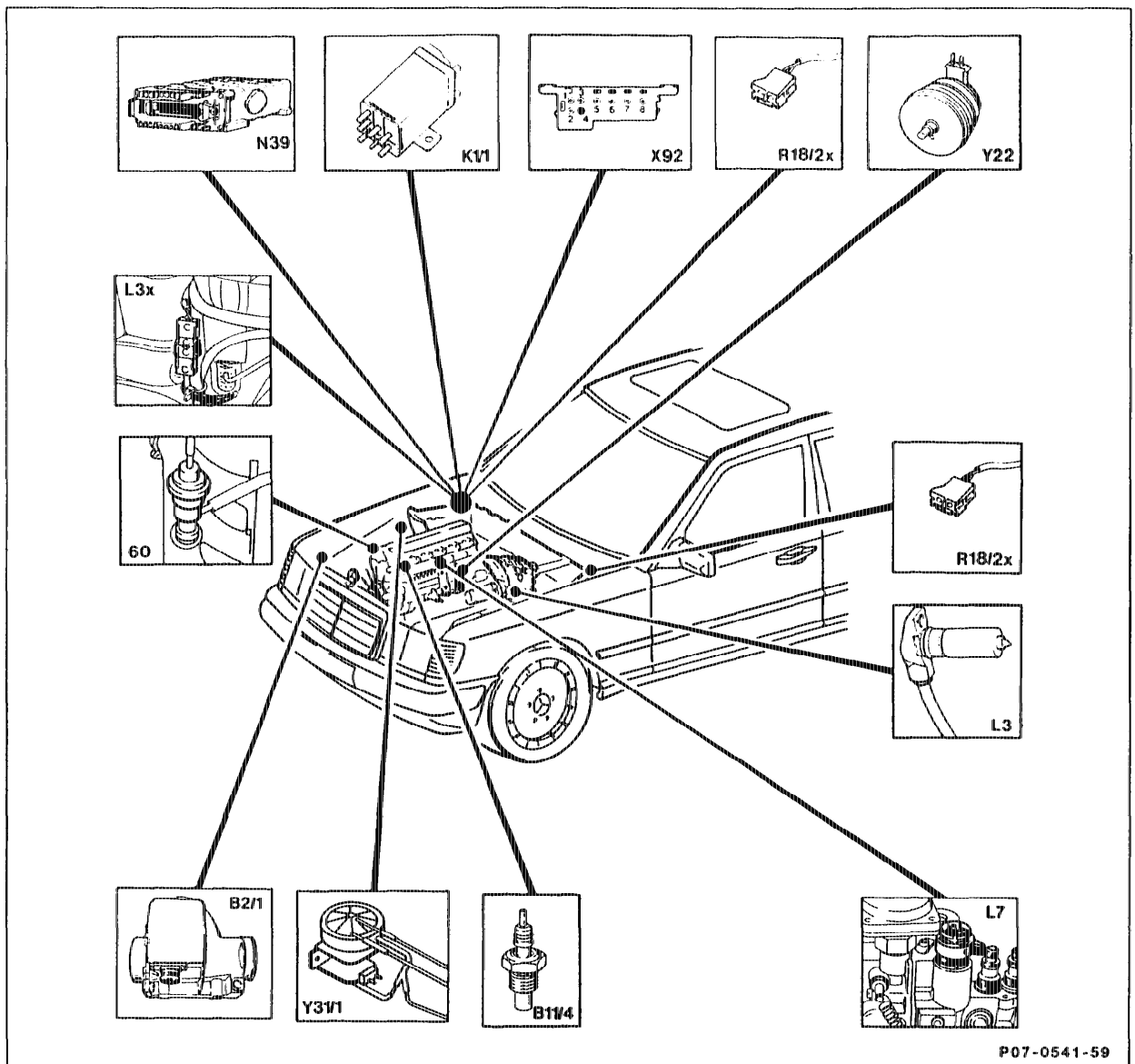
b) Location of components



P07-0506-59

Model year 1988 (J)

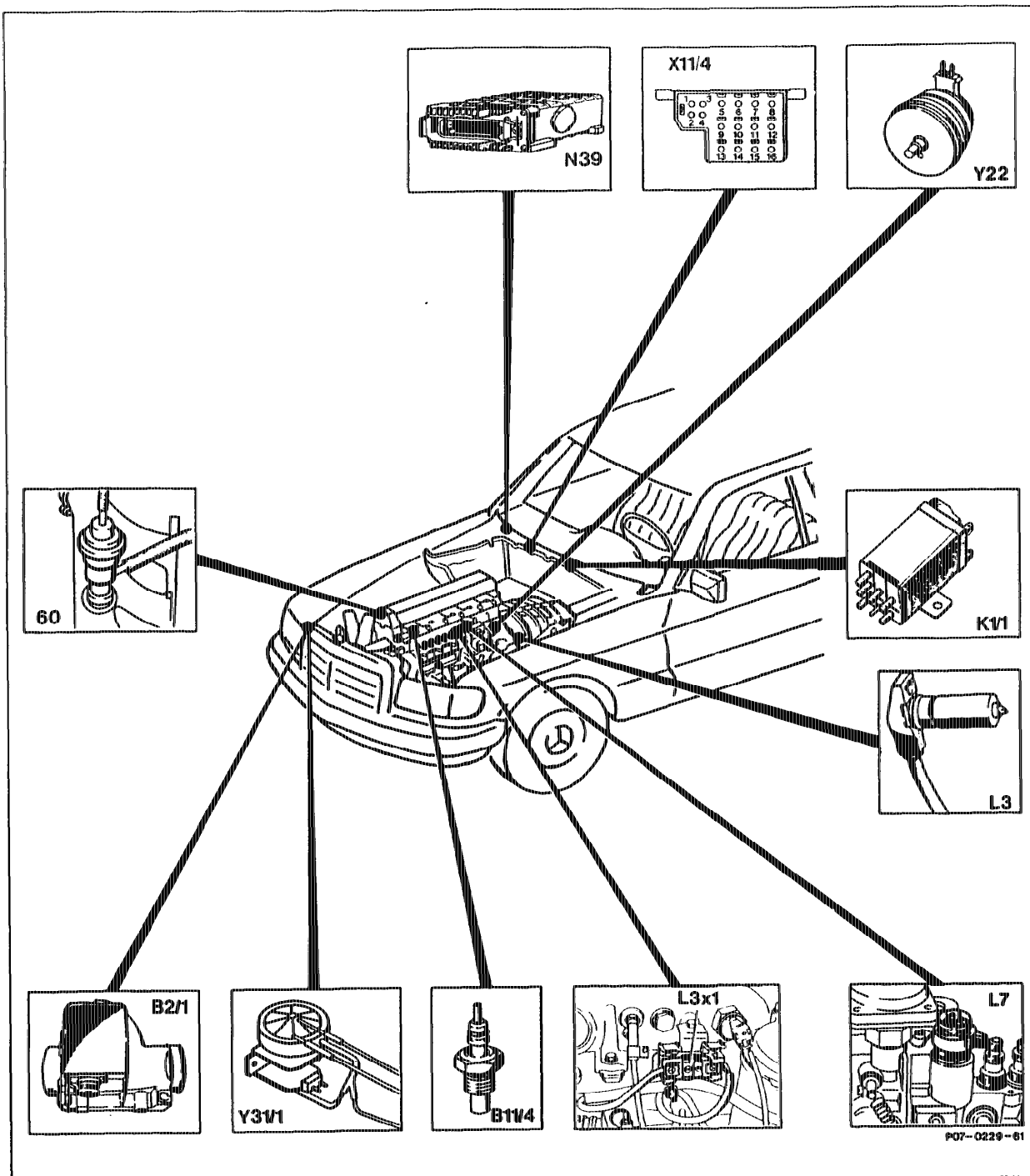
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS	L7	Control rod travel sensor
B11/4	Coolant temperature sensor	N39	EDS control unit
K1/1	Overvoltage protection relay	X92	Test connector
L3	Engine speed sensor – starter ring gear	Y22	ELR actuator
L3x	Plug connector, engine speed sensor – starter ring gear	Y31/1	ARF vacuum transducer
		R18/2x	Plug connection/ARF reference resistor



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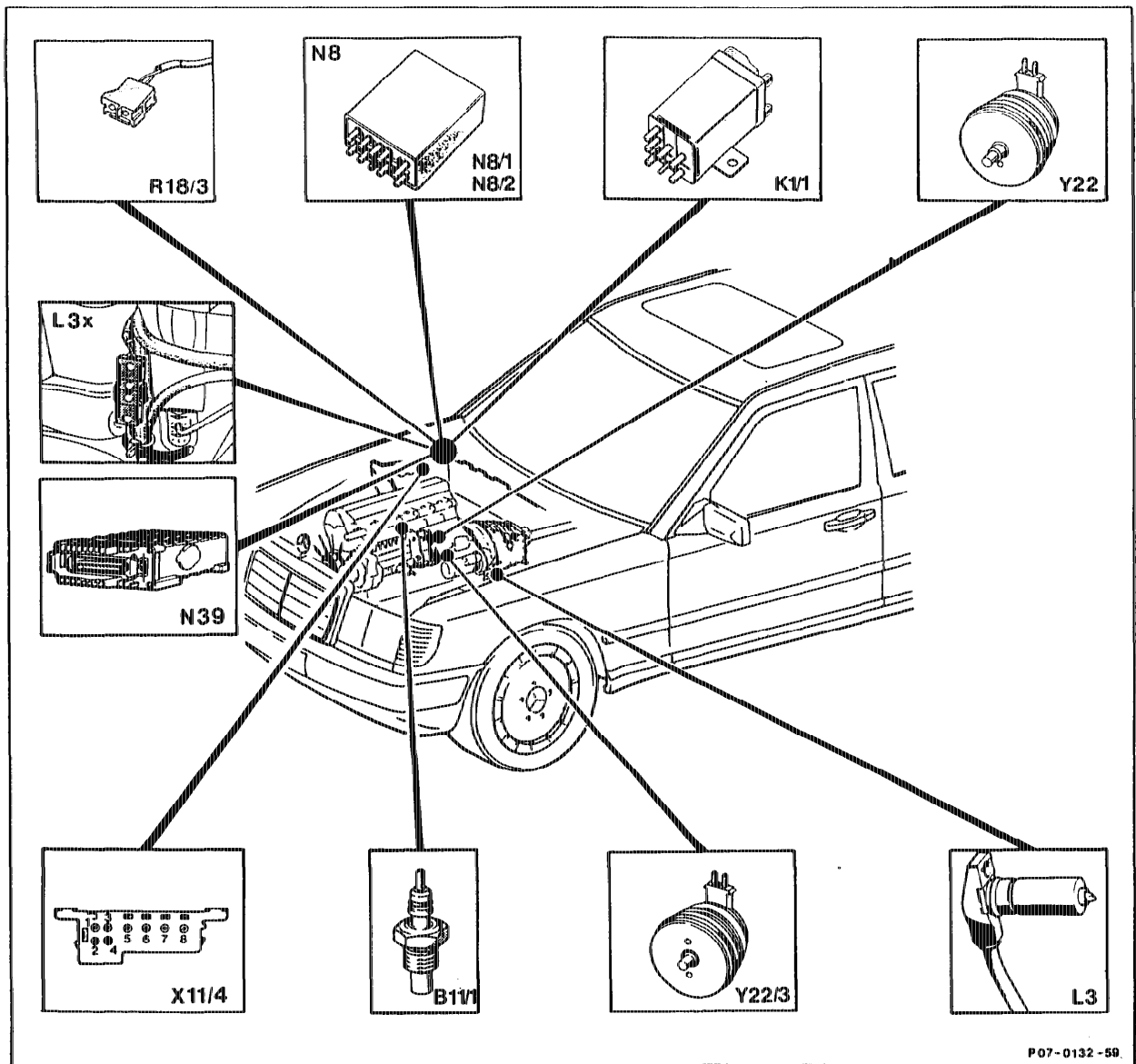
Model Year 1989 (A) (J), Models 124, 201 with Engine 602.96

B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS	N39	EDS control unit
B11/4	Coolant temperature sensor	R18/2x	Plug connection/ARF reference resistor
K1/1	Overvoltage protection relay	X92	Test connector
L3	Engine speed sensor - starter ring gear	Y22	ELR actuator
L3x	Plug connector, engine speed sensor - starter ring gear	Y31/1	ARF vacuum transducer
L7	Control rod travel sensor	60	ARF valve



Model Year 1989 (A) (J), Model 124 with Engine 603.96

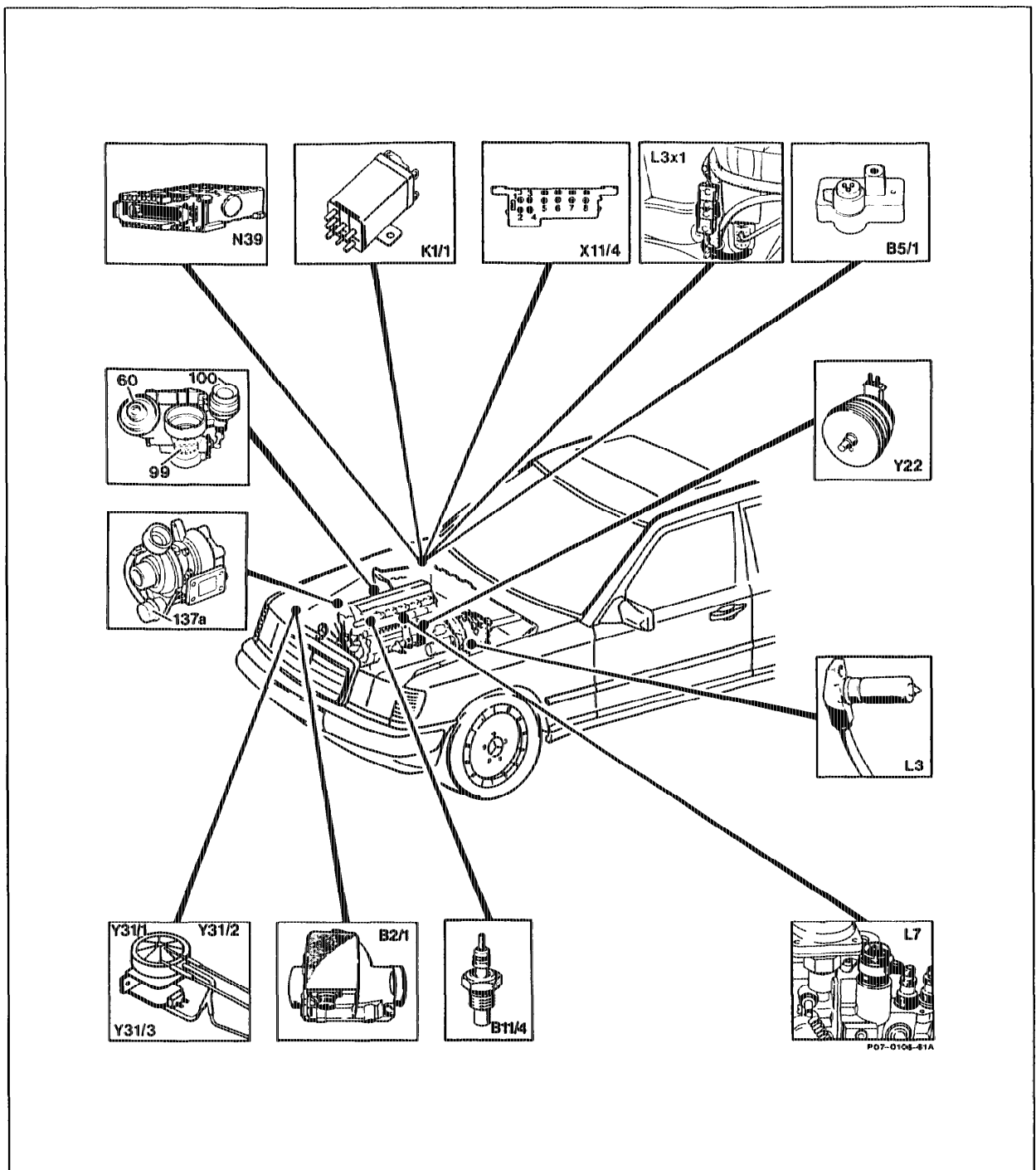
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS	N39	EDS control unit
B11/4	Coolant temperature sensor	X11/4	Test connector
K1/1	Overvoltage protection relay	Y22	ELR actuator
L3	Engine speed sensor - starter ring gear	Y31/1	ARF vacuum transducer
L3x	Plug connector, engine speed sensor - starter ring gear	60	ARF valve
L7	Control rod travel sensor		



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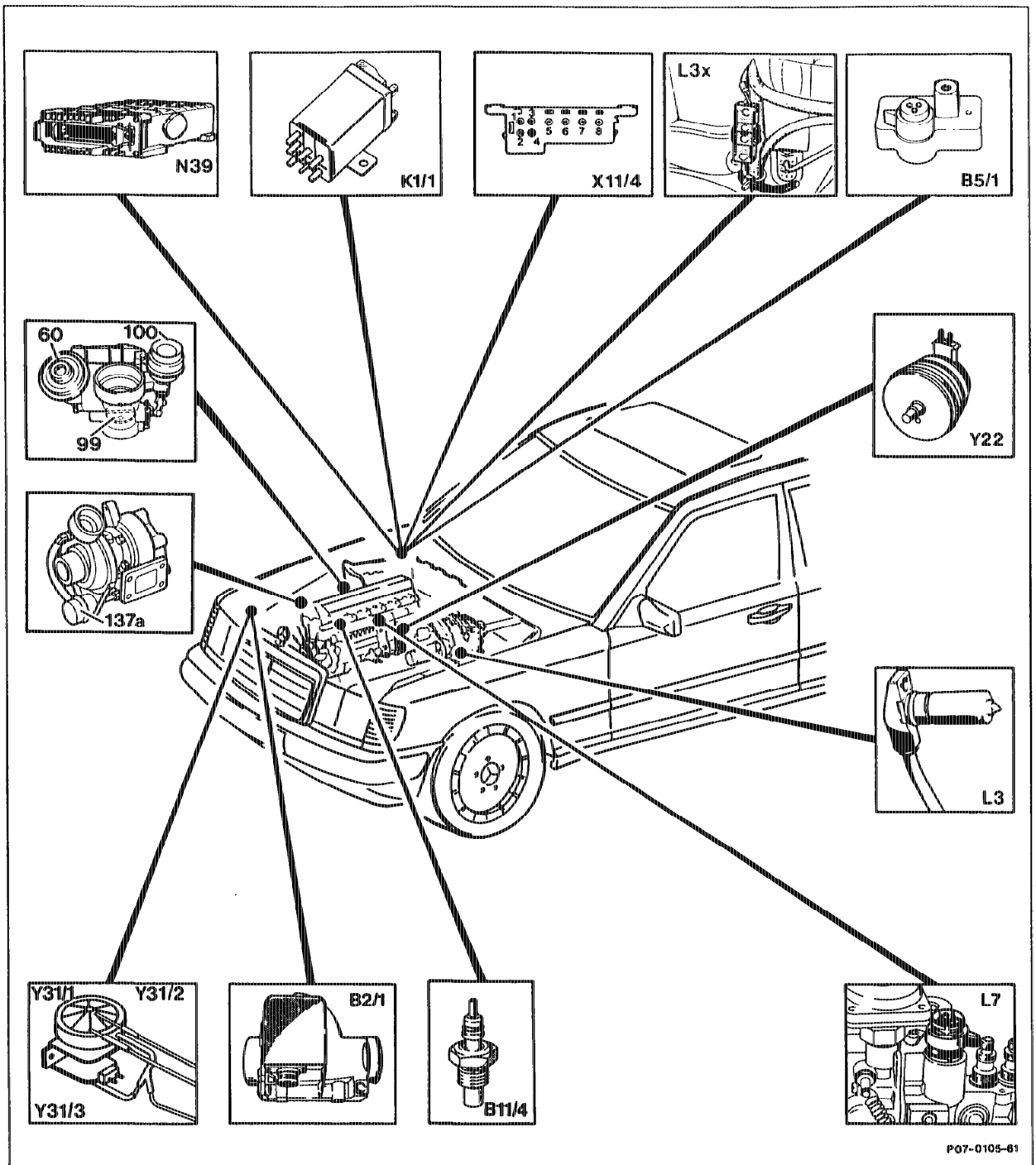
Model Year 1990 Standard, (A), (FIN), Engine 602.96

B11/1	Coolant temperature sensor, ELR	N39	EDS control unit (A only)
K1/1	Overvoltage protection relay	R18/3	ARA reference resistor
L3	Engine speed sensor – starter ring gear	X11/4	Test connector for diagnosis (pulse signal)
L3x	Plug connector, engine speed sensor – starter ring gear	Y22	ELR actuator
N8	ELR control unit	Y22/3	ARA actuator
N8/1	ELR/ARA control unit (manual transmission only)		
N8/2	ARA control unit		



Model Year 1990, (USA), Engine 602.962

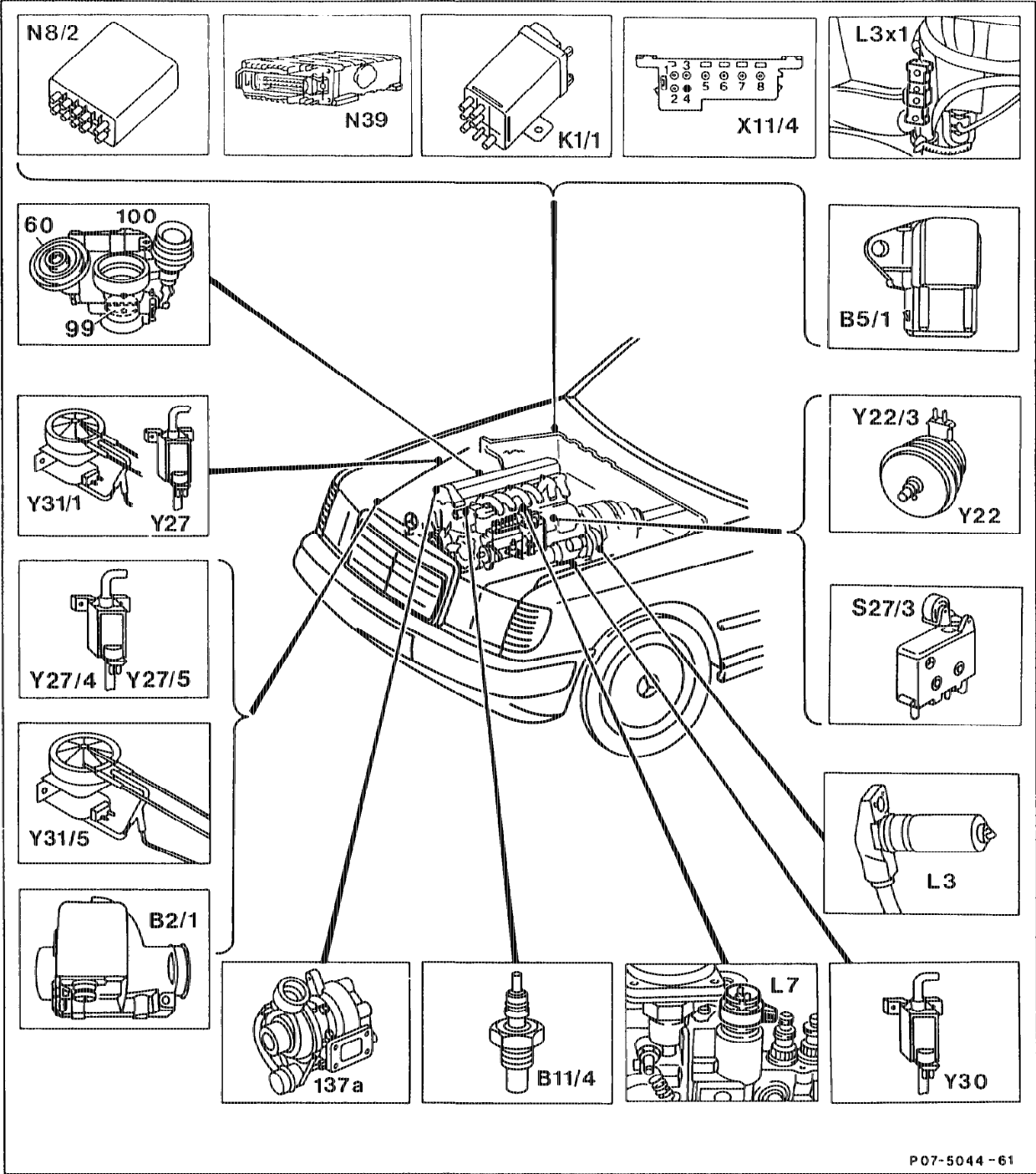
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS	Y22	ELR actuator
B5/1	Pressure sensor (EDS)	Y31/1	ARF vacuum transducer
B11/4	Coolant temperature sensor	Y31/2	Vacuum transducer – pressure control flap
K1/1	Overvoltage protection relay	Y31/3	Vacuum transducer – charge pressure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



P07-0105-61

Model Year 1990, (USA), Engine 603.970

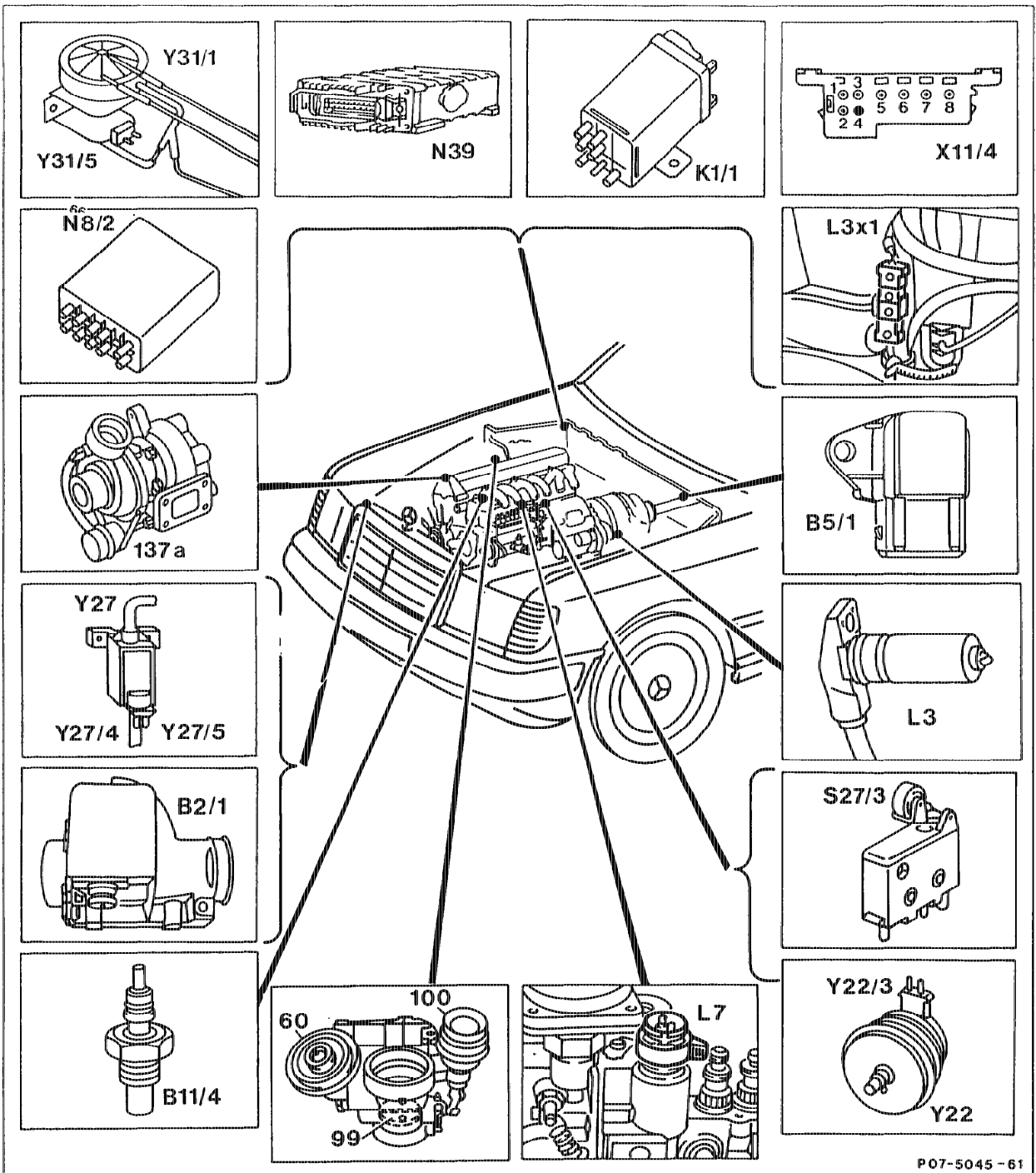
- | | | | |
|-------|---|-------|---|
| B2/1 | Air flow sensor potentiometer | N39 | EDS control unit |
| B5/1 | EDS pressure sensor | X11/4 | Test connector |
| B11/4 | Coolant temperature sensor | Y22 | ELR actuator |
| K1/1 | Overvoltage protection relay | Y31/1 | ARF vacuum transducer |
| L3 | Engine 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 | ARF valve |



Model Year 1992, Basic Version Code 62/0 (as of 06/91), (A) (FIN) (CH) (DK) (USA) (J), Engines 602.96, 603.96 in Model 124

B2/1	Air flow sensor potentiometer with intake air temperature sensor, electronic diesel system	Y27	ARF switchover valve
B5/1	EDS pressure sensor, engine 602.96	Y27/4	Switchover valve, left boost pressure control, engine 602.96
B11/4	Coolant temperature sensor, electronic diesel system	Y27/5	Switchover valve, right vacuum control flap, engine 602.96
K1/1	Overvoltage protection relay 87E (9-pin)	Y30	Switchover valve, engine overload protection, engine 603.96
L3	Engine speed sensor, starter ring gear	Y31/1	ARF vacuum transducer
L3x1	Plug connection, engine speed sensor, starter ring gear	Y31/5	Vacuum transducer, boost pressure control/vacuum control flap, engine 602.96
L7	Control rod travel sensor		
N8/2	ARA control unit (manual transmission only, engine 602.96)	60	ARF valve
N39	EDS control unit	99	Vacuum control flap in mixing housing, engine 602.96
S27/3	ARF microswitch		
X11/4	Test coupling	100	Vacuum unit, vacuum control flap, engine 602.96
Y22	ELR actuator	137a	Vacuum unit, boost pressure control valve, engine 602.96
Y22/3	ARA actuator (manual transmission only, engine 602.96)		



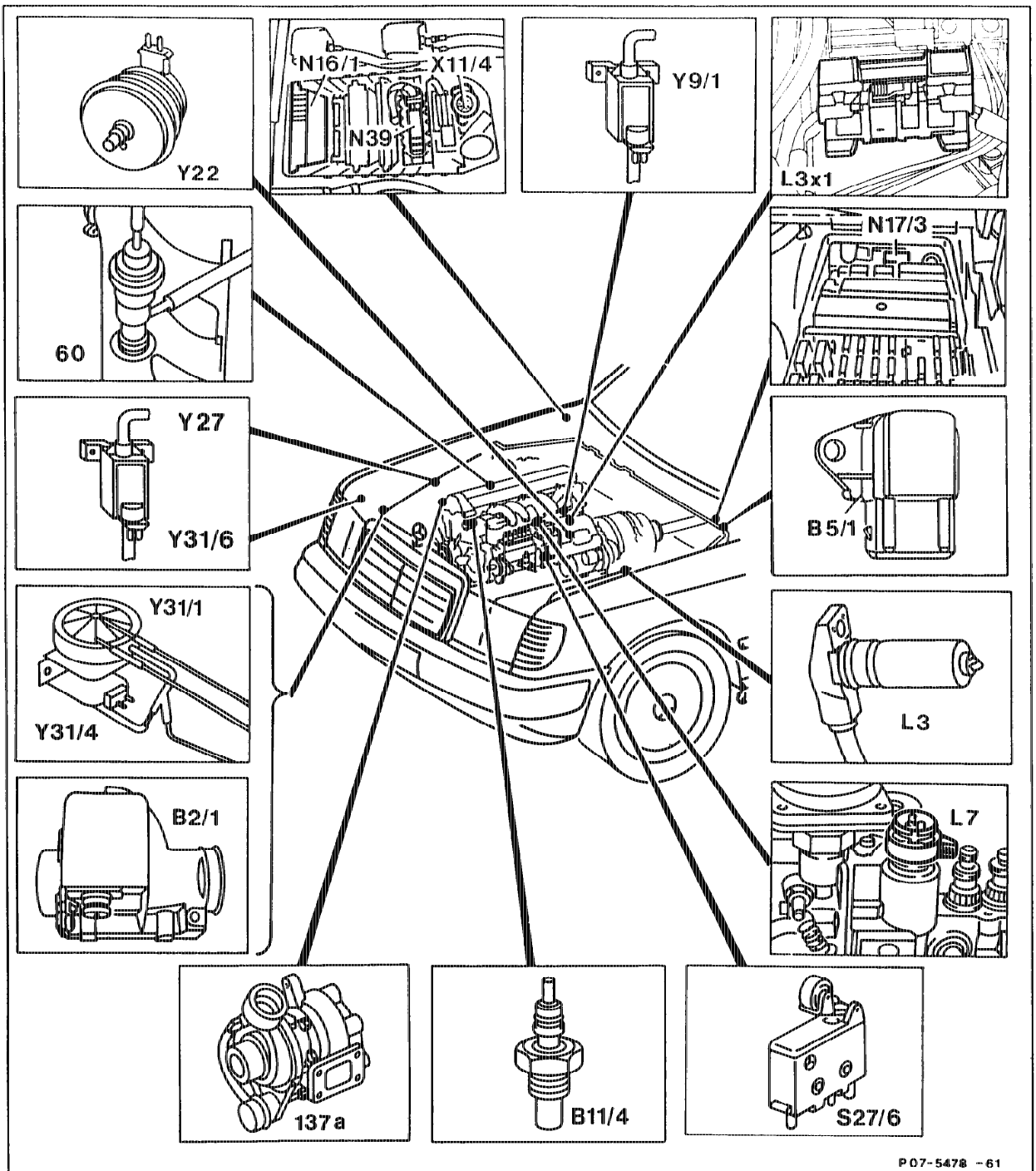


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Model Year 1992, Basic Version Code 62/0 (as of 06/91), (A) (FIN), Engine 602.96 in Model 201

B2/1	Air flow sensor potentiometer with intake air temperature sensor, electronic diesel system	Y22	ELR actuator
B5/1	EDS pressure sensor	Y22/3	ARA actuator (manual transmission only)
B11/4	Coolant temperature sensor, electronic diesel system	Y27	ARF switchover valve
K1/1	Overvoltage protection relay 87E, 7-pin	Y27/4	Boost pressure control switchover valve
L3	Engine speed sensor, starter ring gear	Y27/5	Vacuum control flap switchover valve
L3x1	Plug connection, engine speed sensor, starter ring gear	Y31/1	ARF vacuum transducer
L7	Control rod travel sensor	Y31/5	Vacuum transducer/boost pressure control/vacuum control flap
N8/2	ARA control unit (manual transmission only)	60	ARF valve
N39	EDS control unit	99	Vacuum control flap in mixing housing
S27/3	ARF microswitch	100	Vacuum unit, vacuum control flap
X11/4	Test coupling	137a	Vacuum unit, boost pressure control valve





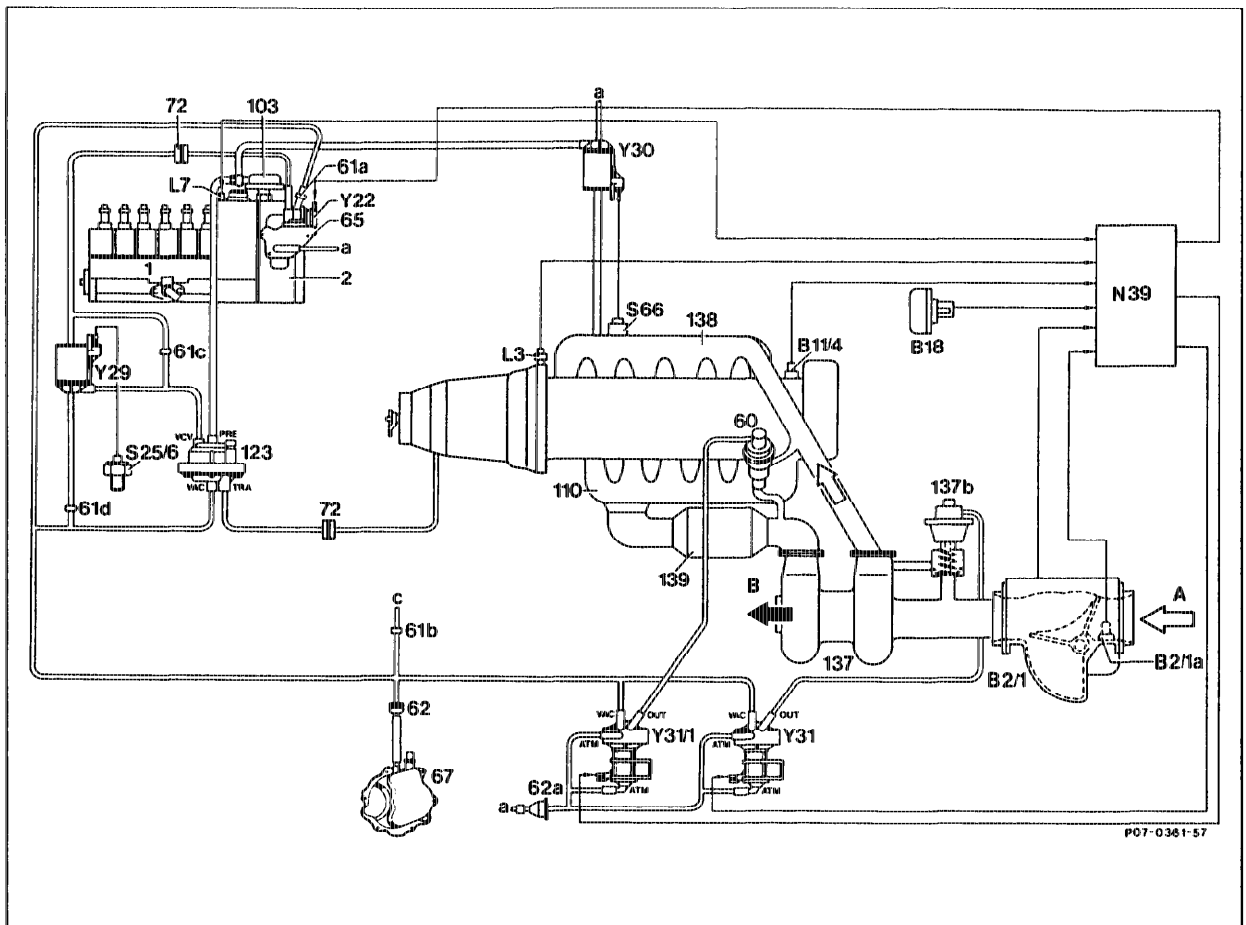
P07-5478 -61

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

B2/1	Air flow sensor potentiometer with intake air temperature sensor, electronic diesel system	N39	EDS control unit
B5/1	EDS pressure sensor	S27/6	A/C compressor cutout/ARF
B11/4	EDS coolant temperature sensor	X11/4	Test coupling
L3	Engine speed sensor, starter ring gear	Y9/1	Key-operated engine stop switchover valve
L3x1	Plug connection, engine speed sensor, starter ring gear	Y22	ELR actuator
L7	Control rod travel sensor	Y27	ARF switchover valve
N16/1	Base module	Y31/1	ARF vacuum transducer
N17/3	Key-operated engine stop relay	Y31/4	Boost pressure control vacuum transducer
		Y31/6	Boost pressure cutoff switchover valve
		60	ARF valve
		137a	Vacuum unit, boost pressure control valve



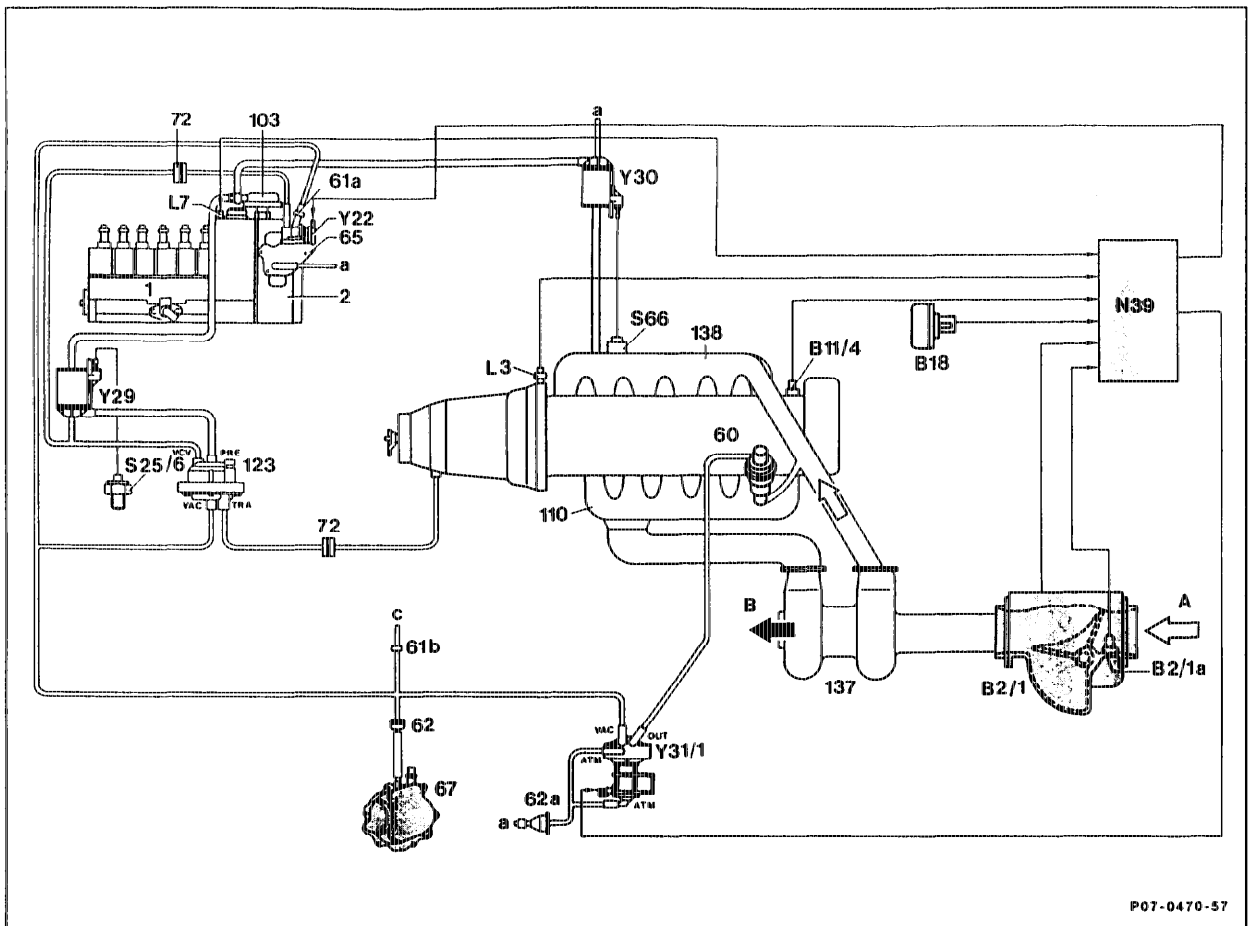
c) Function diagrams



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

1	Injection pump	L7	Control rod travel sensor
2	Governor	N39	EDS control unit
60	Exhaust gas recirculating valve	S25/6	Temperature switch 50 °C
61a	Restriction, blue	S66	Switch, engine overload protection
61b	Restriction, orange	Y22	Actuator
61c	Restriction	Y29	Switch-over valve, vacuum amplifier
61d	Restriction	Y30	Switch-over valve, engine overload protection
62	Filter	Y31	Vacuum transducer, recirculating air valve
62a	Filter		(model 126 only)
65	Vacuum control valve	Y31/1	Vacuum transducer, exhaust gas recirculating valve
67	Vacuum pump		
72	Damper	a	Fresh air flow to car interior
103	ALDA unit	A	Intake air
110	Exhaust manifold	B	Exhaust gas
123	Vacuum amplifier		
137	Exhaust gas turbocharger		Pressure and vacuum connections at vacuum transducer or vacuum amplifier
137b	Recirculating air valve (California only)		
138	Charge air distribution pipe		
139	Trap oxidizer (California only)	PRE	Charge pressure from ALDA unit
B2/1	Air flow sensor potentiometer	TRA	To vacuum unit of automatic transmission
B2/1a	Intake air temperature sensor	VAC	Vacuum from vacuum pump
B11/4	Coolant temperature sensor	VCV	To vacuum control valve
B18	Altitude sensor	ATM	Fresh air flow to car interior
L3	Engine speed sensor, starter ring gear	OUT	Exhaust gas recirculation to exhaust gas recirculating valve or recirculating air valve

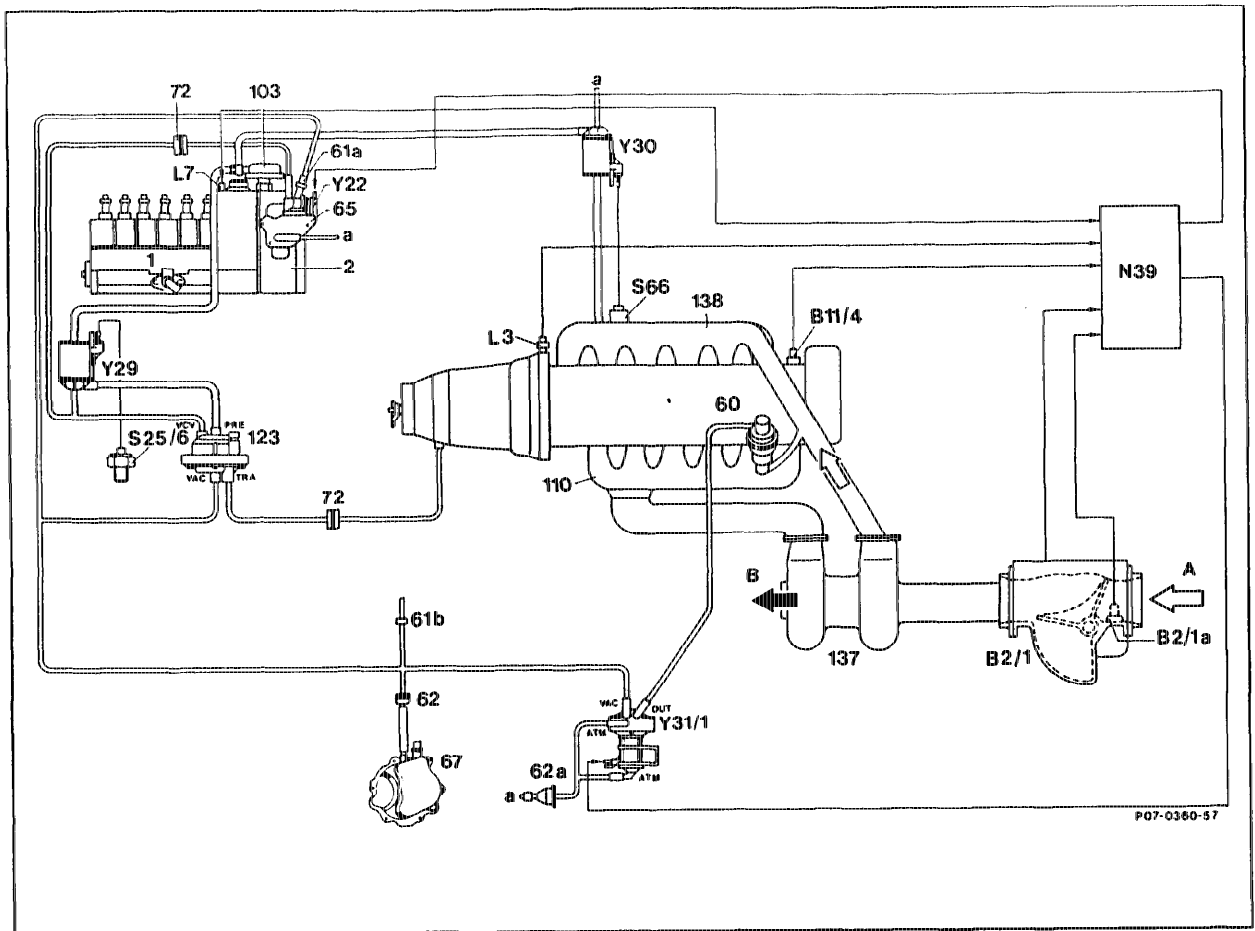




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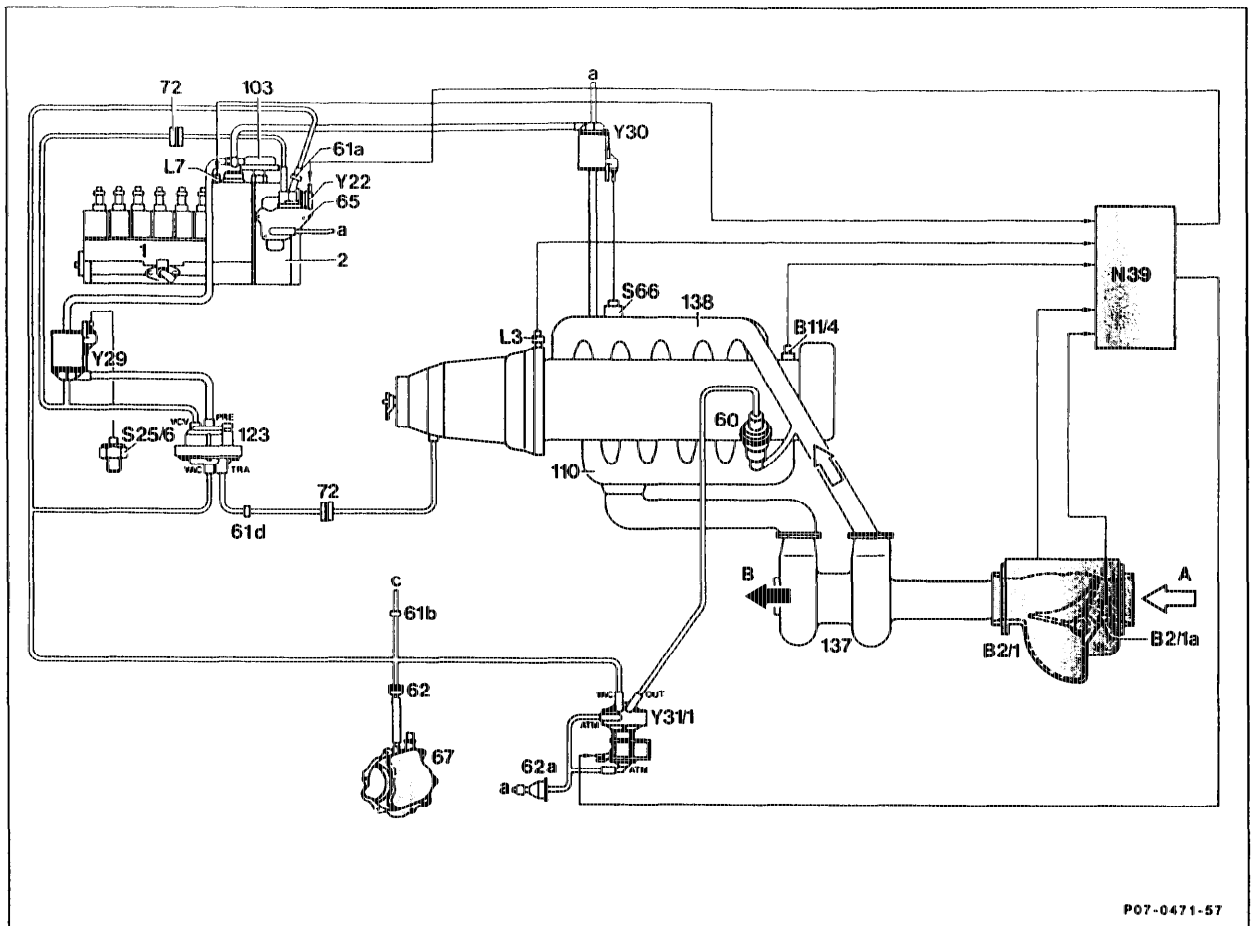
Engine 603.960 in Model 126 Model Year 1986 (USA) Federal
 Engine 602.961 in Model 201 Model Year 1987 (USA) Federal

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



Engine 603.96 in Model 124, Model Year 1988 (J)

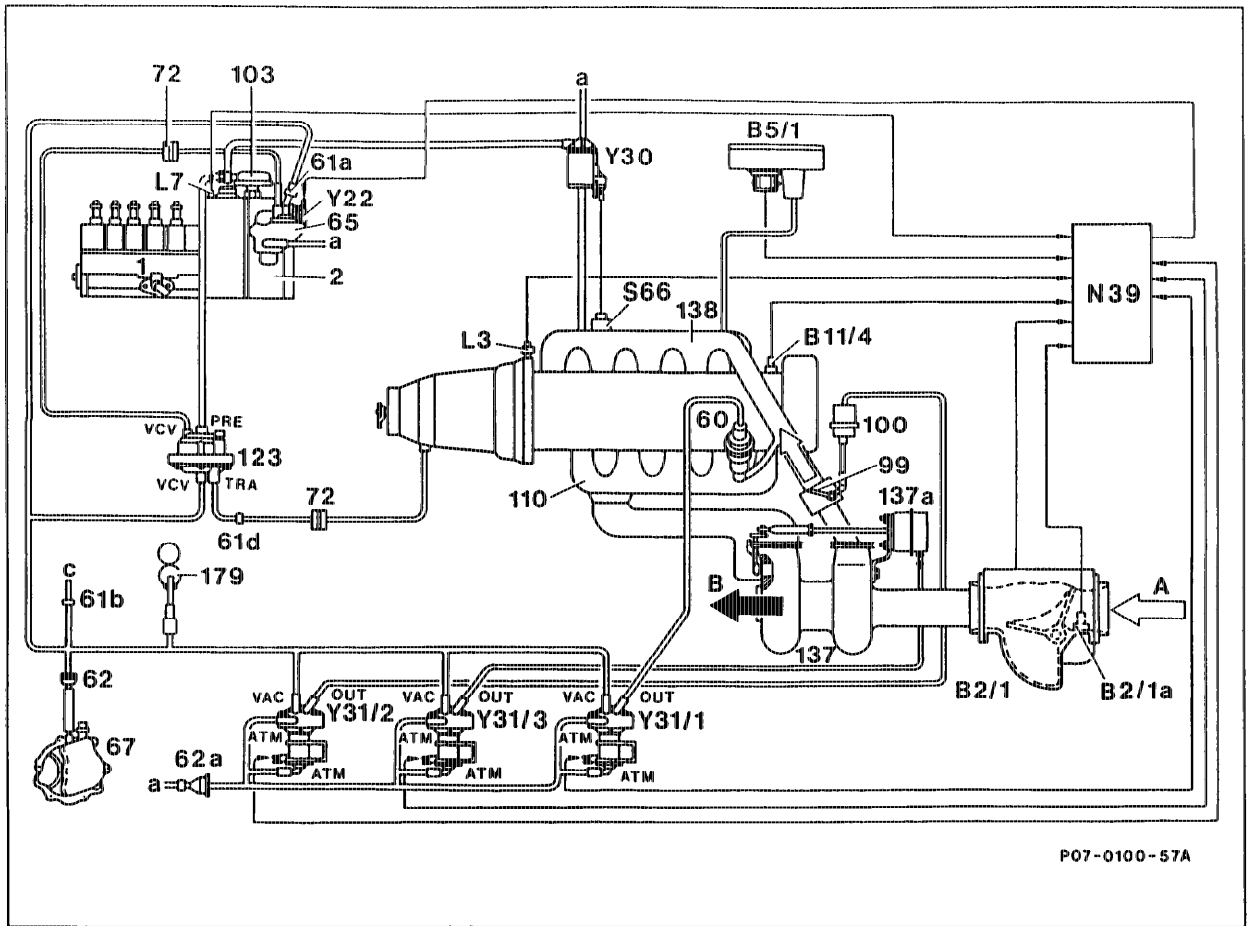
1	Injection pump	S25/6	Temperature switch 50 °C
2	Governor	S66	Switch, engine overload protection
60	Exhaust gas recirculating valve	Y22	Actuator
61a	Restriction, blue	Y29	Switch-over valve, vacuum amplifier
61b	Restriction, orange	Y30	Switch-over valve, engine overload protection
62	Filter	Y31/1	Vacuum transducer, exhaust gas recirculating valve
62a	Filter	a	Fresh air flow to car interior
65	Vacuum control valve	A	Intake air
67	Vacuum pump	B	Exhaust gas
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		
L3	Engine speed sensor, starter ring gear		
L7	Control rod travel sensor		
N39	EDS control unit		
		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



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Engine 602.96, 603.96, Model Year 1989 (A) (J), Model Year 1991 (FIN)

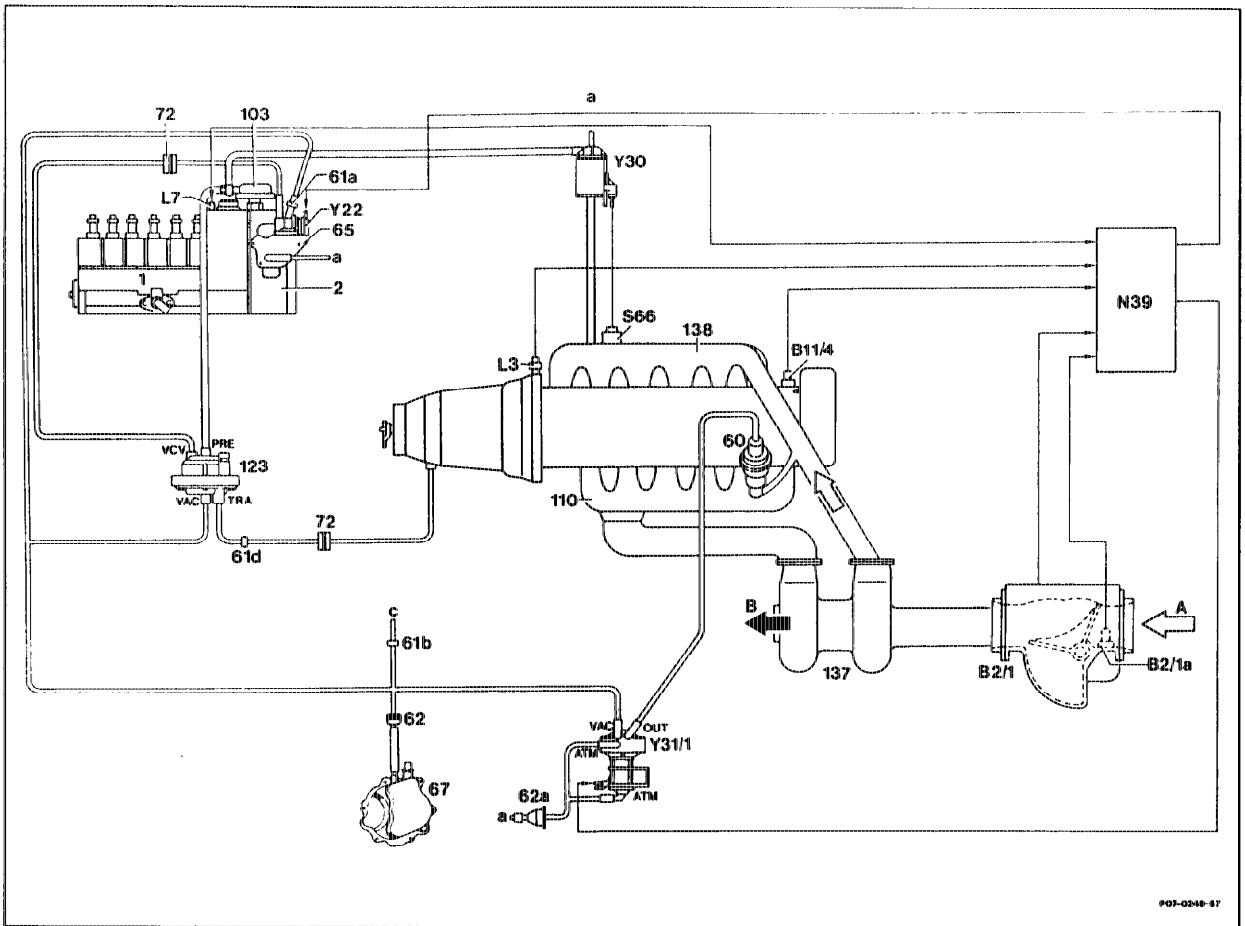
1	Injection pump	N39	EDS control unit
2	Governor	S25/6	Temperature switch 50 °C
60	Exhaust gas recirculating valve	S66	Switch, engine overload protection
61a	Restriction, blue	Y22	Actuator
61b	Restriction, orange	Y29	Switch-over valve, vacuum amplifier
61d	Connector (without restriction)	Y30	Switch-over valve, engine overload protection
62	Filter	Y31/1	Vacuum transducer, exhaust gas recirculating valve
62a	Filter	a	Fresh air flow to car interior
65	Vacuum control valve	A	Intake air
67	Vacuum pump	B	Exhaust gas
72	Damper		
103	ALDA unit		
110	Exhaust manifold		
123	Vacuum transducer, up to 01/91		Pressure and vacuum connections at vacuum transducer or vacuum amplifier
137	Exhaust gas turbocharger		
138	Charge air distribution pipe	PRE	Charge pressure from ALDA unit
B2/1	Air flow sensor potentiometer	TRA	To vacuum unit of automatic transmission
B2/1a	Intake air temperature sensor	VAC	Vacuum from vacuum pump
B11/4	Coolant temperature sensor	VCV	To vacuum control valve
L3	Engine speed sensor, starter ring gear	ATM	Fresh air flow to car interior
L7	Control rod travel sensor	OUT	Exhaust gas recirculation to exhaust gas recirculating valve or recirculating air valve



P07-0100-57A

Engine 602.962, (USA) Model Year 1990 and (CH) (DK) Model Year 1991

1	Injection pump	N39	EDS control unit
2	Governor	S66	Switch, engine overload protection
60	Exhaust gas recirculating valve	Y22	ELR actuator
61a	Restriction	Y30	Switchover valve, engine overload protection
61b	Restriction	Y31/1	Vacuum transducer, exhaust gas recirculating valve
61d	Connector (without restriction)	Y31/2	Vacuum transducer, pressure control flap
62	Filter	Y31/3	Vacuum transducer, charge pressure control
62a	Filter	a	Fresh air flow to car interior
65	Vacuum control valve	c	Other ancillaries
67	Vacuum pump	A	Intake air
72	Damper	B	Exhaust air
99	Pressure control flap in mixture housing		
100	Vacuum unit, pressure control flap		
103	ALDA unit		
110	Exhaust manifold		
123	Vacuum transducer, up to 01/91		
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		
			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 ARF 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



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Engine 603.970 (USA), Model Year 1990

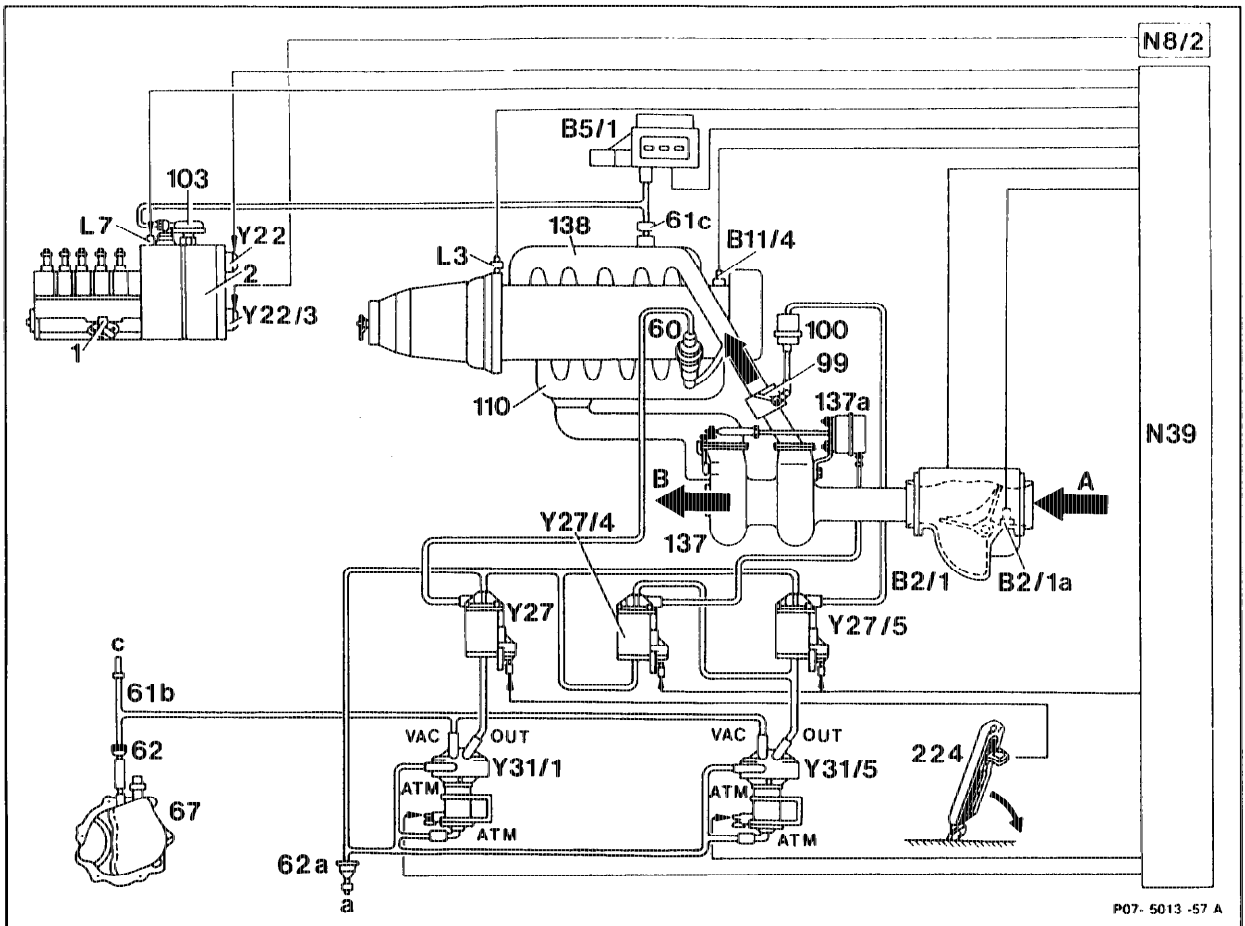
- 1 Injection pump
- 2 Governor
- 60 Exhaust gas recirculating valve
- 61a Restriction
- 61b Restriction
- 61d Connector (without restriction)
- 62 Filter
- 62a Filter
- 65 Vacuum control valve
- 67 Vacuum pump
- 72 Damper
- 103 ALDA unit
- 110 Exhaust manifold
- 123 Vacuum amplifier
- 137 Exhaust gas 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

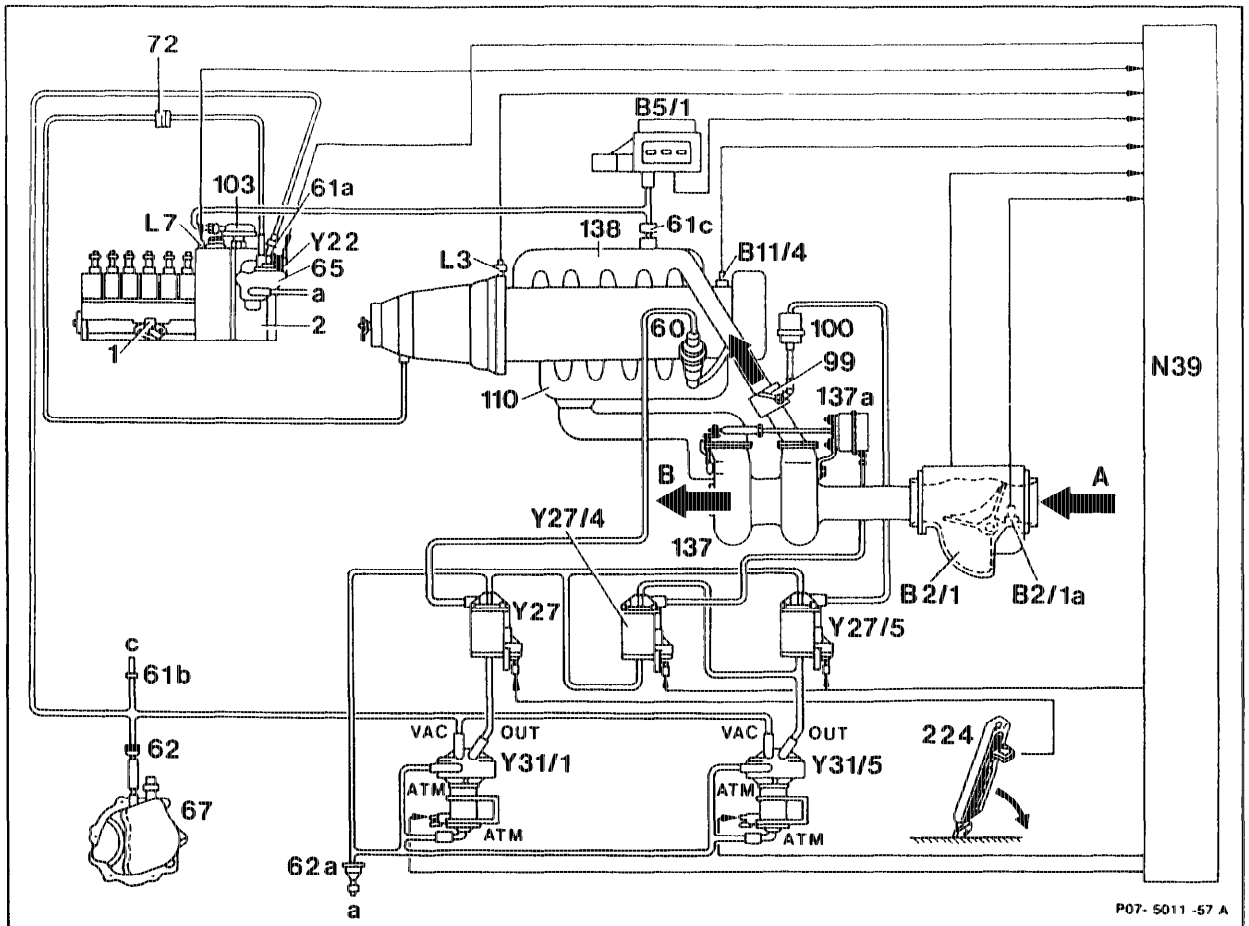
Pressure and vacuum connections at vacuum transducer or vacuum amplifier

- 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



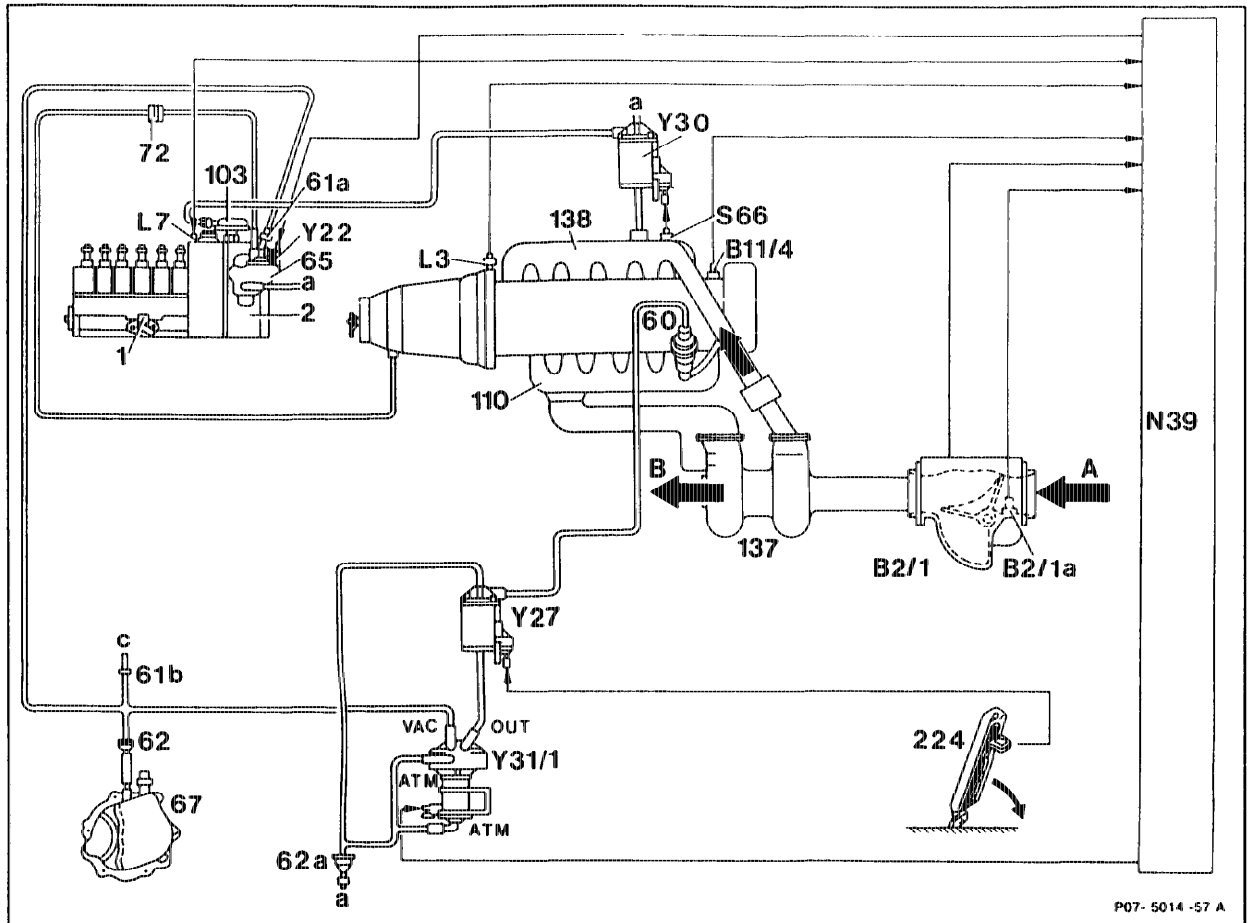
Engine 602.96 with manual transmission, Basic Version Code 62/0 as of 06/91, (A) (FIN) Model Year 1992

1	Injection pump	Y22	ELR actuator
2	Governor	Y22/3	ARA actuator
60	ARF valve	Y27	ARF switchover valve
61b	Restriction 0.5	Y27/4	Boost pressure control switchover valve
61c	Restriction 0.7	Y27/5	Vacuum control flap switchover valve
62	Filter	Y31/1	ARF pressure transducer
62a	Filter	Y31/5	Pressure transducer, boost pressure control/vacuum control flap
67	Vacuum pump		
99	Vacuum control flap in mixing housing		
100	Vacuum unit, vacuum control flap		
103	ALDA unit		
110	Exhaust manifold		
137	Exhaust gas turbocharger		
137a	Vacuum unit, boost pressure control valve		
138	Charge air distribution pipe		
224	Accelerator pedal		
B2/1	Air flow sensor potentiometer		
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		
N8/2	ARA control unit		
N39	EDS control unit		
		A	Intake air
		B	Exhaust air
		a	Fresh air to car interior
		c	Other components
			Pressure and vacuum connections at vacuum transducers
		VAC	Vacuum from vacuum pump
		ATM	Fresh air flow to car interior
		OUT	Outlet from pressure transducer (Y31/1) to switchover valve (Y27) (exhaust gas recirculation)
		OUT	Outlet from pressure transducer (Y31/5) to the switchover valves (Y27/4) and (Y27/5)



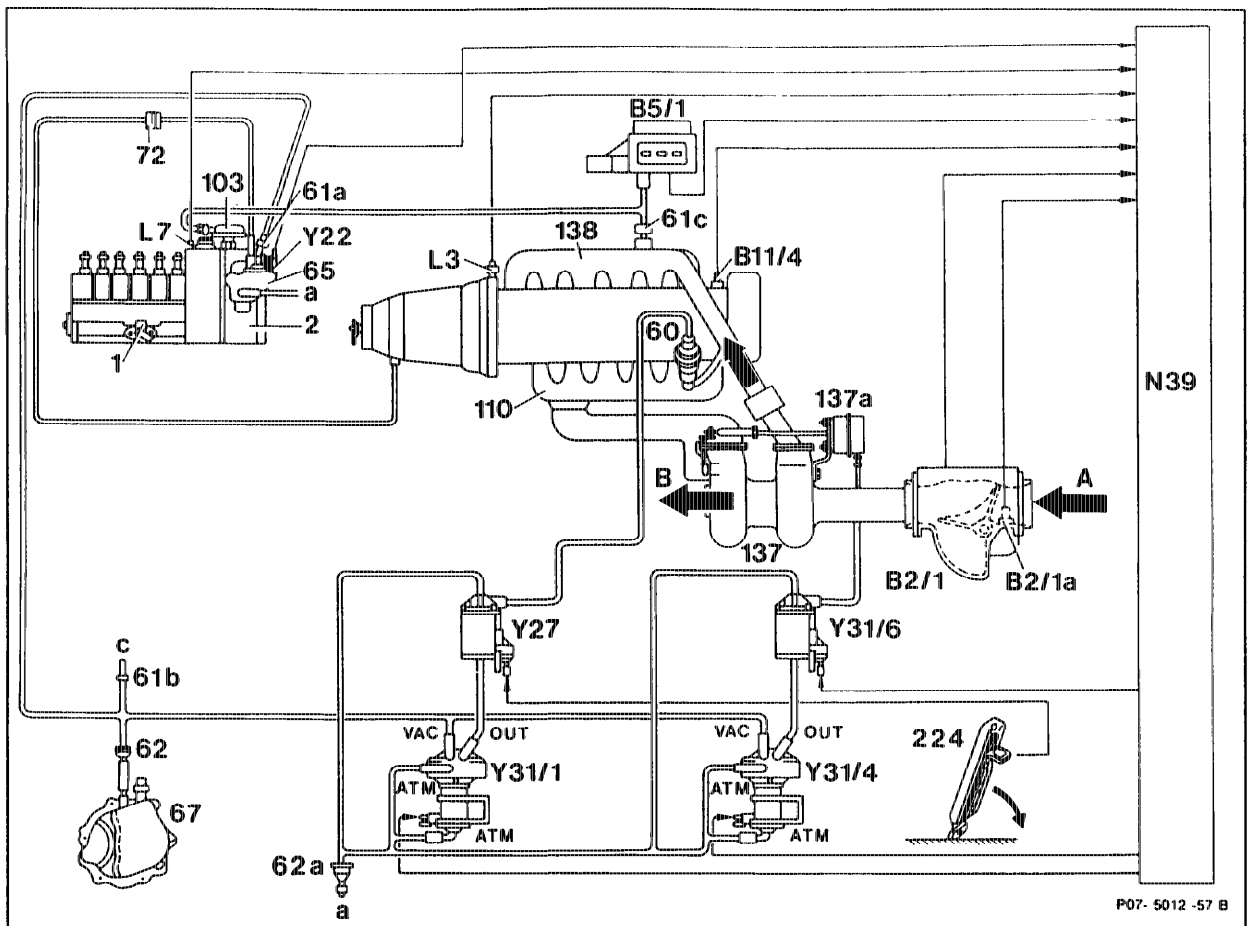
Engine 602.96 with automatic transmission, Basic Version Code 62/0 as of 06/91, (A) (FIN) (CH) (DK)
 (USA) Model Year 1992

1	Injection pump	L7	Control rod travel sensor
2	Governor	N39	EDS control unit
60	ARF valve	Y22	ELR actuator
61a	Restriction	Y27	ARF switchover valve
61b	Restriction 0.5	Y27/4	Boost pressure control switchover valve
61c	Restriction 0.7	Y27/5	Vacuum control flap switchover valve
62	Filter	Y31/1	ARF vacuum transducer
62a	Filter	Y31/5	Vacuum transducer, boost pressure control/vacuum control flap
65	Vacuum control valve	A	Intake air
67	Vacuum pump	B	Exhaust air
72	Damper	a	Fresh air flow to car interior
99	Vacuum control flap in mixing housing	c	Other components
100	Vacuum unit, control flap vacuum unit		
103	ALDA unit		
110	Exhaust manifold		
137	Exhaust gas turbocharger		
137a	Vacuum unit, boost pressure control valve		
138	Charge air distribution pipe		
224	Accelerator pedal		
B2/1	Air flow sensor potentiometer		
B2/1a	Intake air temperature sensor		
B5/1	EDS pressure sensor		
B11/4	EDS coolant temperature sensor		
L3	Engine speed sensor, starter ring gear		
			Pressure and vacuum connections at vacuum transducers
		VAC	Vacuum from vacuum pump
		ATM	Fresh air flow to car interior
		OUT	Outlet from vacuum transducer (Y31/1) to switchover valve (Y27) (exhaust gas recirculation)
		OUT	Outlet from vacuum transducer (Y31/5) to the switchover valves (Y27/4) and (Y27/5)



Engine 603.96, Basic Version Code 62/0 as of 06/91, (A) (FIN) (J) Model Year 1992

1	Injection pump	L7	Control rod travel sensor
2	Governor	N39	EDS control unit
60	ARF valve	S66	Engine overload protection switch
61a	Restriction	Y22	ELR actuator
61b	Restriction 0.5	Y27	ARF switchover valve
62	Filter	Y30	Engine overload protection switchover valve
62a	Filter	Y31/1	ARF vacuum transducer
65	Vacuum control valve	A	Intake air
67	Vacuum pump	B	Exhaust air
72	Damper	a	Fresh air flow to car interior
103	ALDA unit	c	Other components
110	Exhaust manifold		
137	Exhaust gas turbocharger		
138	Charge air distribution pipe		
224	Accelerator pedal		
B2/1	Air mass sensor potentiometer		
B2/1a	Intake air temperature sensor		
B11/4	EDS coolant temperature sensor		
L3	Engine speed sensor, starter ring gear		
			Pressure and vacuum connections at vacuum transducers
		VAC	Vacuum from vacuum pump
		ATM	Fresh air flow to car interior
		OUT	Outlet from vacuum transducer (Y31/1) to switchover valve (Y27) (exhaust gas recirculation)

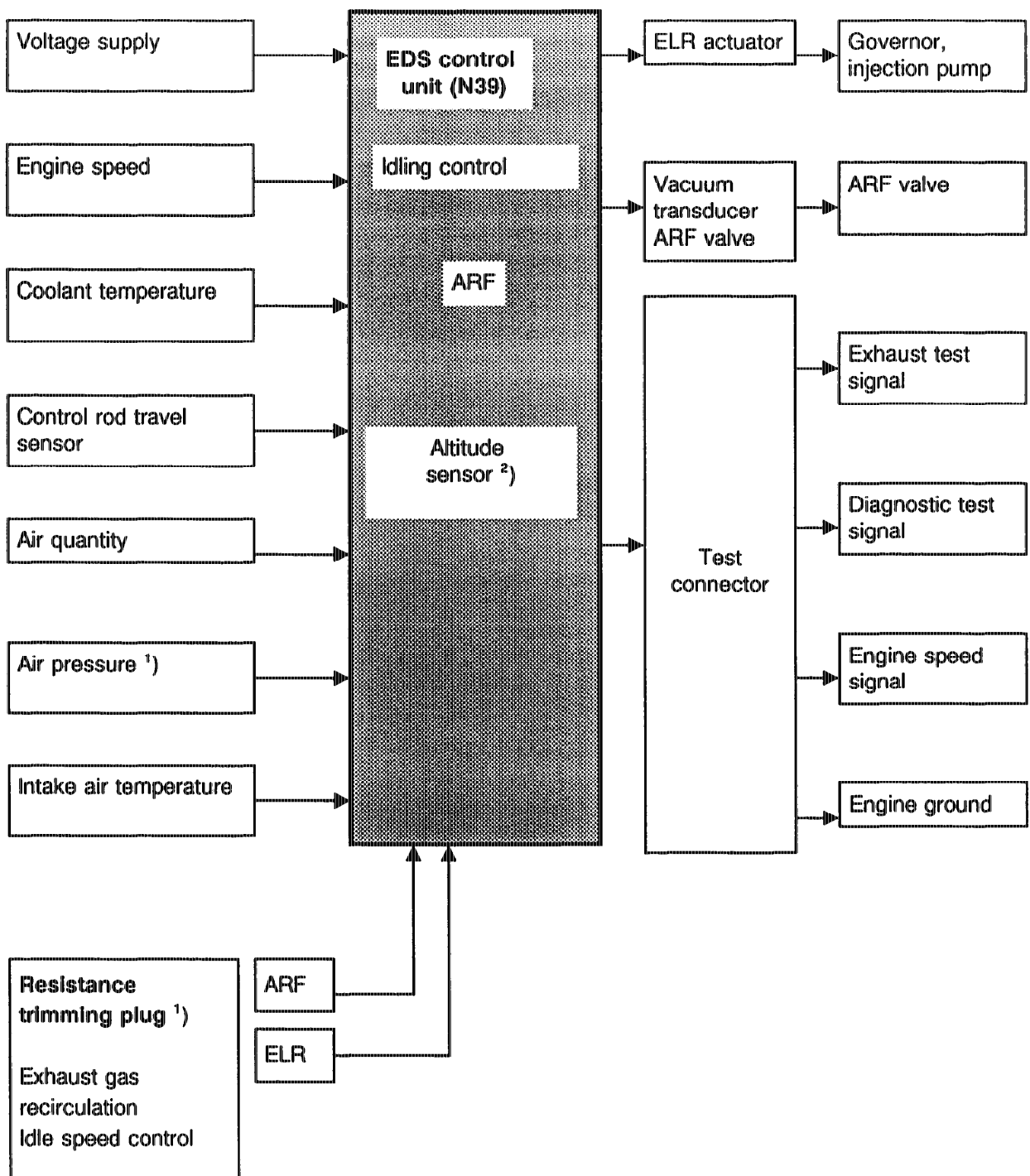


P07- 5012 -57 B

Engine 603.971 base version Code 62/0, (USA), model year 1992

1	Injection pump	N39	EDS control unit
2	Governor	Y22	ELR actuator
60	Exhaust gas recirculation valve	Y27	ARF switchover valve
61a	Restriction	Y31/1	Exhaust gas recirculation valve vacuum transducer
61b	Restriction 0.5	Y31/4	Boost pressure control vacuum transducer
61c	Restriction 0.7	Y31/6	Boost pressure cutoff switchover valve
62	Filter	A	Intake air
62a	Filter	B	Exhaust air
65	Vacuum control valve	a	Fresh air flow to car interior
67	Vacuum pump	c	Other components
72	Damper		
103	ALDA unit		
110	Exhaust manifold		
137	Exhaust gas turbocharger		
137a	Vacuum unit, boost pressure control valve		
138	Charge air distribution pipe		
224	Accelerator pedal		
B2/1	Air mass sensor potentiometer		
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		
			Pressure and vacuum connections at vacuum transducers
		VAC	Vacuum from vacuum pump
		ATM	Fresh air flow to car interior
		OUT	Outlet from vacuum transducer (Y31/1) to switchover valve (Y27) (exhaust gas recirculation)
		OUT	Outlet from vacuum transducer (Y31/4) to switchover valve (Y31/6) or to vacuum unit, boost pressure control valve (137a)

d) Influencing variables of electronic diesel system (EDS)
Engines 602.96 and 603.96 up to Model Year 1991



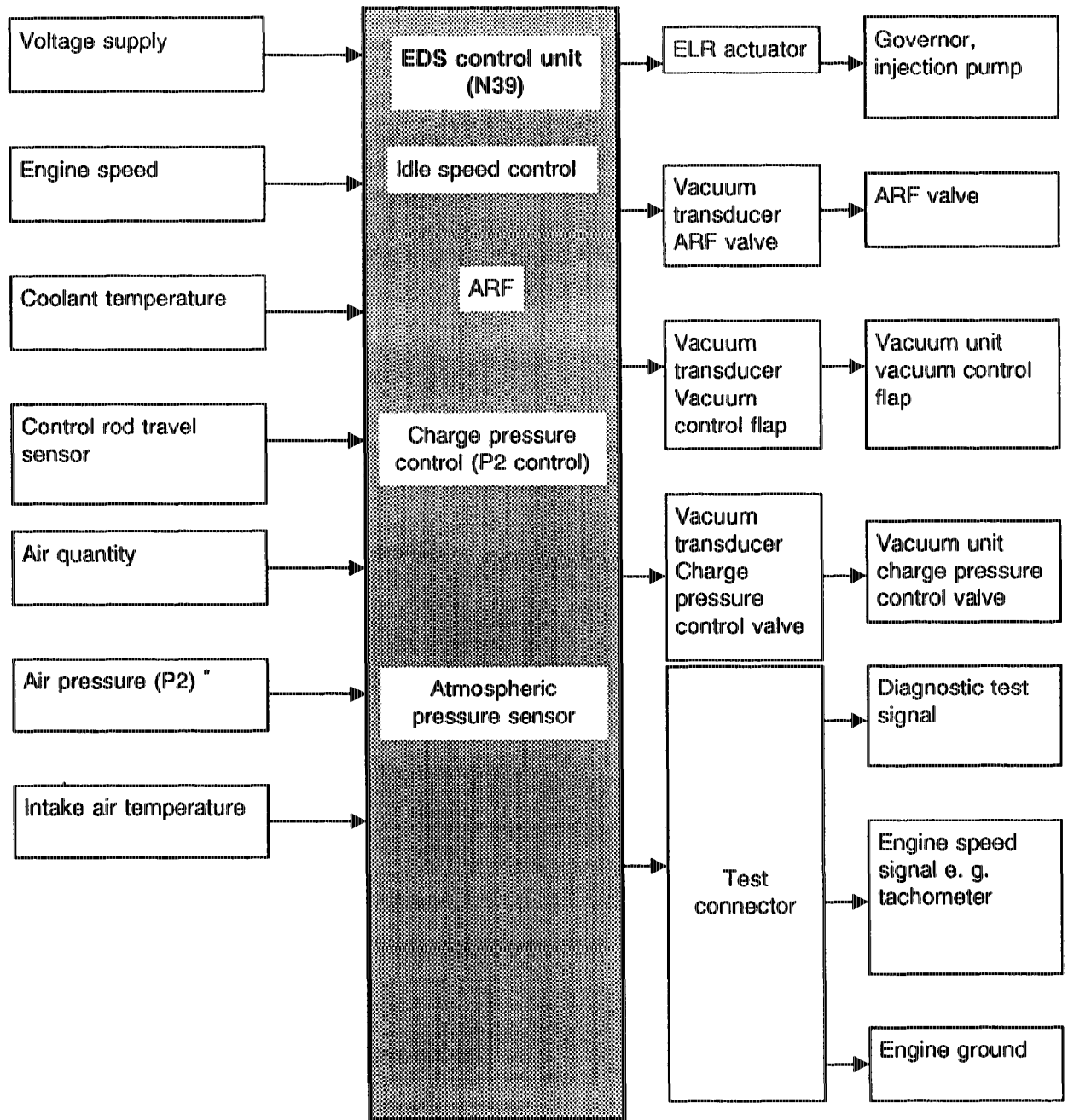
¹⁾ Model Year 1986/87 only

²⁾ Effective Model Year 1988 integrated in control unit.

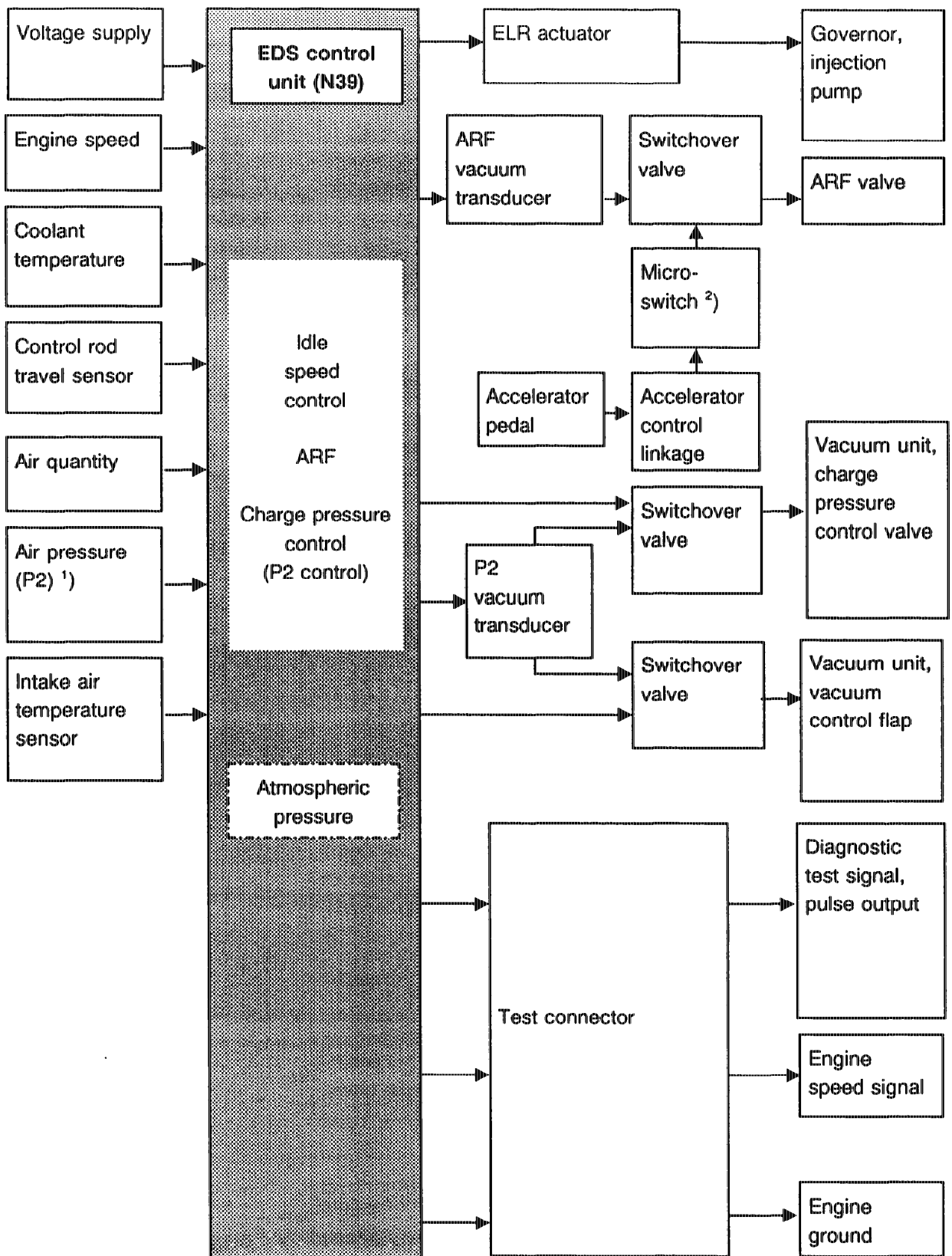
Engine 602.96

CH DK Model Year 1991

USA Model Years 1990, 1991

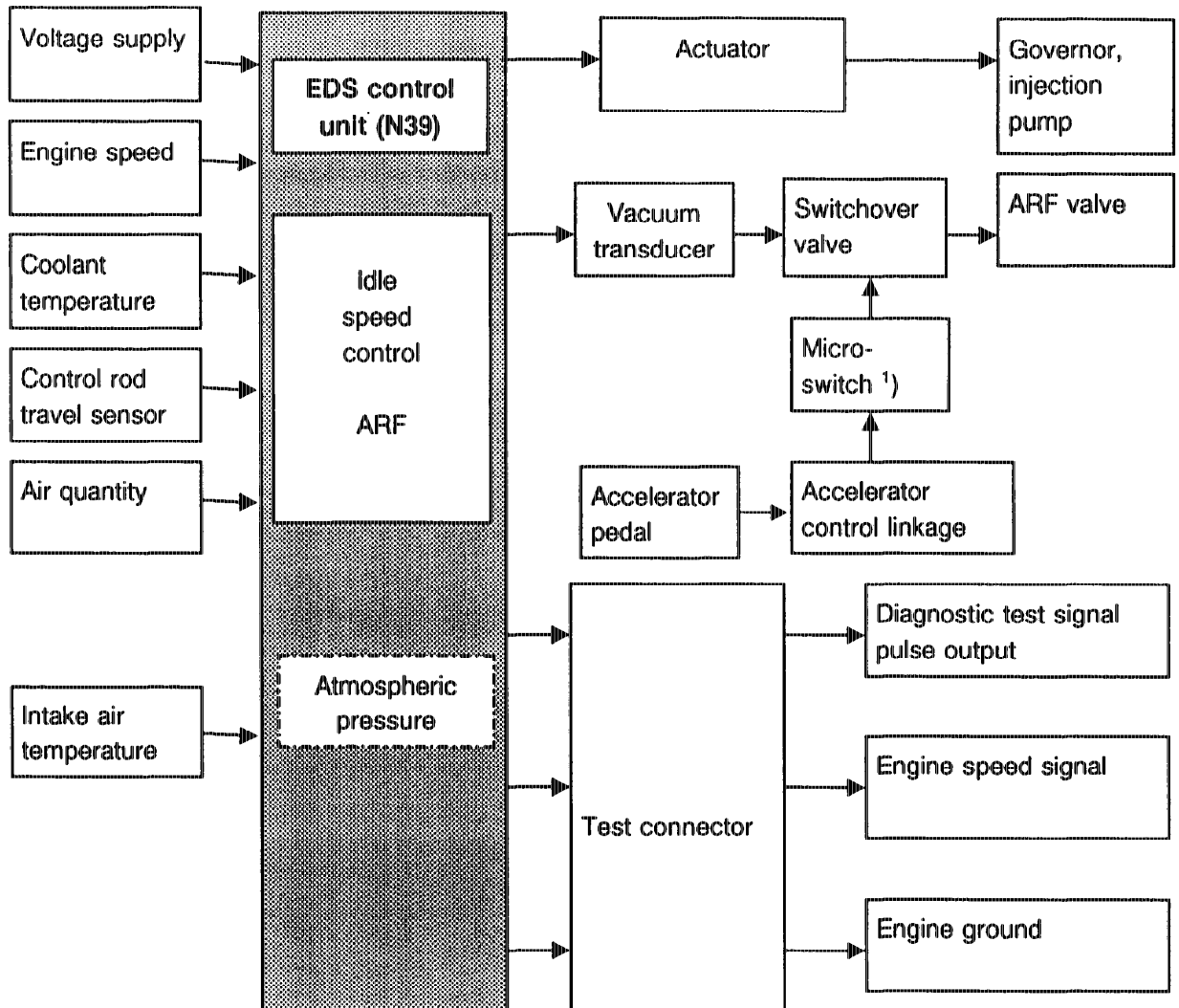


* Pressure upstream of inlet valves

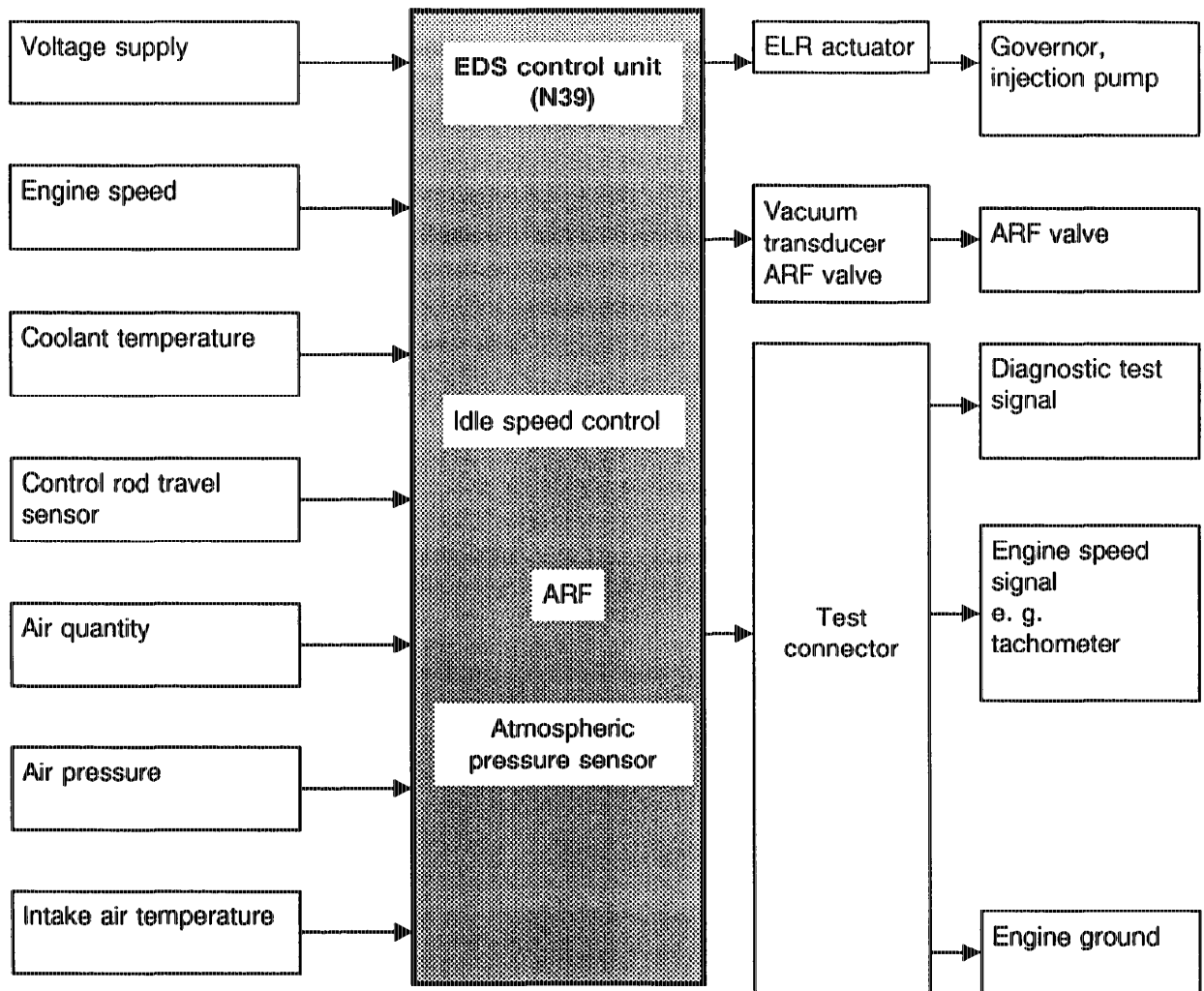


1) Pressure upstream of inlet valves.

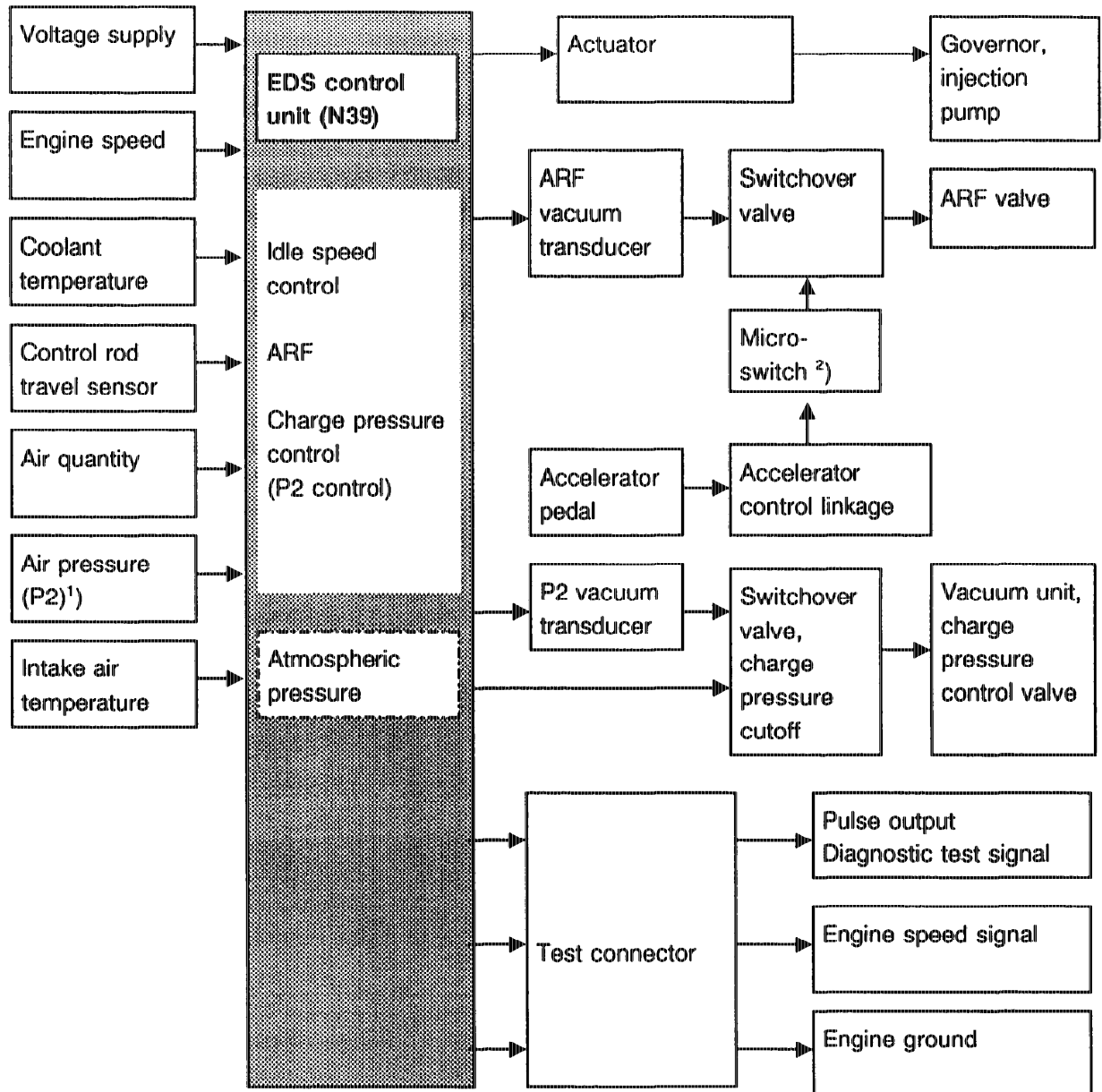
2) Swichover valve is actuated by microswitch of accelerator control 10° before full load.



1) The switchover valve is actuated by the microswitch of the accelerator control 10° before full load.



Engine 603.971
 Base version Code 62/0,
 (USA) as of model year 1992



¹⁾ Pressure upstream of inlet valves.

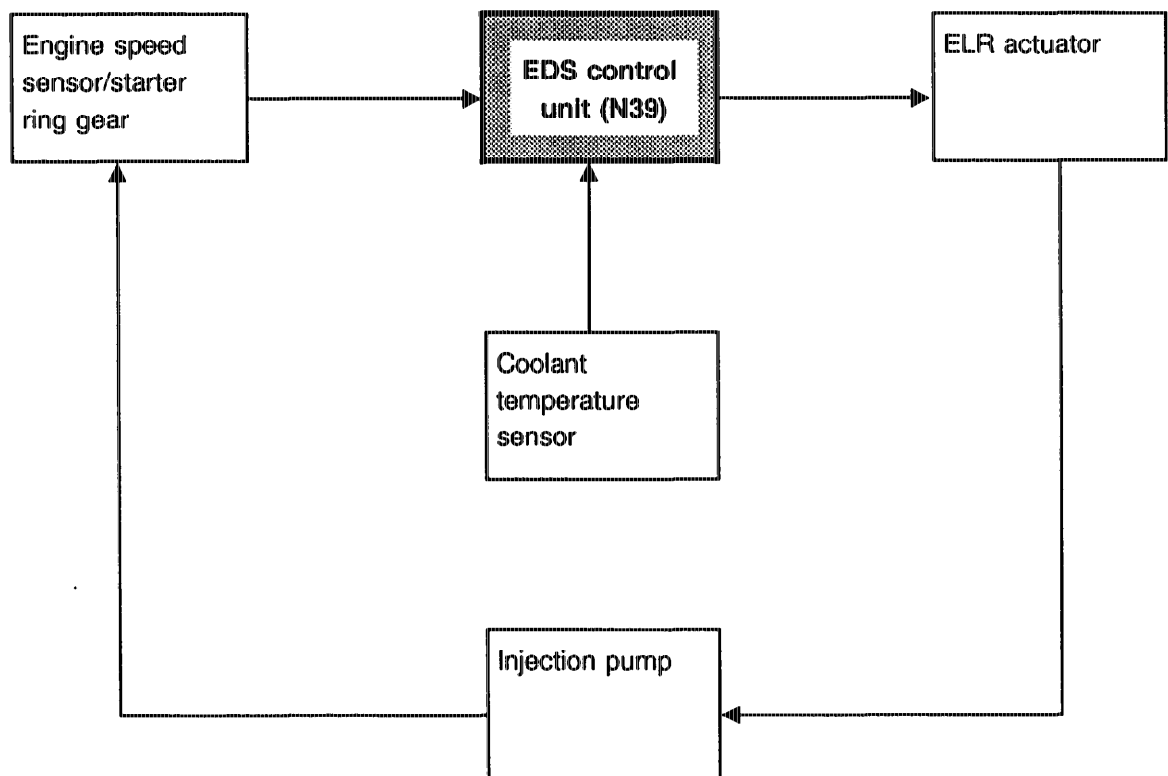
²⁾ The switchover valve is actuated by the microswitch of the accelerator control 10° before full load.

e) Electronic idle speed control (ELR)

The engine 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 engine speed signal and performs the set value/actual value comparison. This enables idling speed to be maintained at a constant level by the actuator irrespective of engine load. Set idling speed is raised in accordance with a fixed characteristic curve by the temperature sensor at coolant temperatures $< 60\text{ }^{\circ}\text{C}$.

Block diagram of idle speed control (ELR)



f) Exhaust gas recirculation (ARF)

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/min or 3500/min on Engine 602.962 from Model Year 1990 (USA)
- Engine speed up to approx. 3500/min as of Model year 1992, Engines 602.96, 603.96 and 603.971
- Control rod travel less than 9 mm
- Battery voltage 11–14 Volt

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 ARF valve.

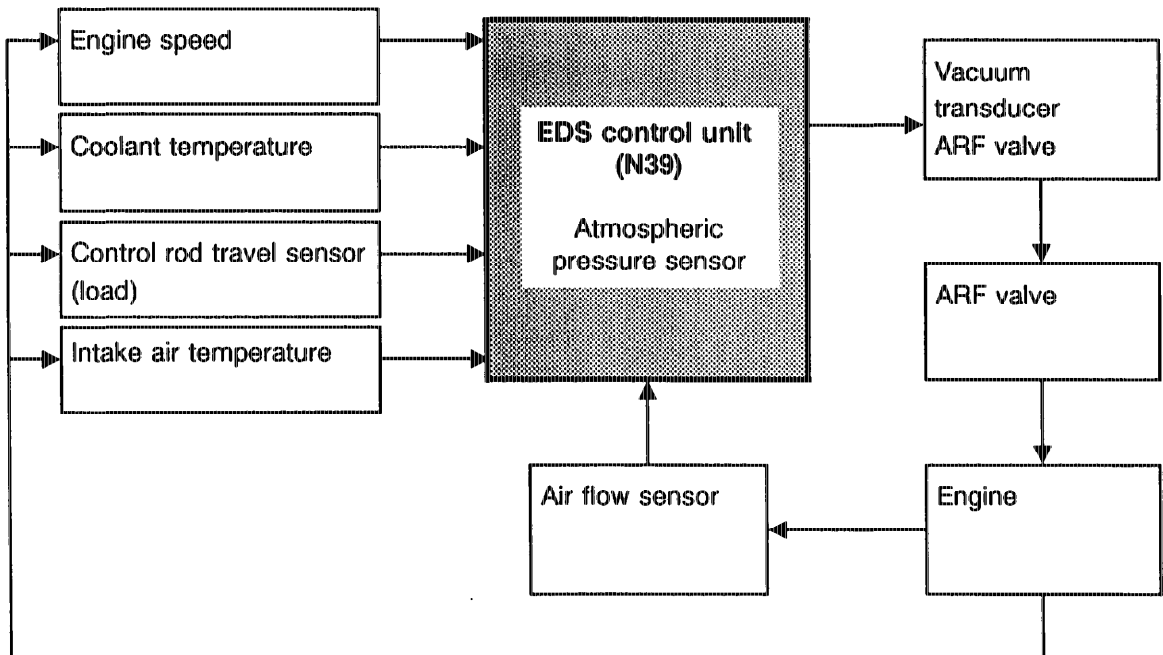
The ARF quantity is reduced as engine load and speed increase. This means
Increase in the control current = increase in ARF quantity.
Reduction in control current = reduction in ARF quantity.

Additionally as of Model Year 1992: ARF shutoff at 10° before full load by means of microswitch of accelerator control and switchover valve in vacuum line. This reduces smoke emissions during load change in full load direction.

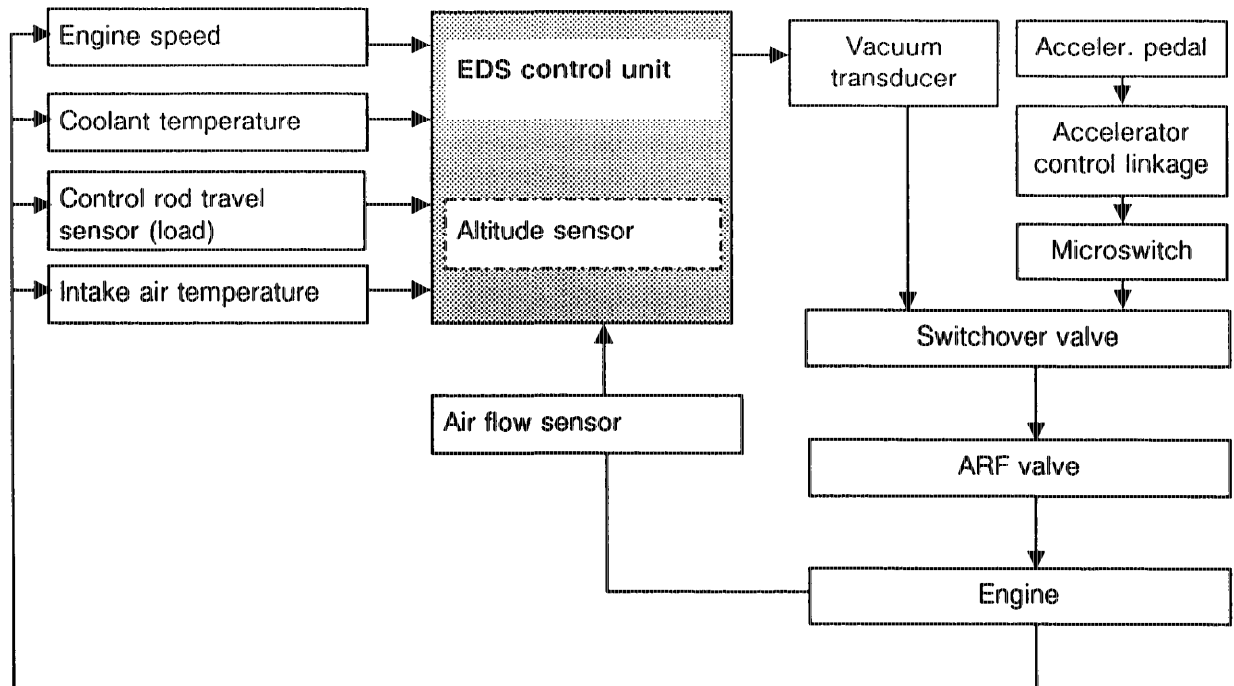
Note

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

Block diagram ARF up to Model Year 1991 (Inclusive)



Block diagram ARF as of Model Year 1992



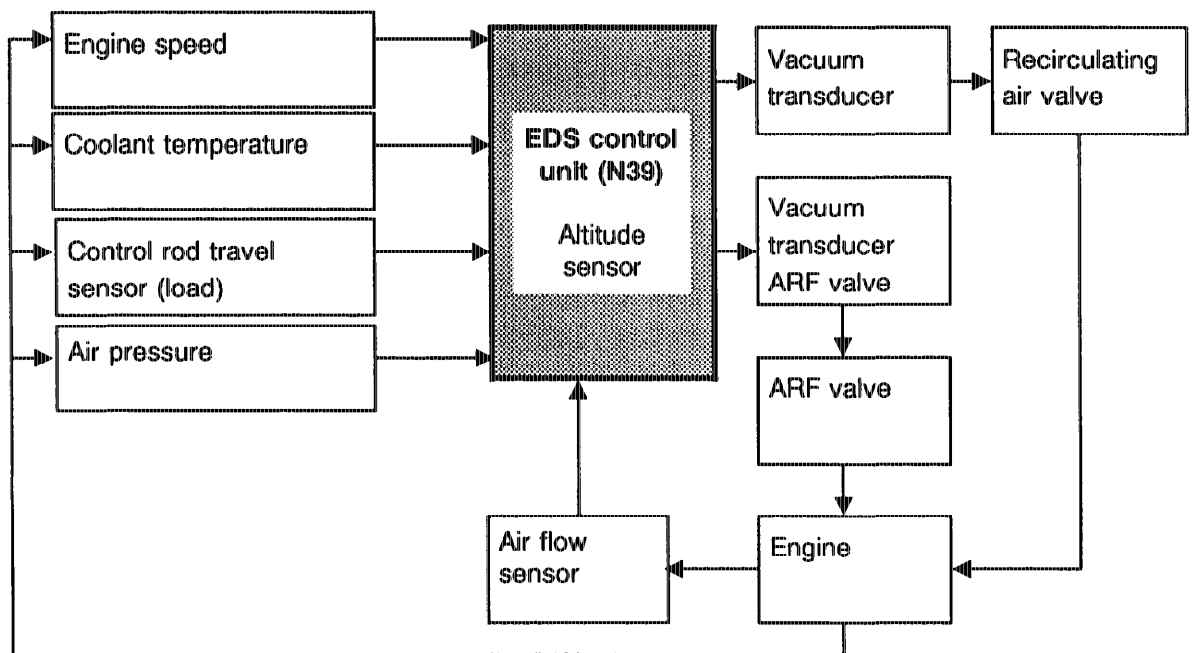
The ARF system with vacuum transducer, switchover valve (as of Model Year 1992), ARF valve, air flow sensor and EDS control unit operates as a closed control loop.

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

In order to achieve more favourable 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/min. The control rod travel must be <9 mm.

Block diagram recirculating air control



h) Charge pressure control (P2 control)

Engine 602.96

Basic Version Code 62/0 as of 06/91

(USA) as of Model Year 1990

(CH) (DK) as of Model Year 1991

(A) (FIN) as of Model Year 1992

Engine 603.971

Base version Code 62/0

(USA) as of model year 1992

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 in respect of performance, NO_x, HC and particle emissions.

Function

Particle emissions are lowered by reducing the pressure (P2) in front of the inlet 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.

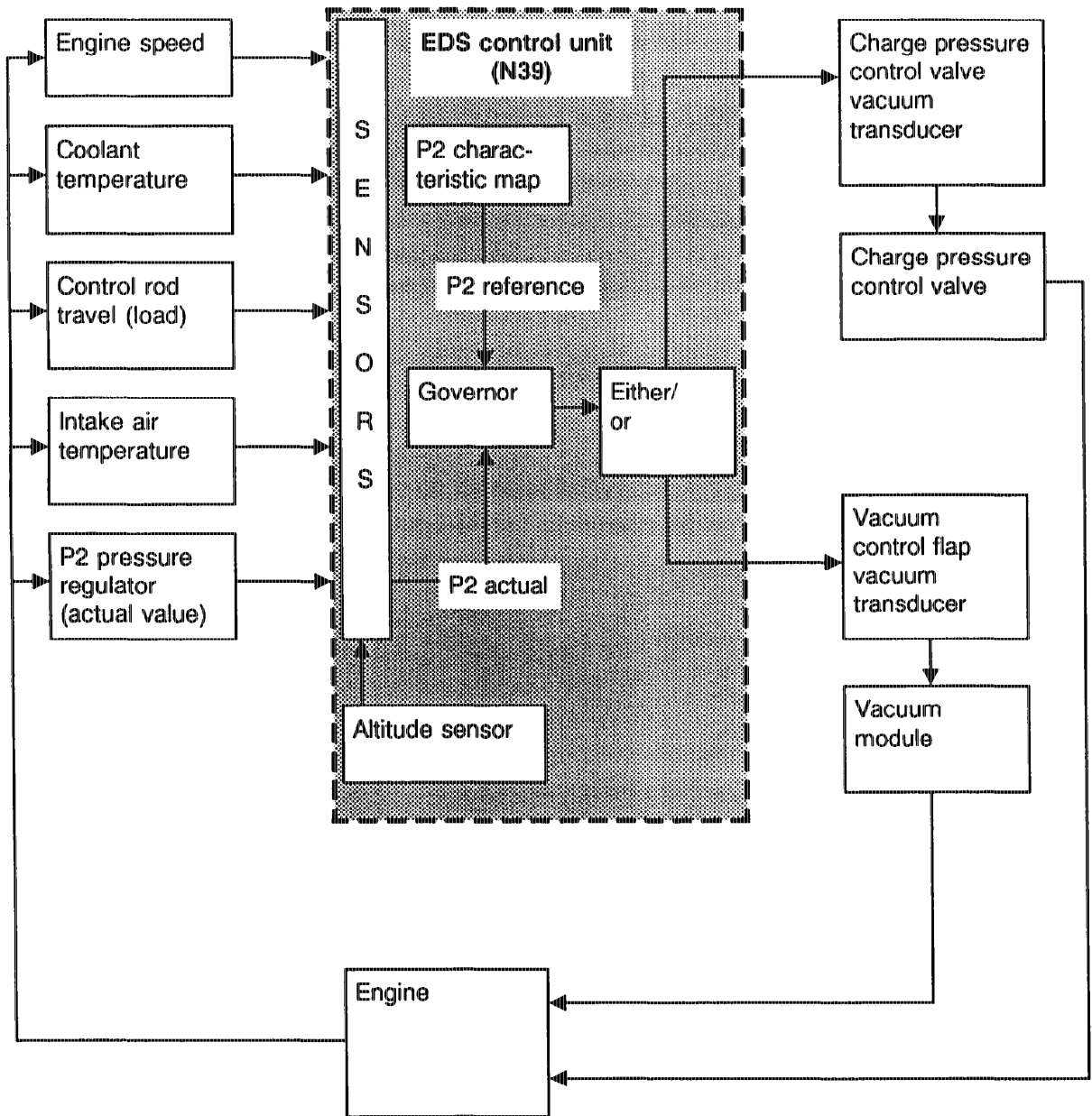
Charge pressure control is dependent on:

- Coolant temperature (up to 1991)
- Intake air temperature (up to 1991)
- Intake air pressure (pressure upstream of inlet valves)
- Engine speed
- Position of control rod (control rod travel)

Block diagram charge pressure control (P2 control), Engine 602.962

USA Model Year 1990

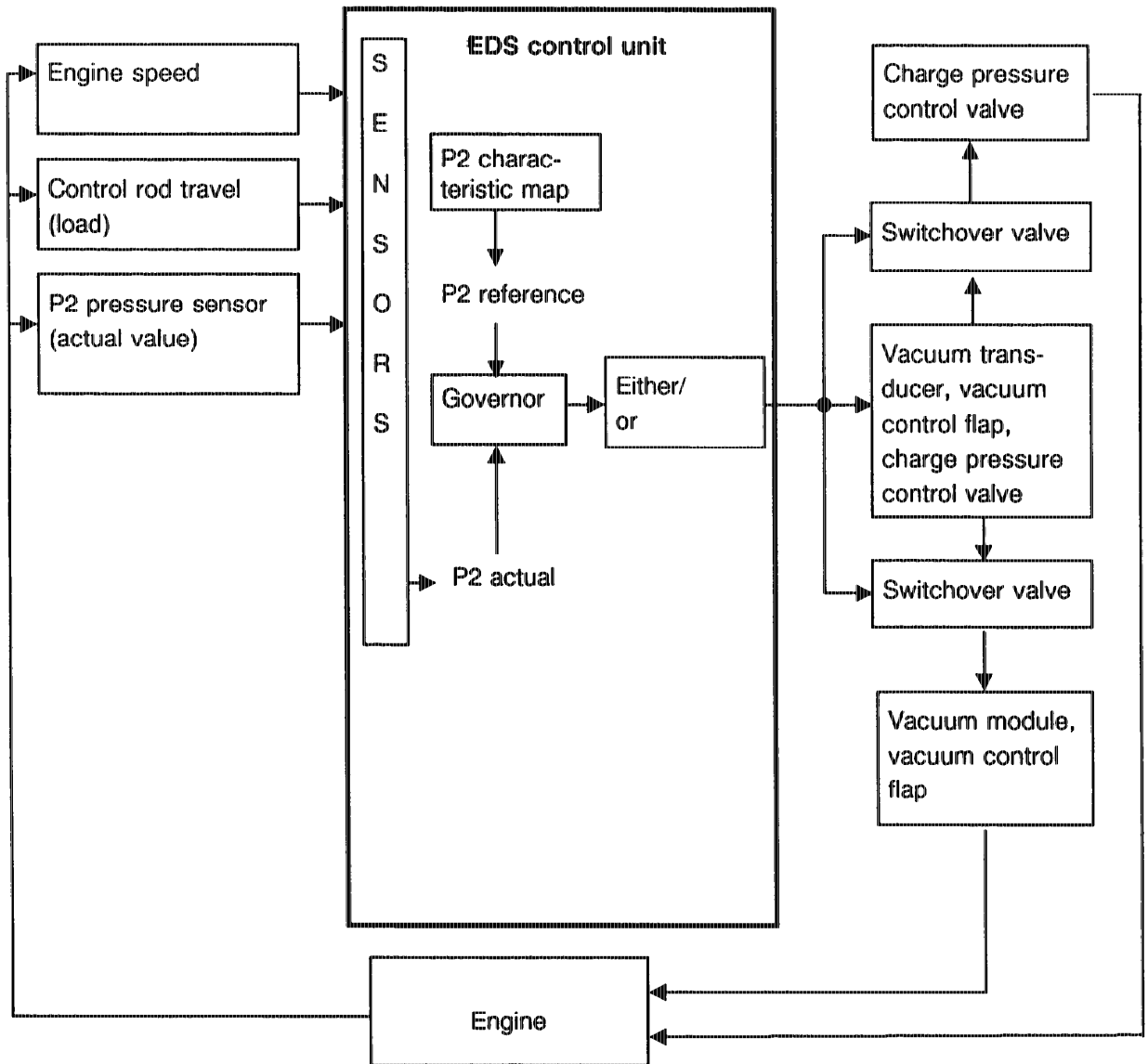
CH DK Model Year 1991



Block diagram charge pressure control (P2 control), Engine 602.96

Basic Version Code 62/0 as of 06/91

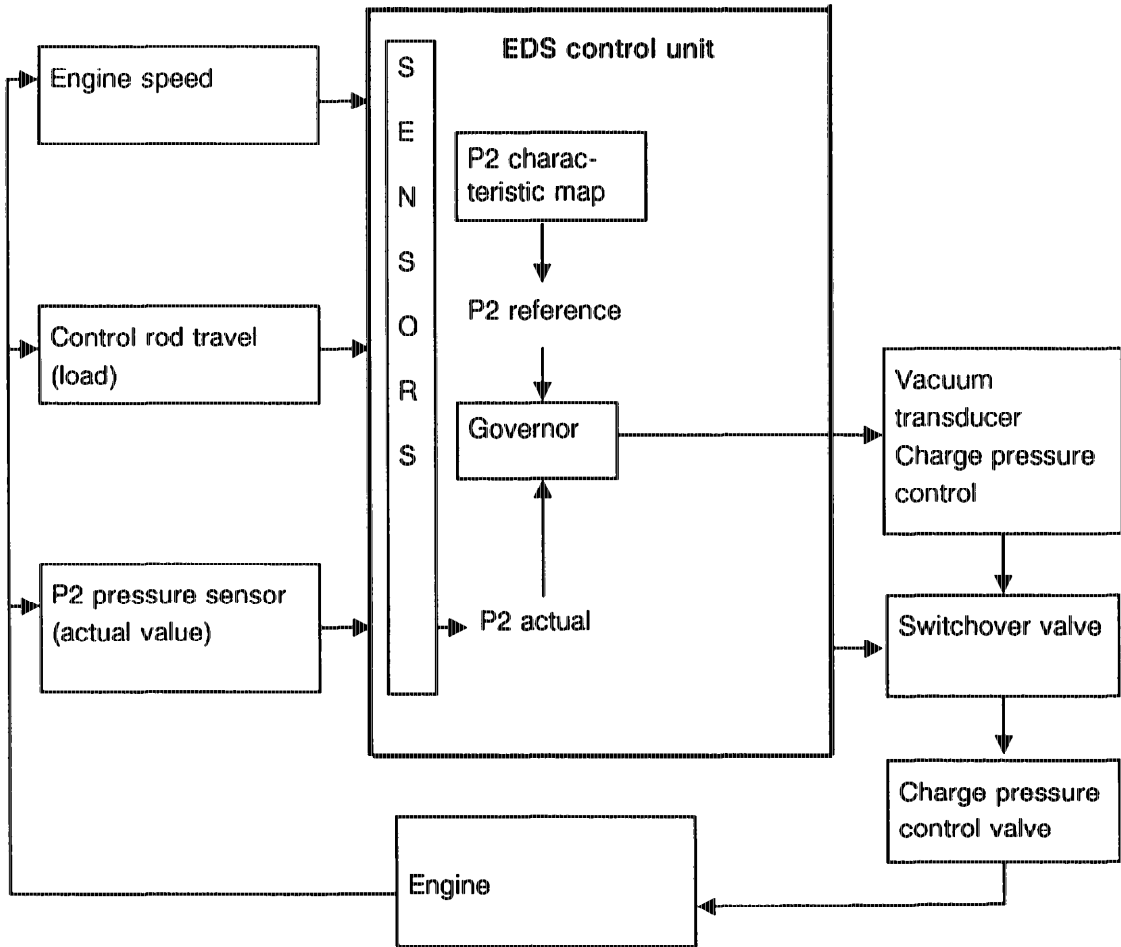
(USA) (CH) (DK) (A) (FIN) as of Model Year 1992



Block diagram boost pressure control (P2 control), engine 603.971

Base version Code 62/0

(USA) as of model year 1992



i) System diagnostics

With the self-test program integrated in the EDS control unit, the "electronic diesel system" can be checked and faults recorded and stored.

Temporary faults of more than 4 seconds duration are also memorized.

E.g. sensor faults with the exception of speed sensors are memorised, 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 (J) (USA)

EDS control unit **with** fault detection.

Only permanently occurring faults are detected.

Model Year 1988 (J)

Basic Version Code 62/0 as of 06/91

As of Model Year 1992, (A) (FIN) (CH) (DK) (J)

(USA)

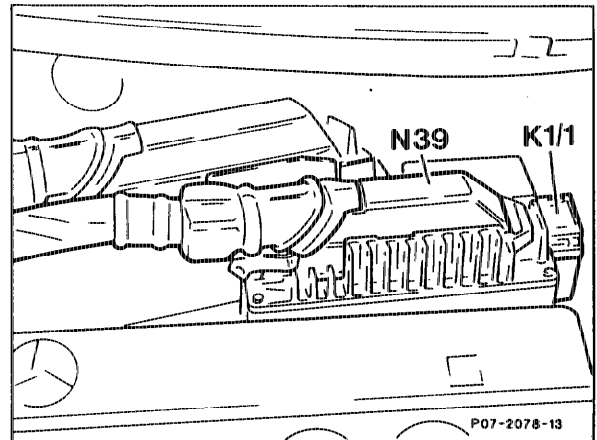
EDS control unit **with** fault memory.

Intermittently occurring faults are also **stored**.

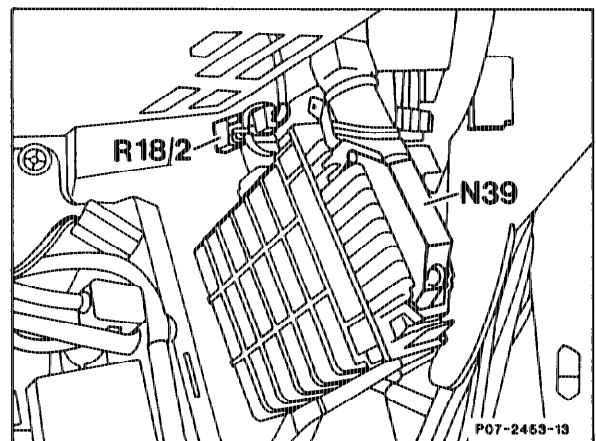
j) Location and function of components

EDS control unit (N39)

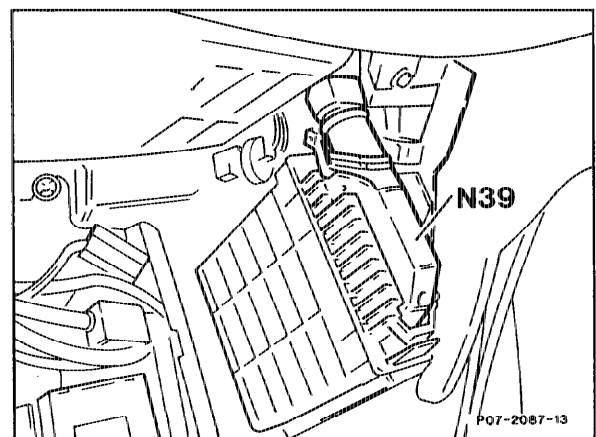
The control unit processes the incoming signals and supplies a current (mA) to the vacuum transducers, switchover valves, as well as to the actuator of the injection pump. The entire signal can be checked with the pulse counter by means of a signal, or the fault memory read via an outlet which runs to the test coupling (X92) or (X11/4).



Model 124 behind the battery in component compartment

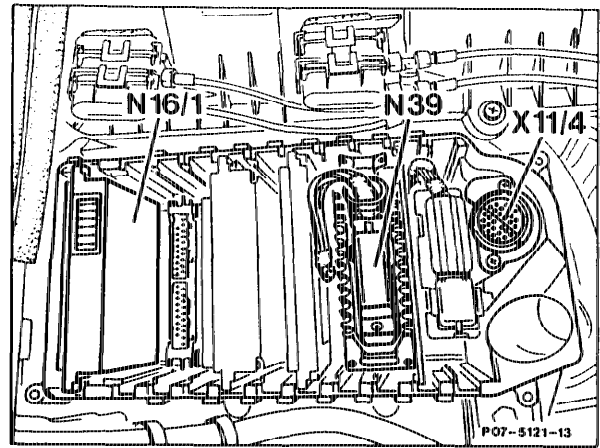


Model 126 in right footwell behind side panelling

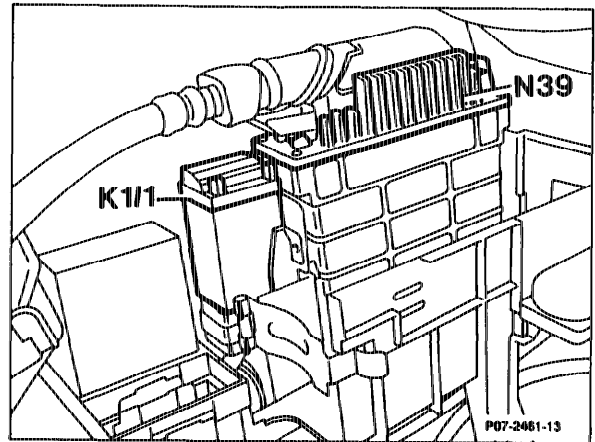


Model 126.13
(Engine 603.970)
Installed on right in interior

Model 140
Engine 603.971



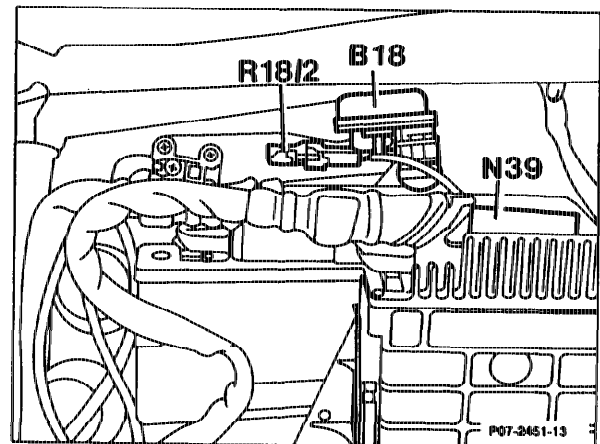
Model 201 behind battery in
component compartment



Altitude sensor (B18)

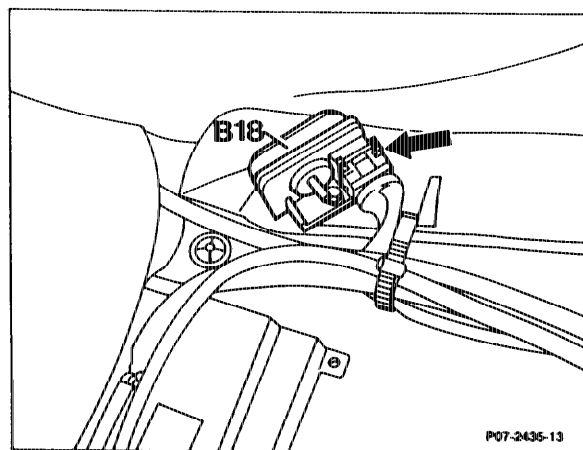
Model Year 1986/87 (USA)

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 vacuum transducer current.



Models 124, 201 in component compartment

Model 126 in right footwell



Altitude sensor (integrated in control unit)

A CH DK FIN USA as of Model Year 1990

Basic Equipment Code 62/0 as of 06/91

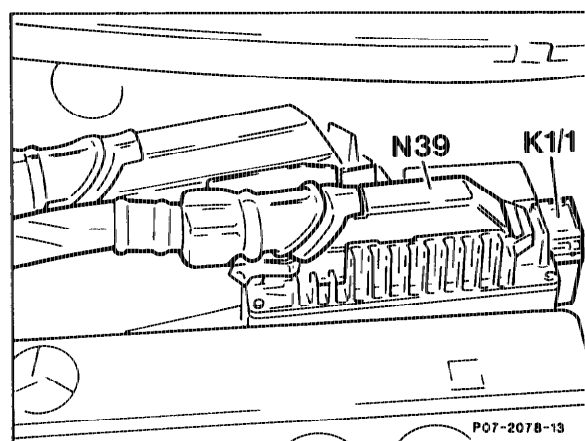
J as of Model Year 1992

The quantity of recirculated exhaust gas is influenced by the atmospheric pressure sensor as a function of altitude or air pressure. The atmospheric pressure sensor supplies a voltage signal to the control unit which is proportional to air pressure (i. e. low voltage with low air pressure). The control unit matches the quantity of exhaust gas recirculated to the respective air pressure by reducing the vacuum transducer current.

Overvoltage protection (K1 or K1/1)

The power for the electronic control units is supplied through the overvoltage protection relay.

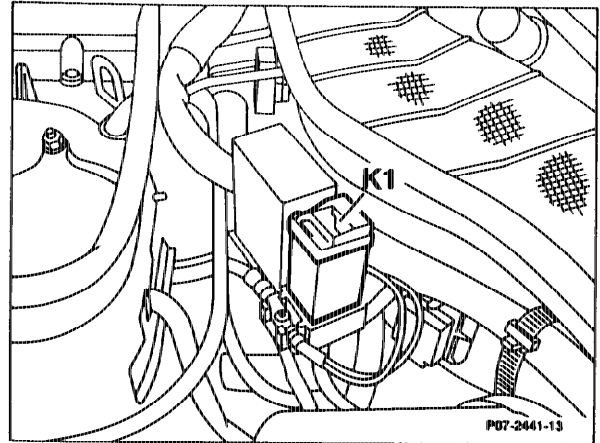
Models 124, 201 behind battery in component compartment



Battery voltage is supplied constantly to terminal 30. A 10 A fuse is fitted between terminals 30 and 30a. The fault memory is 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 overvoltage protection is achieved by means of a 22 volts Zener diode. Voltage peaks in excess of 22 volts occurring upstream of the overvoltage protection are switched directly to ground by the Zener diode.

An overload is prevented by a fuse. Terminals 87E and 87L are protected separately.

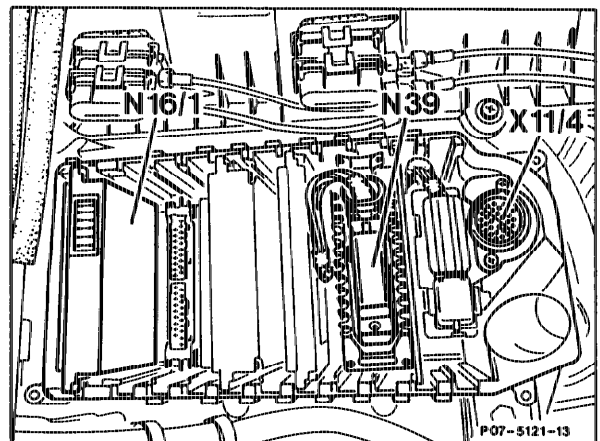


Model 126 in component compartment next to ABS control unit

Base module (N16/1)

Engine 603.971, Model 140 base version
Code 62/0, (USA) as of model year 1992

The base module (N16/1) performs the function of the overvoltage protection relay.



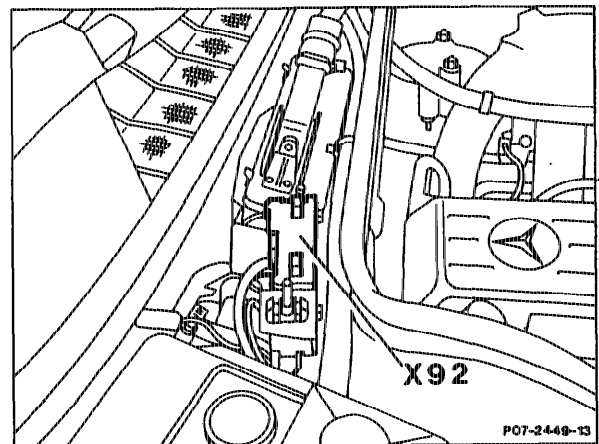
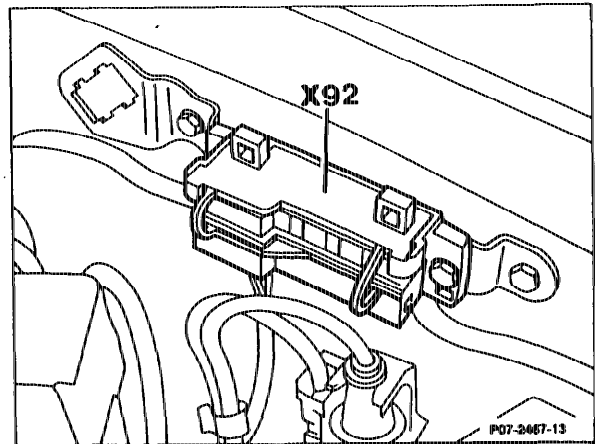
Test coupling (X92) or (X11/4)

Test coupling (X92)

Ⓝ USA Model Year 1986/87

The diagnostic test signal can be tapped via the test coupling.

Model 124 and 201 in right of component compartment

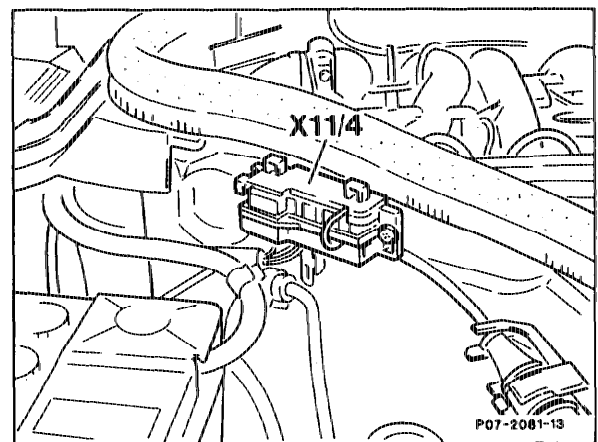


Model 126

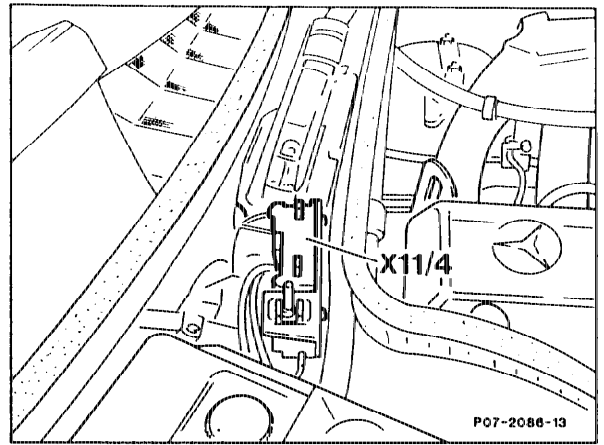
Test coupling (X11/4)

The pulse readout for the diagnosis of the EDS can be tapped via test coupling, contact 4.

Model 124, 201



Model 126

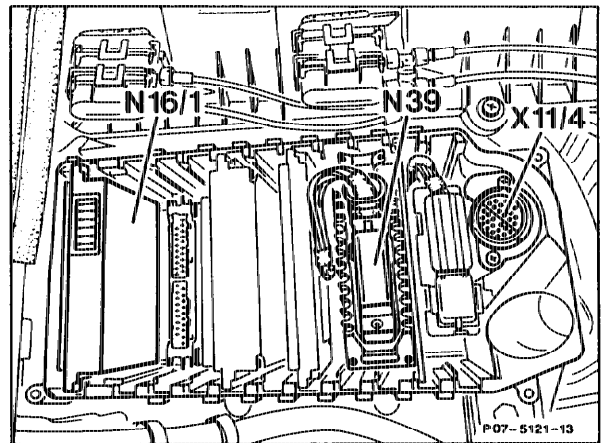


Test coupling (X11/4) integrated in module box

Model 140 (USA) Model Year 1992

The pulse readout for diagnosis can be tapped at contact 4 of the 38-pin test coupling.

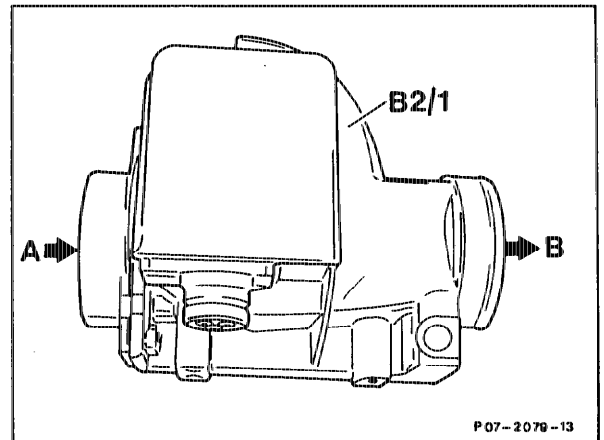
Model 140



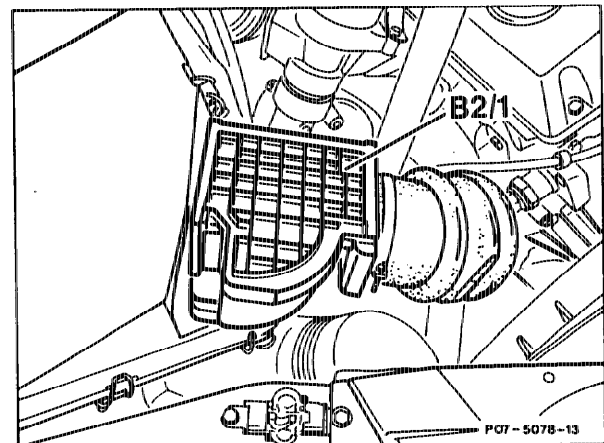
Air flow sensor potentiometer (B2/1)

Fitted in the air flow between air filter and exhaust gas turbocharger.

- A from air filter
- B to exhaust gas turbocharger



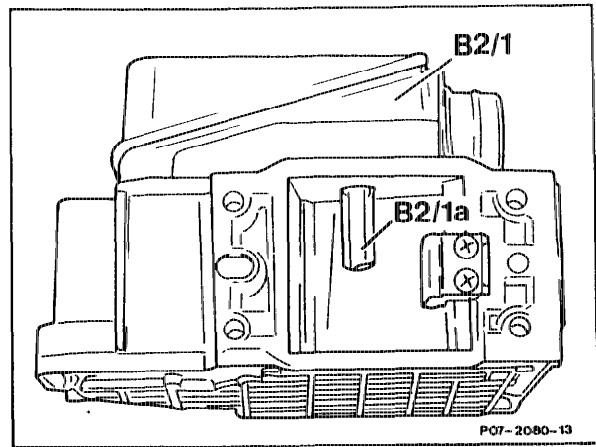
Model 140



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



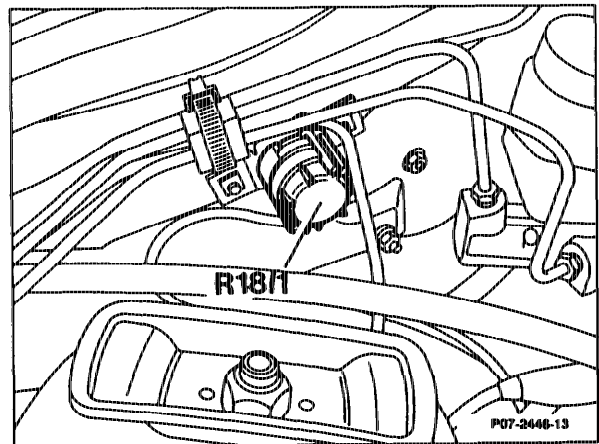
Resistance trimming plug (R18/1) for idling speed

Model Year 1986, 1987, 1988

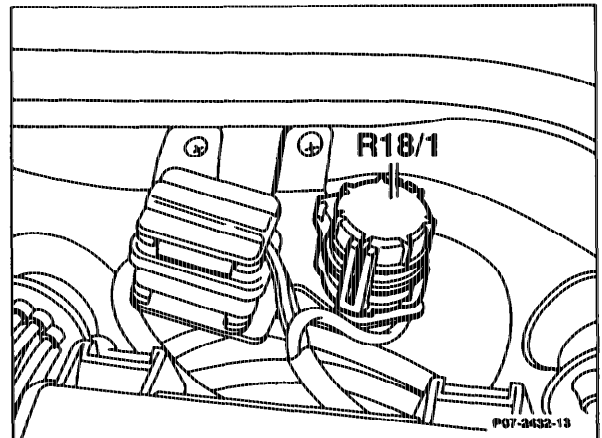
For setting the idling speed.

Specification: 630 ± 20/min.

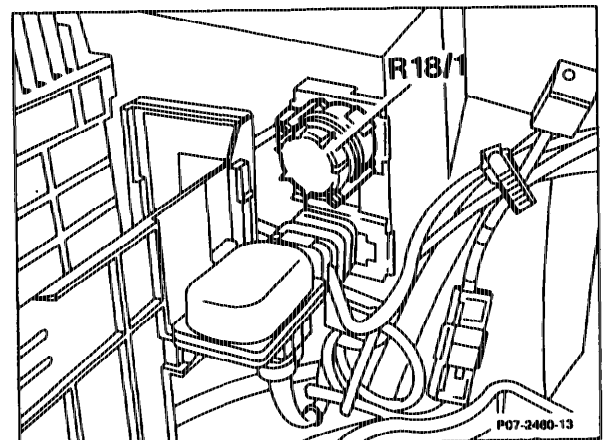
Model 124



Model 126

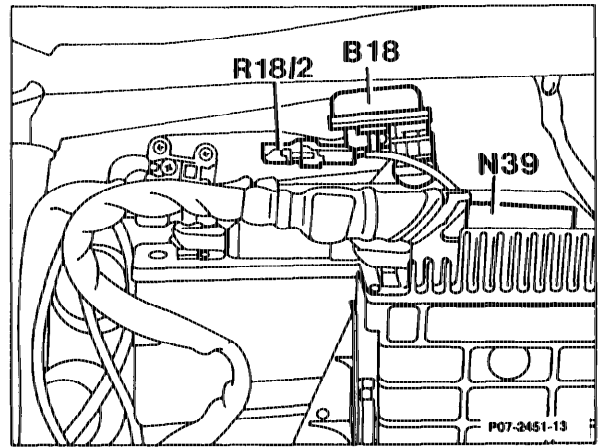


Model 201

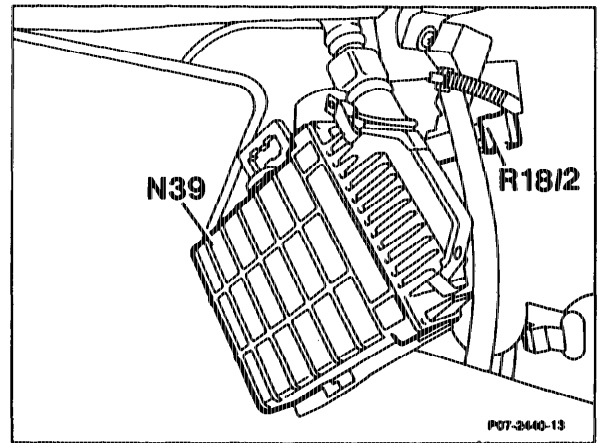


Reference resistor (R18/2) for exhaust gas recirculation, Model Year 1986, 1987, 1988

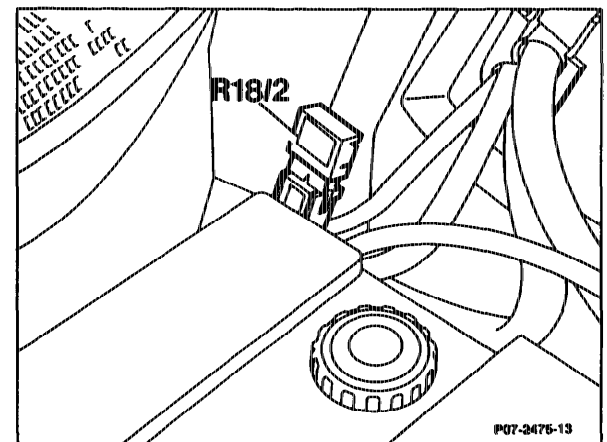
Model 124 in components compartment



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



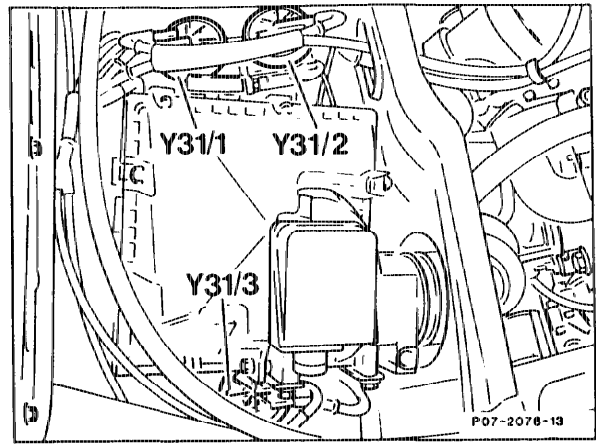
Model 201 in component compartment next to battery



Vacuum transducer (Y31/1, Y31/2, Y31/3) up to Model Year 1991

Vacuum transducer (Y31/1, Y31/4, Y31/5) as of Model Year 1992

The vacuum transducers are supplied with a control current as an input signal from the control unit depending on the operating state. The vacuum transducer then supplies the appropriate vacuum for the actuators. As of model year 1992 the vacuum is transmitted from the vacuum transducers through electrical switchover valves to the ARF valve and to the vacuum unit of the vacuum control flap or charge pressure control.



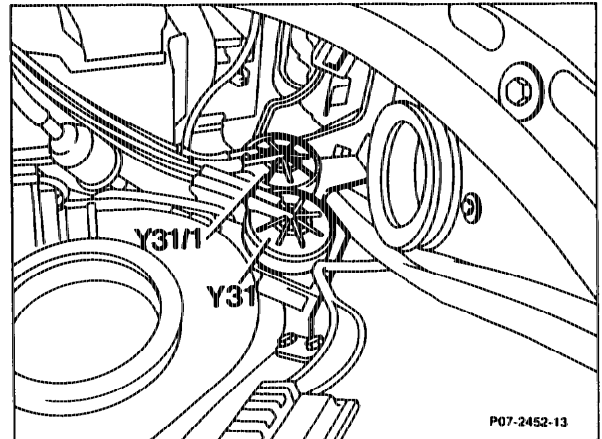
Engine 602.962 (USA) Model Year 1990

Y31/1 Vacuum transducer – ARF valve

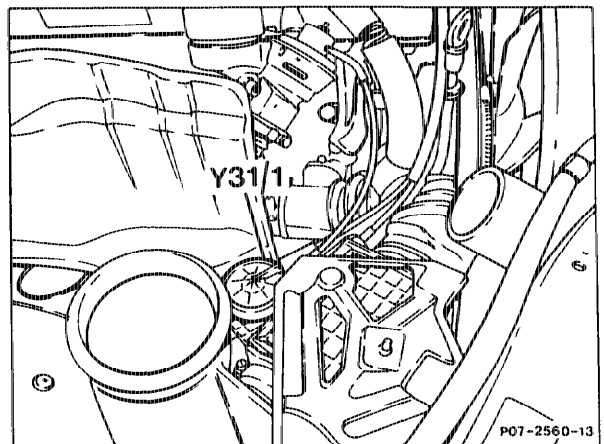
Y31/2 Vacuum transducer – vacuum control flap

Y31/3 Vacuum transducer – charge pressure control

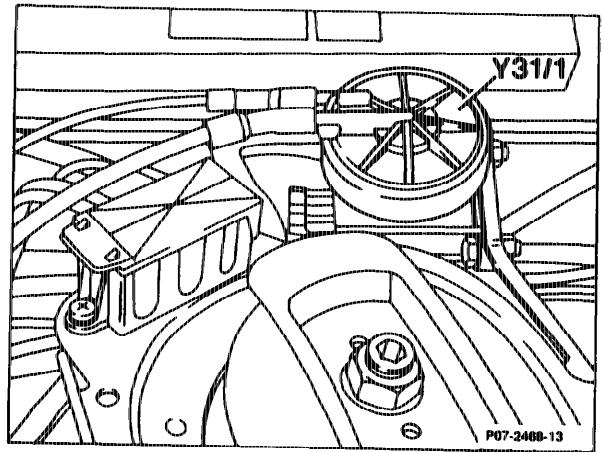
Engine 603.96 in Model 124



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



Engine 602.96 in Model 201



Engine 602.96 Model 124

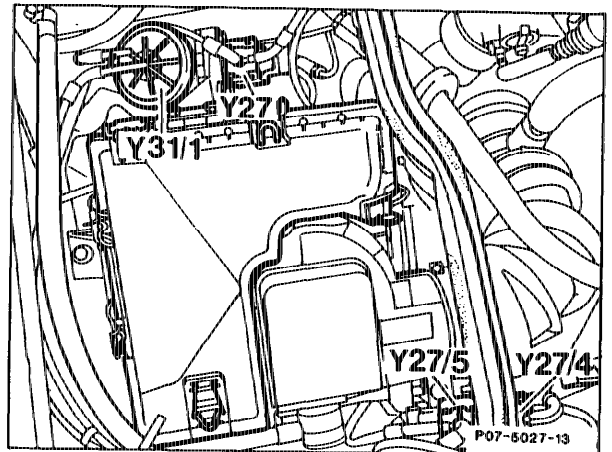
Basic Version Code 62/0 as of 06/91

(A) (FIN) (CH) (DK) (USA) as of Model

Year 1992

Y31/1 Vacuum transducer ARF valve

Y31/5 Vacuum transducer charge pressure control/vacuum control flap (not visible fitted below air filter)



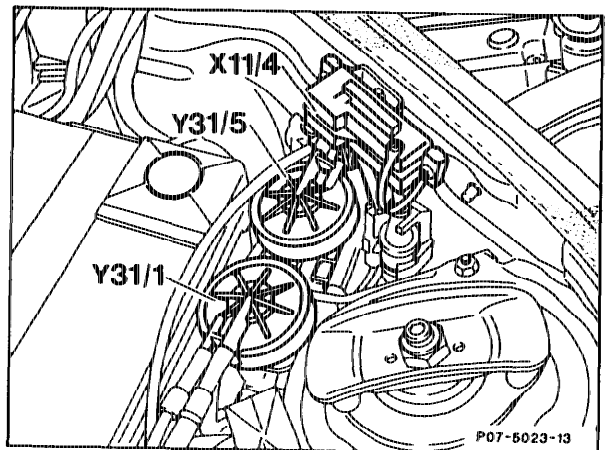
Engine 602.96 Model 201

Basic Version Code 62/0 as of 06/91

(A) (FIN) as of Model Year 1992

Y31/1 Vacuum transducer ARF valve

Y31/5 Vacuum transducer charge pressure control/vacuum control flap



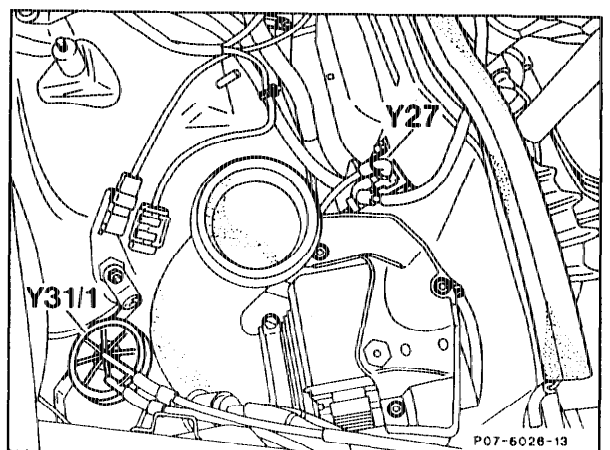
Engine 603.96 Model 124

Basic Version Code 62/0 as of 06/91

(A) (FIN) (J) as of Model Year 1992

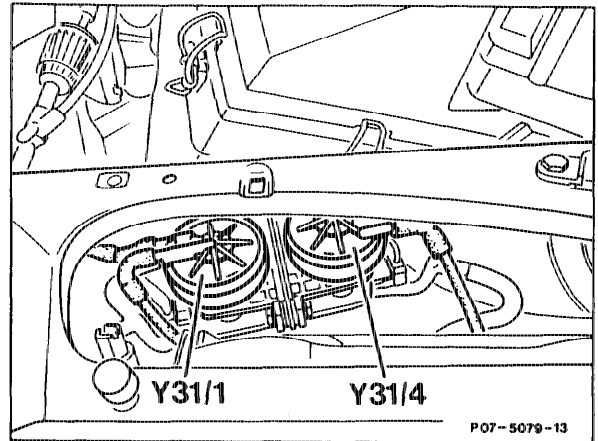
Y27 ARF switchover valve

Y31/1 Vacuum transducer, ARF valve



Engine 603.971 Model 140
 Base version Code 62/0
 (USA) as of model year 1992

Y31/1 Vacuum transducer ARF valve
 Y31/4 Vacuum transducer charge pressure control



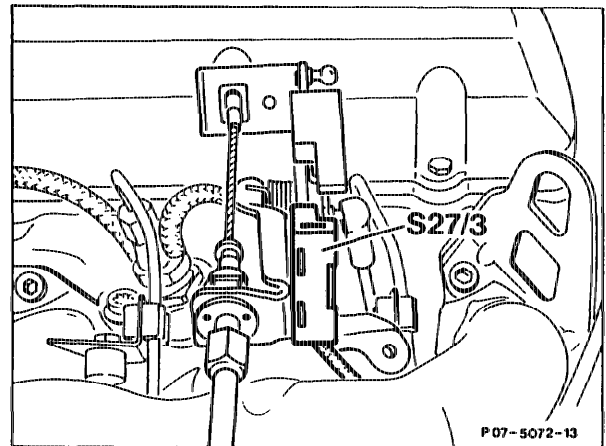
ARF electrical switchover valve (Y27), ARF microswitch (S27/3)

Basic Version Code 62/0 as of 06/91

(A) (FIN) (CH) (DK) (USA) (J) as of Model Year 1992

Microswitch, compressor cutoff/ARF (S27/6) only (USA) Model 140 as of Model Year 1992

The ARF switchover valve (Y27) is actuated 10° before full load by the ARF microswitch (S27/3) of the accelerator control, or by the compressor cutoff/ARF microswitch (S27/6) of the accelerator control. This closes the ARF valve.



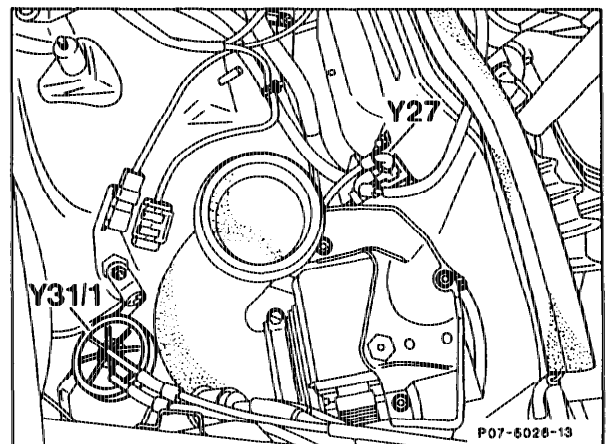
S27/3 ARF microswitch

Note

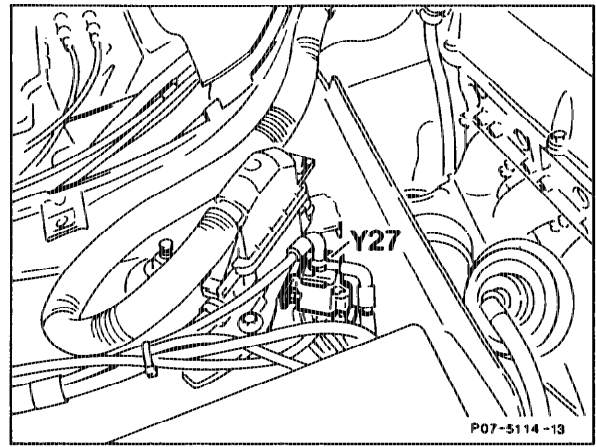
The illustration of the ARF electrical switchover valve (Y27), engine 602.96 can be found in the section "electrical switchover valves charge pressure control (Y27/4) or vacuum control flap (Y27/5)".

Engine 603.96 Model 124

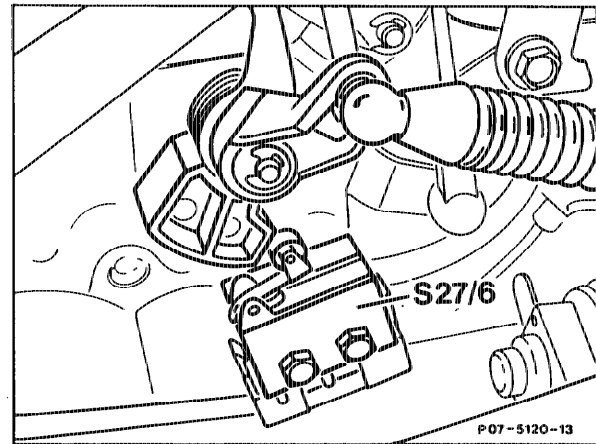
Y27 ARF switchover valve



Engine 603.971 Model 140
 Base version Code 62/0
 (USA) as of model year 1992
 Y27 ARF switchover valve



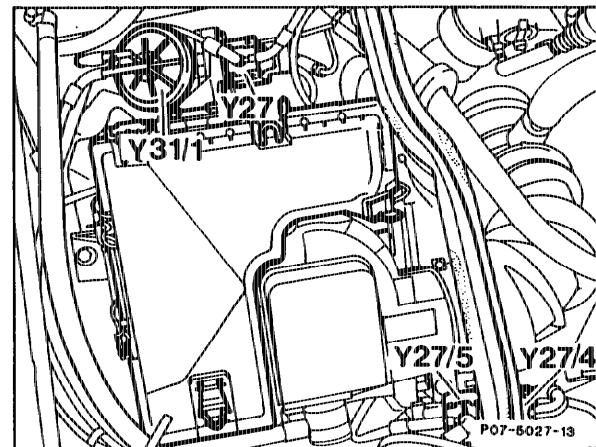
Engine 603.971 Model 140
 (USA) as of Model Year 1992
 S27/6 Compressor cutoff/ARF microswitch



Electrical switchover valves, charge pressure control (Y27/4) or vacuum control flap (Y27/5), Engine 602.96

Basic Version Code 62/0 as of 06/91
 (A) (FIN) (CH) (DK) (USA) as of Model Year 1992

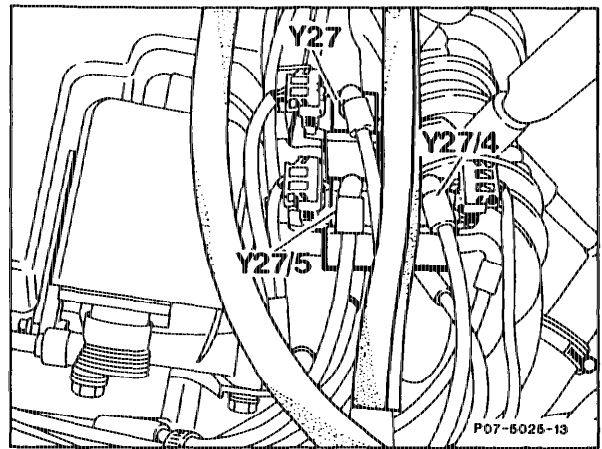
The electrical switchover valves are supplied with a control current as an input signal from the control unit depending on the operating state, and with the vacuum from the vacuum transducer. They transmit the vacuum in line with the command of the control unit to the charge pressure control valve vacuum unit or vacuum control flap vacuum unit.



Engine 602.96 Model 124
 Y27 Exhaust gas recirculation switchover valve
 Y27/4 Charge pressure control switchover valve
 Y27/5 Vacuum control flap switchover valve

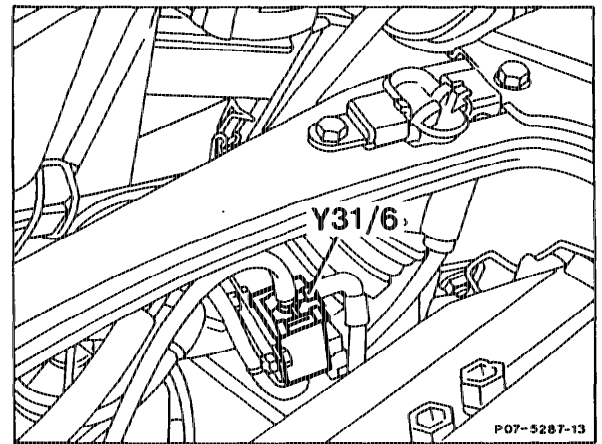
Engine 602.96 Model 201

- Y27 Exhaust gas recirculation switchover valve
- Y27/4 Charge pressure control switchover valve
- Y27/5 Vacuum control flap switchover valve



Electrical switchover valve, charge pressure cutoff (Y31/6), only Engine 603.971 Model 140 (USA) Model Year 1992

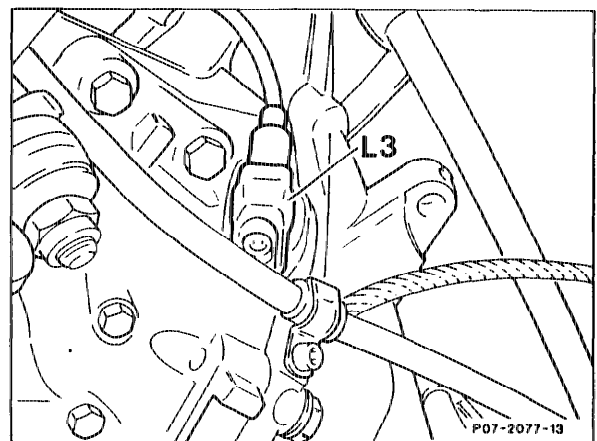
If a fault occurs in the charge pressure control loop, the electrical switchover valve (Y31/6) admits air to the charge pressure control valve. Consequently, no charge pressure is built up and no turbocharger quantity is released by the injection pump.



Y31/6 Charge pressure cutoff switchover valve

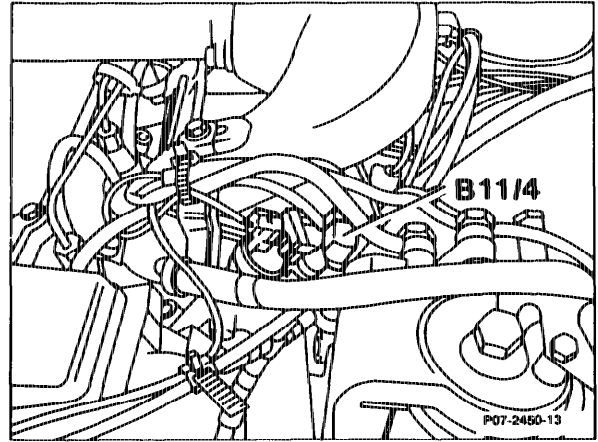
Engine speed sensor (L3)

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



Coolant temperature sensor (EDS) (B11/4)

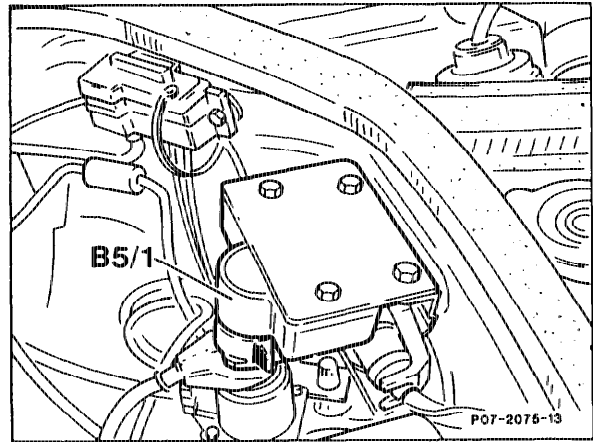
The coolant temperature is detected by the coolant temperature sensor (EDS) (B11/4). The sensor is actuated by the EDS control unit. The resistance of the EDS coolant temperature sensor varies as a function of coolant temperature.



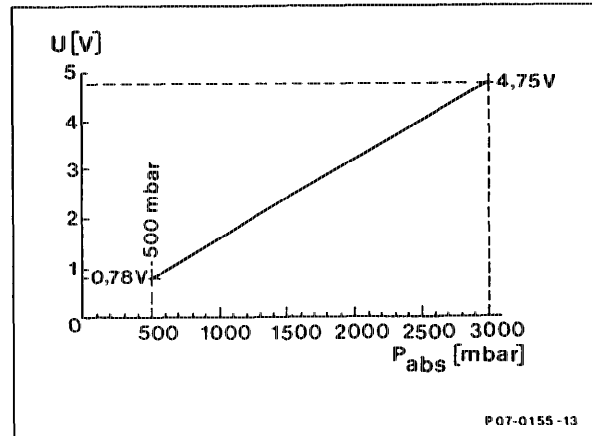
Bosch pressure sensor (B5/1)

The pressure sensor detects the existing pressure (P2) and converts it into a voltage which is used as an input signal by the EDS control unit.

Engine 602.96 up to Model Year 1992
Fitted on right behind firewall in direction
of travel

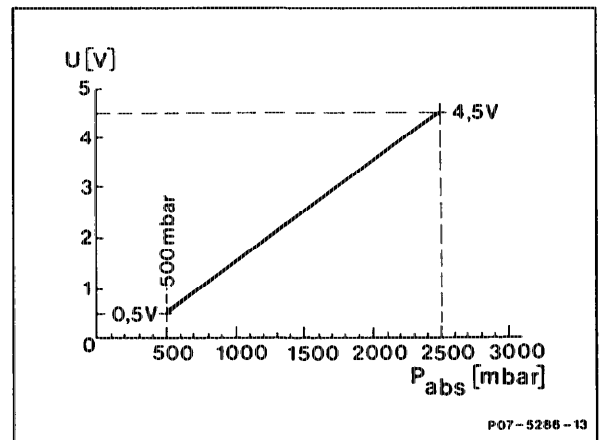
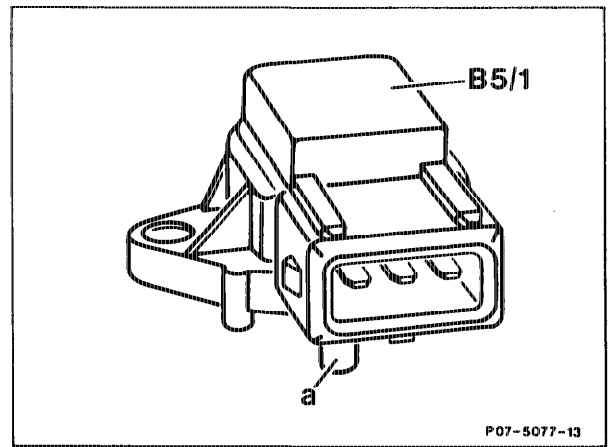


Bosch pressure sensor
Absolute pressure characteristic curve
(P_{abs} in mbar) at 5 V voltage



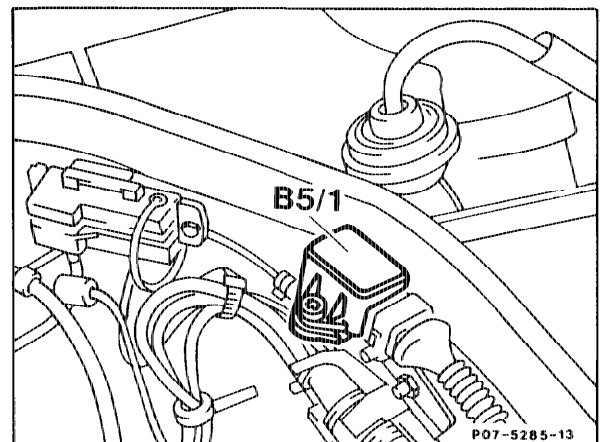
Nippon Denso pressure sensor (B5/1)
Engines 602.96, 603.971 as of Model Year
1992

The function is the same as for the Bosch pressure sensor.

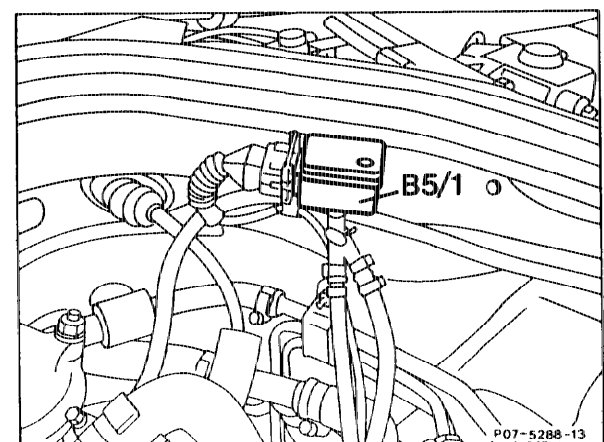


Nippon Denso pressure sensor
 Absolute pressure characteristic curve
 (P_{abs} in mbar) at 5 volts voltage

Model 124
 On right behind firewall in direction of travel



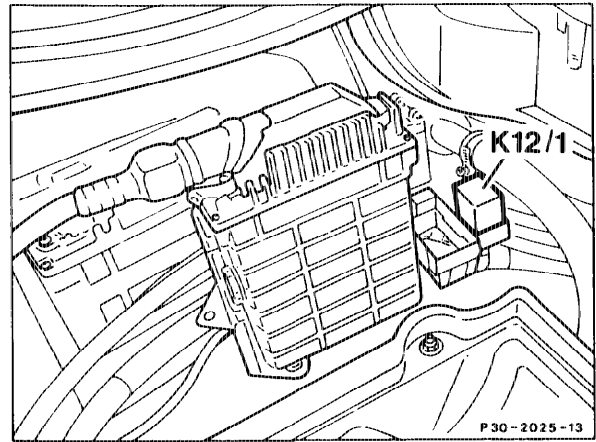
Model 201,140
 On left in front of firewall in direction of travel



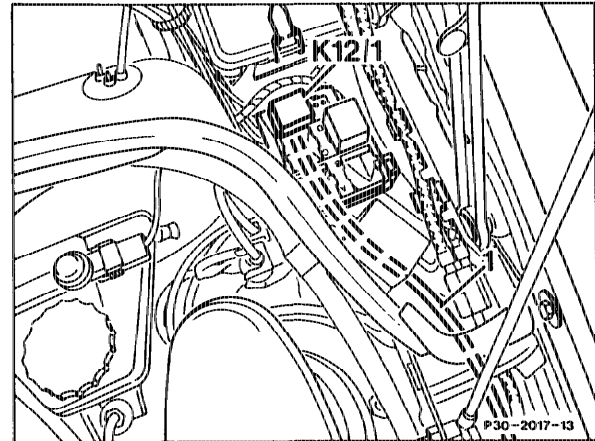
Tempomat cruise control, Model Year 1990

In order not to influence the control of the Tempomat cruise control in the part load range, the charge pressure cutoff is rendered inoperative by the Tempomat cruise control/charge pressure cutoff relay (K12/1) during use of the cruise control.

Model 124
K12/1 Tempomat cruise control/charge pressure cutoff relay



Model 201
K12/1 Tempomat cruise control/charge pressure cutoff relay



Note

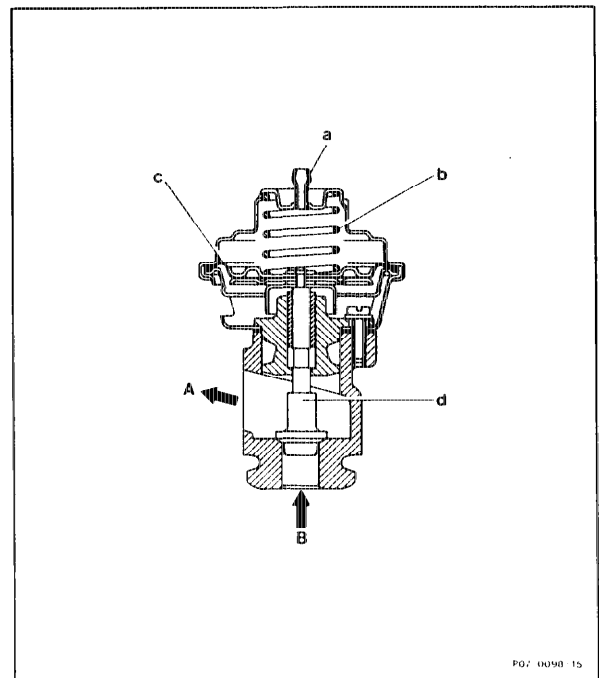
For wiring diagrams see Wiring Diagrams Volume 4 for Model 124 and Volume 5 for Model 201 Group 30.

ARF valve

The ARF valve is bolted to the mixing pipe on the side of the cylinder head. It is connected to the exhaust manifold by means of a corrugated pipe. The ARF valve is operated by means of a controlled vacuum from the vacuum transducer (Y31/1).

Version up to July 1991

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

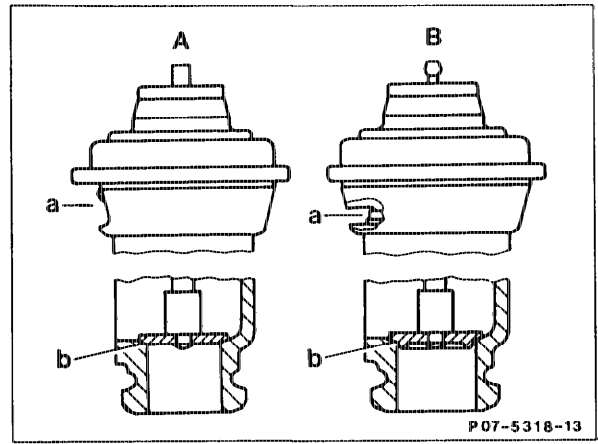


Notes

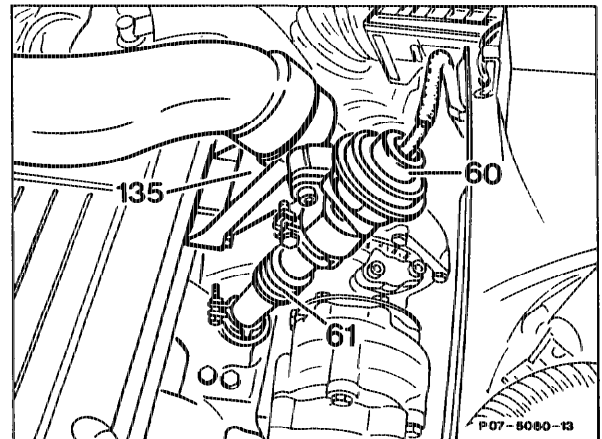
ARF valve as of 06/91

For noise reasons, the ARF valve is provided with a smaller air passage (a) and a shaped valve seat (b). The connection fitting for the vacuum connection is designed in a tulip shape.

- A. Version up to 06/91
- B. Version as of 06/91



- a Air passage
- b Valve seat



- 60 ARF valve
- 61 Corrugated pipe
- 135 Mixing pipe

Engine 602.961/962, 603.960/963/971

Cast EGR valve (was steel).

Reason: cost and weight reduction.

Production breakpoint: December 1992

Model	Engine	Engine end no. Automatic transmission
124.133/193	603.960	046010
124.333/393	603.963	003995
140.134 (USA)	603.971	001998
201.128 (I)	602.961	011387

Production breakpoint: January 1993

Model	Engine	Engine end no. Automatic transmission
124.128/188	602.962	017093
201.128	602.961	011441

Engine 603.960/963/971

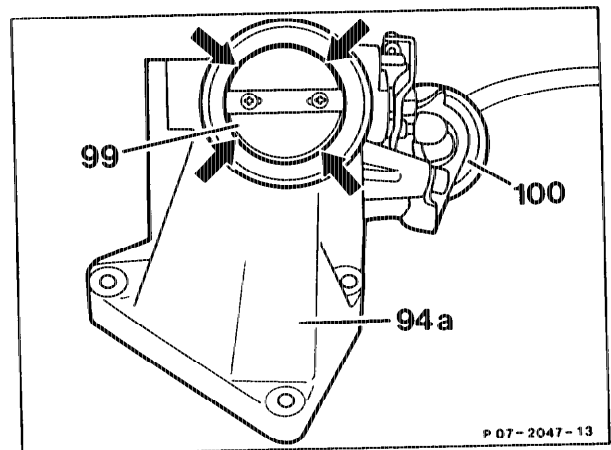
EGR valve vent restrictor modified.

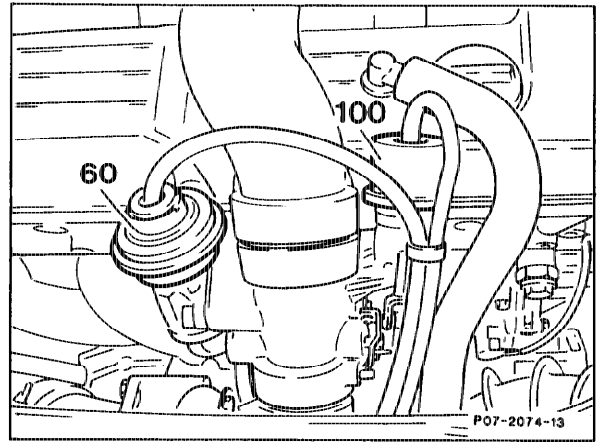
Production breakpoint as of June 1993

Model	Engine	Engine end no. Automatic transmission
124.133/193	603.960	048091
124.333/393	603.963	004100
140.134	603.971	004832

Mixture housing (94a) with vacuum control flap (99) and vacuum unit (100), Engine 602.96 (USA) as of Model Year 1990
(CH) (DK) as of Model Year 1991
Basic Version Code 62/0 as of 06/91
(A) (FIN) as of Model Year 1992

In order to increase the vacuum in the charge air distribution pipe, a pneumatically operated vacuum control flap is fitted to the mixing housing. The vacuum control flap closes the fresh air port during engine operation with ARF. A minimum opening (arrows) between the vacuum control flap and the mixing housing is retained. As of Model Year 1992 the vacuum unit (100) is actuated by the charge pressure control/vacuum control flap via the vacuum control flap electrical switchover valve (see function diagram).





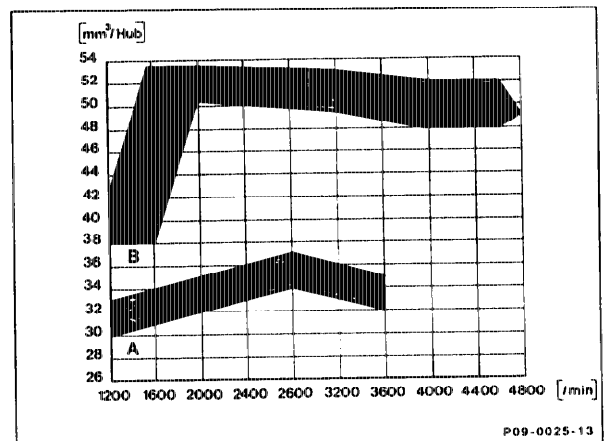
V. Engine overload protection

Note

Engines with boost pressure control (P2 control) do not as a general rule have an engine overload protection.

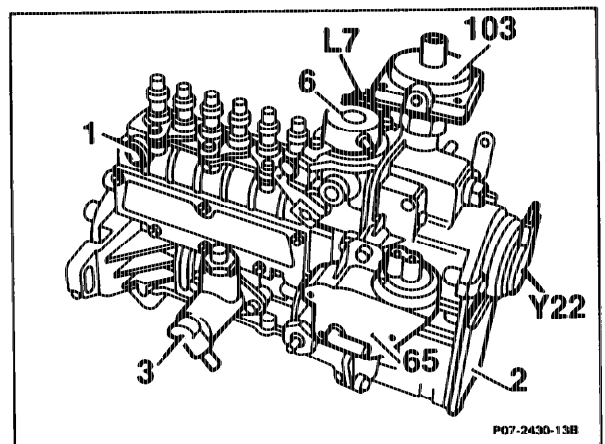
A pressure switch is fitted in the charge air pipe for overload protection of mechanical parts of the engine. If the charge pressure rises above 1.1 ± 0.15 bar gauge pressure, air is admitted to the ALDA unit through the switchover valve and the quantity of fuel is limited to that of a naturally aspirated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

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

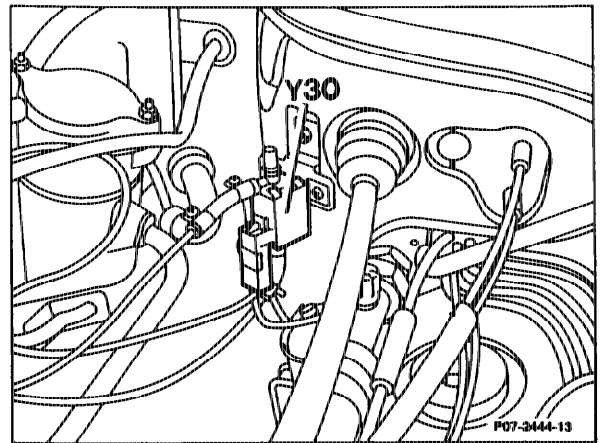


Location of components

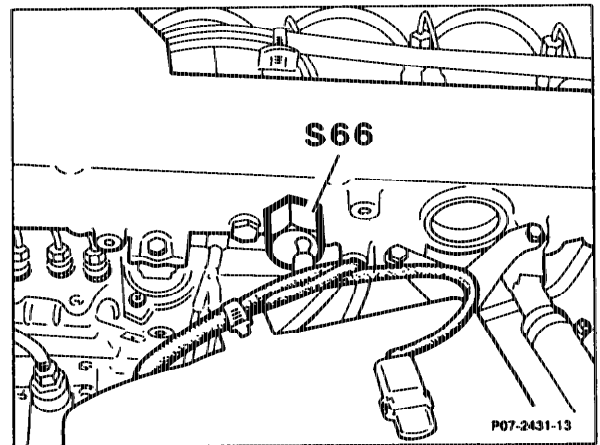
- 1 Injection pump
- 2 Governor
- 3 Fuel pump
- 6 Stop unit
- 103 ALDA unit
- Y22 Actuator



Y30 Switchover valve, engine overload protection



S66 Switch, engine overload protection



Engine 602.962, 603.960/963

Discontinuation of engine overload protection.

Production breakpoint: as of January 1993

Model	Engine	Engine end no.	
		Manual transmission	Automatic transmission
124.128/188	602.962	027382	-
124.333/393	603.963	-	004004

Production breakpoint: as of February 1993

Model	Engine	Engine end no. Automatic transmission
124.128/188	602.962	017181
124.133/193	603.960	046668

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.