



MERCEDES-BENZ

Service

Model Year 1990/91 (USA)
Models 124.1 and 126.1 Turbodiesels



Mercedes-Benz

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Model Year 1990/91 (USA)
Models 124.1 and 126.1 Turbodiesels

Introduction into Service

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This introduction manual is intended to familiarize you with the technical changes made on Model Year 1990 Diesel models 124.128 and 126.135 as well as model 126.134 to be introduced as an early Model Year 1991 vehicle.

Coverage for the other model year 1990 vehicles is contained in three additional introduction manuals as follows:

Model Year 1990 (USA)
Models 124.0, 126.0, 201

Model Year 1990 (USA)
Model 129

Model Year 1990 (USA)
Models 124.230/290 (4MATIC)

Engine 602.962 in model 124 is identical with engine 602.961 except for the modifications described.

The essential feature of models 126.134/135 is the 6 cylinder diesel engine with 3.5 liter displacement and turbocharger, based on engine 603.96.

Until the latest repair instructions are available on microfiche, this Introduction Manual can be utilized by Mercedes-Benz service personnel to familiarize themselves with important technical details and modifications to perform maintenance and repairs on the above Model Year 1990 vehicles.

All other repair instructions, adjustment values and maintenance jobs not listed here can be found in the existing technical literature.

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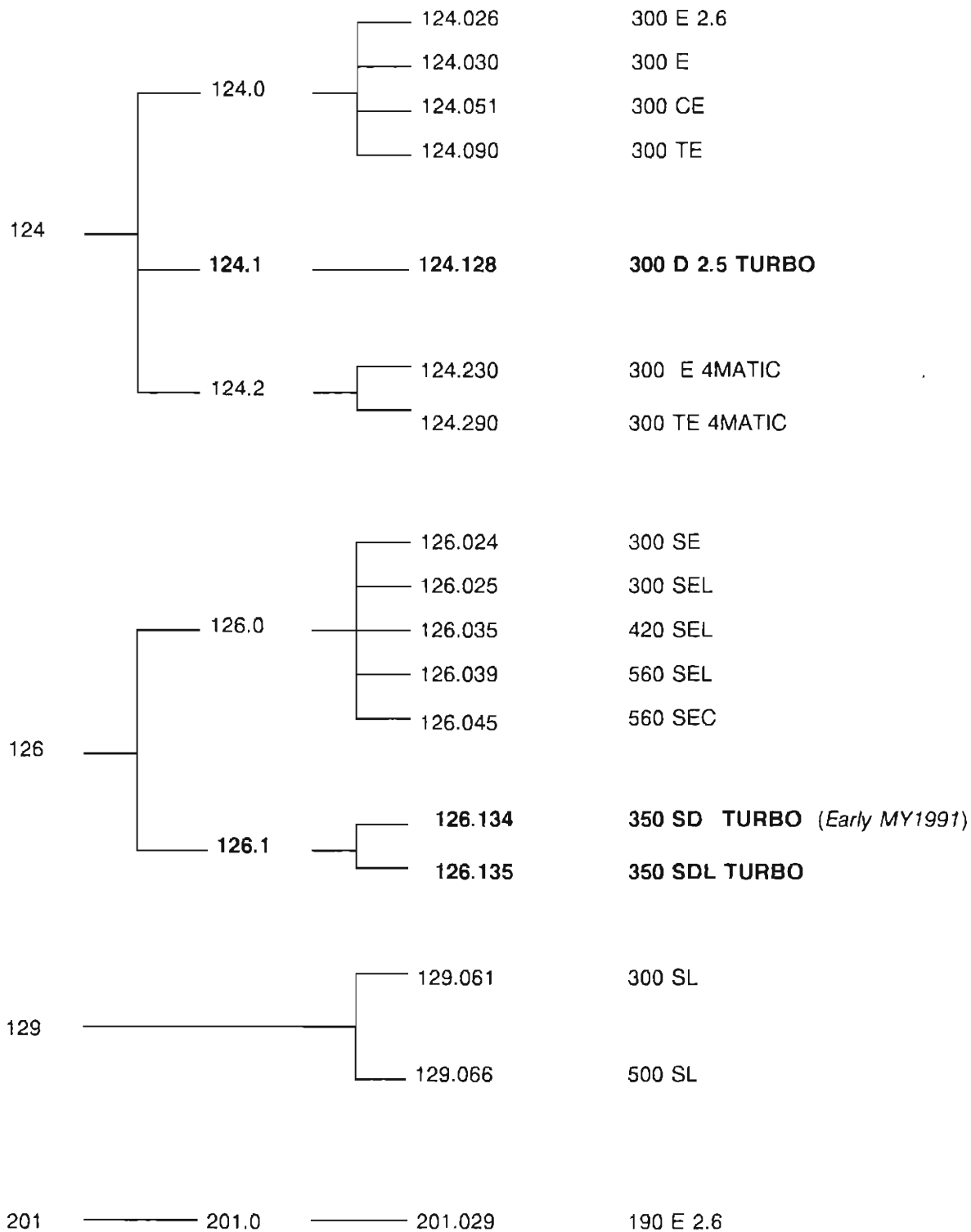
January, 1990

Vehicle and component identification . . .	6	07.1 Diesel fuel injection system	
Vehicle identification	8	General information	21
Technical highlights	11	Survey of the fuel injection system . .	21
		Test and adjustment specifications . .	22
		Nozzle holders/prechambers	22
		Injection lines	23
		Electronic diesel system (EDS)	
Engines 602.962, 603.970		Engines 602.962, 603.970	24
01 Engine block, cylinder head, crankcase ventilation		Block diagram, electronic diesel system (EDS) Engines 603.970, 602.962 . .	24
Engine block		1. Electronic idle speed control	26
Engines 602.962, 603.970	13	2. Exhaust gas recirculation (EGR) . .	27
Oil pan		3. Boost control (P2-control)	
Engine 603.970	14	Engine 602.962	28
Oil dipstick		4. System diagnostics	30
Engine 603.970	14	Component locations	
Cylinder head gasket		Engines 602.962, 603.970	31
Engines 602.962, 603.970	15	Function of the components	33
Crankcase ventilation		General function diagram (EDS)	
Engines 602.962, 603.970	15	Engines 602.962, 603.970	38
Prechamber		Vacuum line layout (EDS)	
Engines 602.962, 603.970	16	Engines 602.962, 603.970	40
03 Crankshaft and pistons		Electric wiring diagram (EDS)	
Crankshaft		Engines 602.962, 603.970	42
Engine 603.970	17	Testing the electronic diesel system (EDS)	44
Connecting rods		Testing with the impulse counter	46
Engine 603.970	17	Connection diagram, impulse counter	47
Connecting rod bearings		Malfunction table	
Engine 603.970	18	Engine 602.962	48
Pistons		Socket box connection diagram	48
Engine 603.970	18	Test program with socket box	
05 Camshaft, valves		Engine 602.962	49
Camshaft		Function tests, ISC, EGR,	
Engines 602.962, 603.970	19	P2-control, engine 602.962	58
Valve stem seals		Malfunction table	
Engines 602.962, 603.970	20	Engine 603.970	60
		Test program with socket box	
		Engine 603.970	61
		Function test ISC, EGR	
		Engine 603.970	68

<p>09 Turbocharger</p> <ul style="list-style-type: none"> Turbocharger survey 69 Wastegate vacuum actuator <ul style="list-style-type: none"> Engine 602.962 69 Wastegate <ul style="list-style-type: none"> Engine 603.970 69 Function chart, boost control <ul style="list-style-type: none"> Engine 602.962 70 Function chart, turbocharger <ul style="list-style-type: none"> Engine 602.962 71 <p>13 Belt drive</p> <ul style="list-style-type: none"> Poly-V-belt <ul style="list-style-type: none"> Engine 603.970 73 <p>15 Electrical system, engine</p> <ul style="list-style-type: none"> Preglow system 75 Preglow indicator malfunction display . 76 Coolant temperature sensors 77 Pin type glow plugs 77 Electric wiring diagrams, preglow system <ul style="list-style-type: none"> Engines 602.962, 603.970 78 <p>18 Engine lubrication</p> <ul style="list-style-type: none"> Oil circuit 81 Oil baffles 81 Oil spray nozzles 82 	<p>20 Engine cooling</p> <ul style="list-style-type: none"> Gas bubble separator <ul style="list-style-type: none"> Engine 602.962 83 Coolant pump belt pulley <ul style="list-style-type: none"> Engine 603.970 83 <p>30 Accelerator control, cruise control</p> <ul style="list-style-type: none"> Cruise control <ul style="list-style-type: none"> Engines 602.962, 603.970 85 <p>Chassis</p> <hr style="border: 0.5px solid black; margin-top: 5px;"/> <p>27 Automatic transmission</p> <ul style="list-style-type: none"> General information 87 Models 124.128, 126.135/135 88 <p>32 Suspension</p> <ul style="list-style-type: none"> Test and adjustment specifications, <ul style="list-style-type: none"> Models 124.128, 126.134/135 89 <p>35 Rear axle</p> <ul style="list-style-type: none"> Models 124.128, 126.134/135 93 <p>40 Wheels, chassis measurement ... 95</p> <p>41 Driveshaft 97</p> <p>Technical data 99</p> <p>Special tools 101</p>
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Vehicle and component identification

Model survey 1990 (USA)



Vehicle and component identification

Component survey ^(USA) 1990

Sales Identification	Model	Engine	Manual Transmission	Automatic Transmission	Power Steering Pump
190 E 2.6	201.029	103.942	717.432	722.409	765.903
300 D 2.5 TURBO	124.128	602.962	-	722.418	765.904
300 E 2.6	124.026	103.940	-	722.409	765.904
300 E	124.030	103.983	-	722.358	765.904
300 CE	124.051	104.980	-	722.359	765.908
300 TE	124.090	103.983	-	722.358	765.904
300 E 4MATIC	124.230	103.985	-	722.342	765.906
300 TE 4MATIC	124.290	103.985	-	722.342	765.906
350 SD TURBO <i>(Early MY 1991)</i>	126.134	603.970	-	722.361	765.706
350 SDL TURBO	126.135	603.970	-	722.361	765.706
300 SE	126.024	103.981	-	722.351	765.706
300 SEL	126.025	103.981	-	722.351	765.706
420 SEL	126.035	116.965	-	722.355	765.706
560 SEL	126.039	117.968	-	722.350	765.706
560 SEC	126.045	117.968	-	722.350	765.706
300 SL	129.061	104.981	717.451	722.500	765.907
500 SL	129.066	119.960	-	722.353	765.925

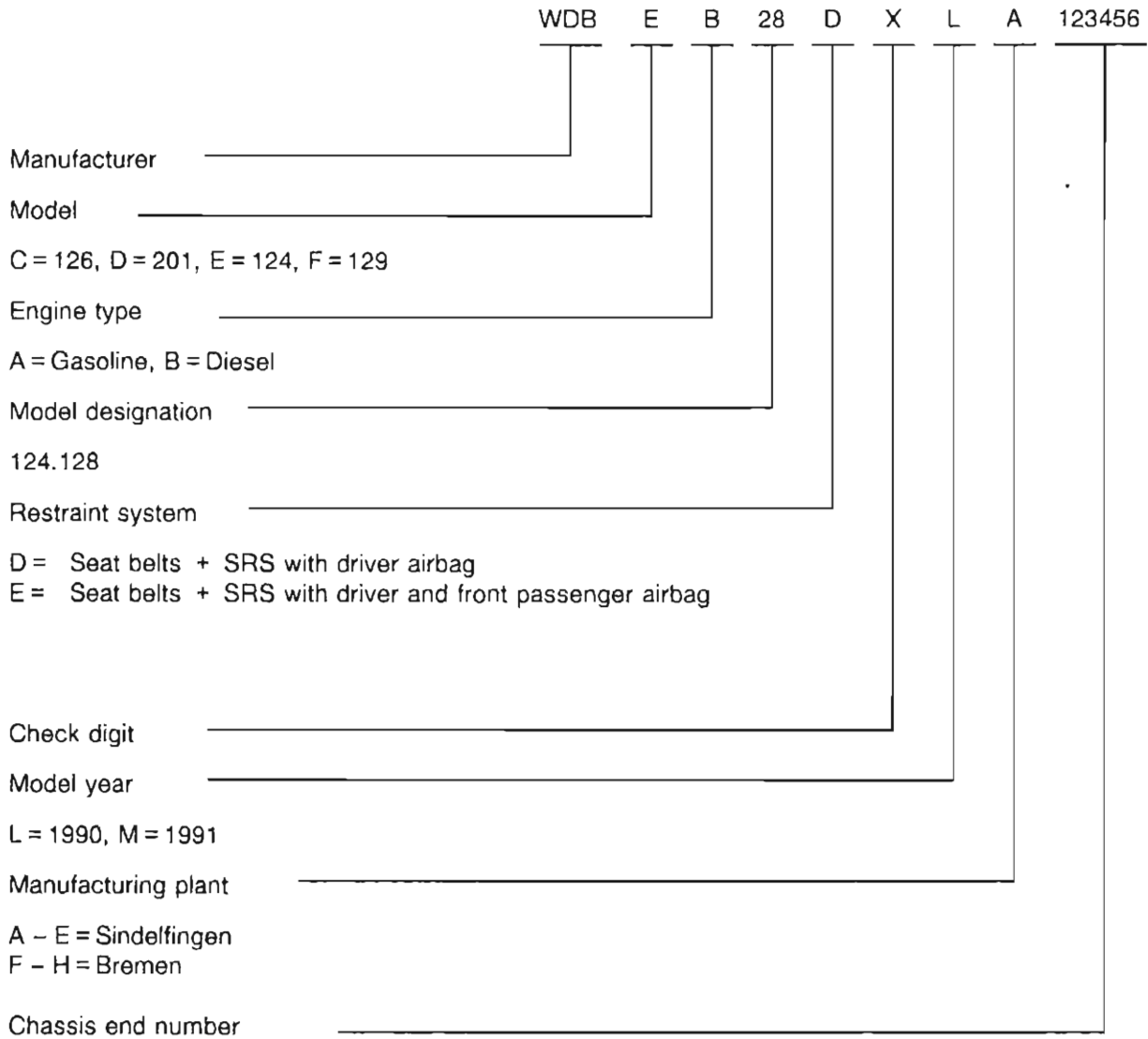
Vehicle identification

Vehicle identification number (VIN)

The following information is encoded into the VIN:

Manufacturer, model, restraint system, model year, manufacturing plant and chassis end number.

Example model 300 D 2.5 TURBO: WDB E B 28 D X L A 123456



Engine family designations

The emission control system information plate attached to the radiator crossmember also shows the engine family designation. The engine family designation identifies model year, displacement, version, etc. (see example below).

Assignment table

Engine family	Version ¹⁾	Model	Vehicle sales designation
LMB 26 V 6 F A 18	A	201.029	190 E 2.6
LMB 26 V 6 F A 18	A	124.026	300 E 2.6
LMB 30 V 6 F A 18	A	124.030	300 E
LMB 30 V 6 F A 29	A	124.051	300 CE
LMB 30 V 6 F A 18	A	124.090	300 TE
LMB 25 D 9 J F 1X	F	124.128	300 D 2.5 TURBO
LMB 30 V 6 F A 18	A	124.230	300 E 4MATIC
LMB 30 V 6 F A 18	A	124.290	300 TE 4MATIC
LMB 30 V 6 F A 40	A	126.024	300 SE
LMB 30 V 6 F A 40	A	126.025	300 SEL
LMB 42 V 6 F A 16	A	126.035	420 SEL
LMB 56 V 6 F A 15	A	126.039	560 SEL
LMB 56 V 6 F A 15	A	126.045	560 SEC
LMB 35 D 9 J F 17	F	126.134	350 SD TURBO (Early MY 1991)
LMB 35 D 9 J F 17	F	126.135	350 SDL TURBO
LMB 30 V 6 F A 3X	A	129.061	300 SL
LMB 50 V 6 F A 12	A	129.066	500 SL

¹⁾ A = All 50 States
F = Federal

Technical highlights

- 15 Electric system, engine** Maximum of 30 seconds preglow and 60 seconds afterglow. Electronic preglow system protected against short circuits. Coolant temperature sensor used to determine the preglow and afterglow time. Pin type glow plugs, shortened to 23 mm.
- 18 Engine lubrication** **Engine 603.970** Two oil baffles, fastened by the crankshaft main bearing bolts.
- 20 Engine cooling** **Engines 602.962, 603.970** Improved venting of the cooling system. **Engine 603.970** Smaller diameter coolant pump pulley.
- 30 Accelerator control, cruise control** To minimize surging in the partial engine load range when operating the vehicle with the cruise control, the engine overload protection switchover valve is activated via a relay to eliminate its function in this mode of operation.

Chassis

- 27 Automatic transmission** The temperature-dependent transmission control is eliminated.
- 32 Suspension** Suspension characteristics modified.
- 35 Rear axle** Models 126.134/135 receive a rear axle differential with a 210 mm diameter ring gear. Constant velocity joints of the rear axle shaft are centered to the connecting flange with a pilot.

Engine block, cylinder head, crankcase ventilation

Engine block,

engine 602.962

Cylinder liners omitted.

Cylinder bores

Only one repair size is allowed (+ 0.7 mm).

Bore tolerance steps for replacement pistons

Identification letter	Cylinder standard tolerance steps	Cylinder repair size (+ 0.7 mm)
A	87.000- 87.006	87.700- 87.706
X	87.006- 87.012	87.706- 87.712
B	87.012- 87.018	87.712- 87.718

engine 603.970

The following modifications were made compared to engine 603.960:

Cylinder liners omitted.

Cylinder diameter increased from 87mm to 89 mm.

Cylinder bores

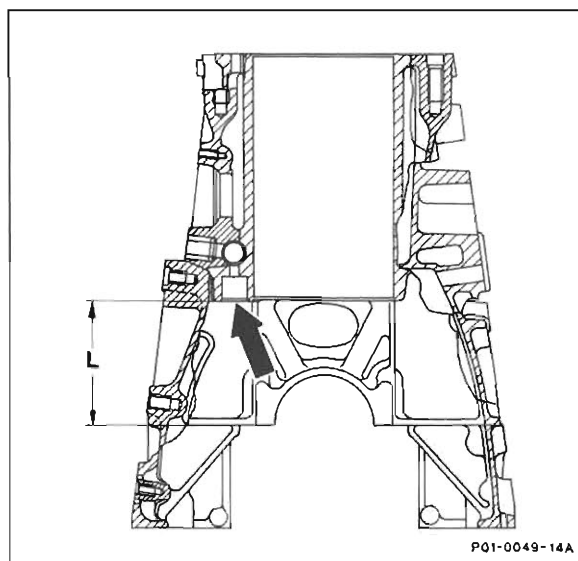
Only one repair size is allowed (+ 0.7 mm).

Bore tolerance steps for replacement pistons

Identification letter	Cylinder standard tolerance steps	Cylinder repair size (+ 0.7 mm)
A	89.000- 89.006	89.700- 89.706
X	89.006- 89.012	89.706- 89.712
B	89.012- 89.018	89.712- 89.718

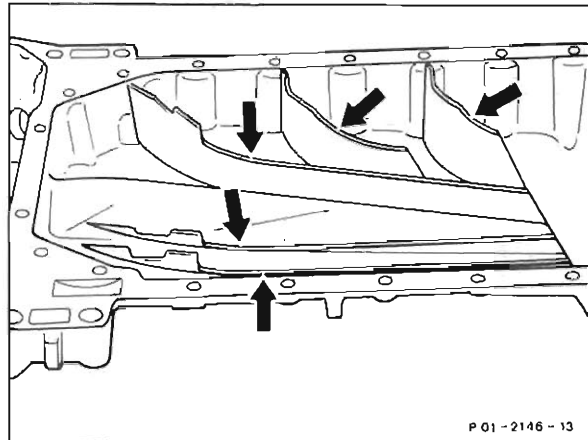
The cylinder bore length was increased by approx. 8 mm, decreasing dimension L correspondingly.

The mounting surface (arrow) for the oil spray nozzle is located 4.5 mm lower.

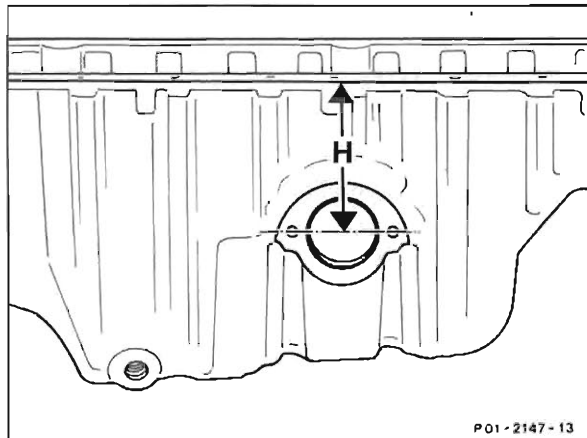


Oil pan, engine 603.970

The oil baffles (arrow) are lower toward the center. Oil fill volume remains unchanged. The oil pan is one piece (without detachable side section).



The mounting hole for the oil level sensor was raised approx. 6.3 mm.



Dimension H : 87.3 mm

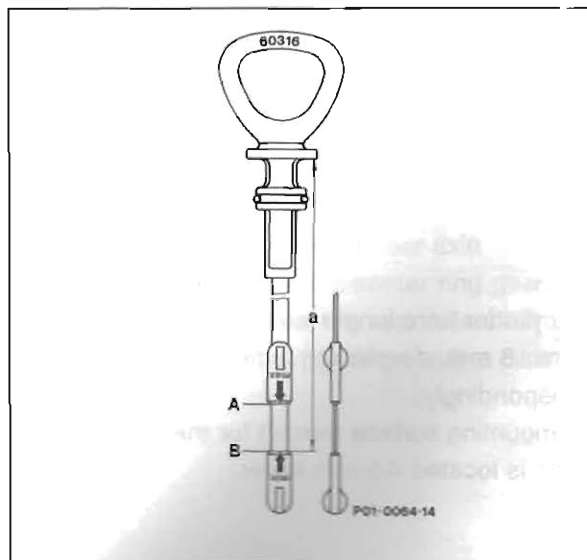
Oil dipstick, engine 603.970

Because the oil pan was modified, the oil dipstick had to be modified also.

Identification number on the handle: 60316

Note:

This oil dipstick should **not** be used with engine 603.960.



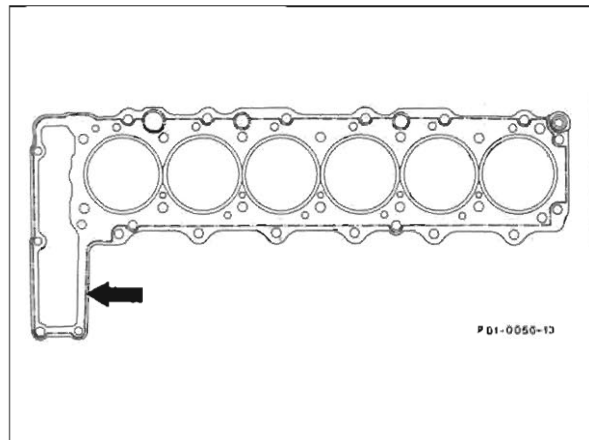
Dimension A-B: 20 mm

Cylinder head gasket, engines 602.962, 603.970

A better seal is achieved by a silicon bead (arrow) along the perimeter on both sides of the gasket and by a Viton seal at in the right rear oil passage.

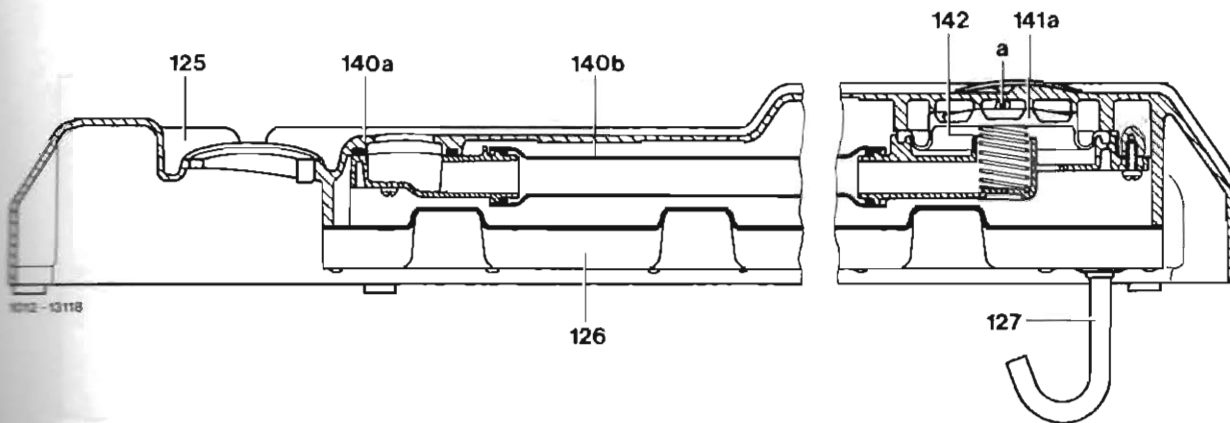
The inside diameter of the metal reinforced combustion chamber opening was increased from 88 mm to 90 mm.

On engine 603.970 the cylinder head gasket is asbestos-free.



Crankcase ventilation, engines 602.962, 603.970

Valve cover



125 Valve cover
126 Oil separator
127 Oil return tube

141a Diaphragm
142 Compression spring
a Ventilation passage

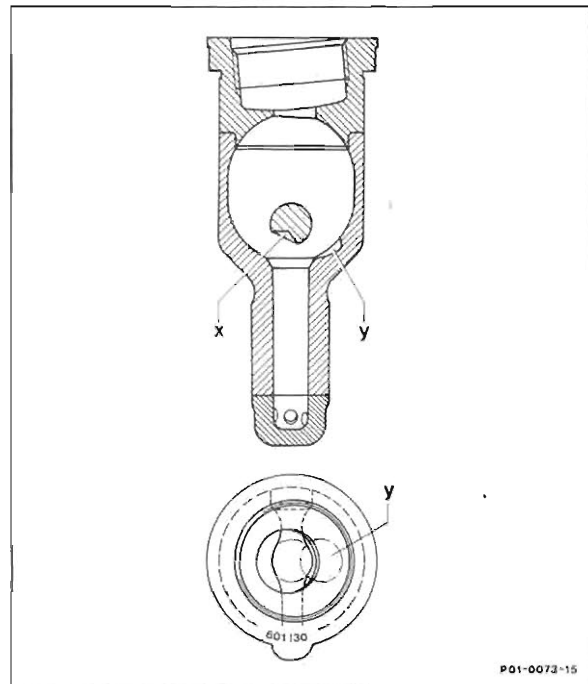
Because of increased pressure differential between the intake manifold and the crankcase, a stronger compression spring (142) with a higher spring rate is used.

Prechamber Engines 602.962, 603.970

The prechambers of both of these engines correspond to those of familiar engine 602.911 (MY 1989).

The volume of the prechambers for both engines was increased from 10.34 cm³ to 11.37 cm³.

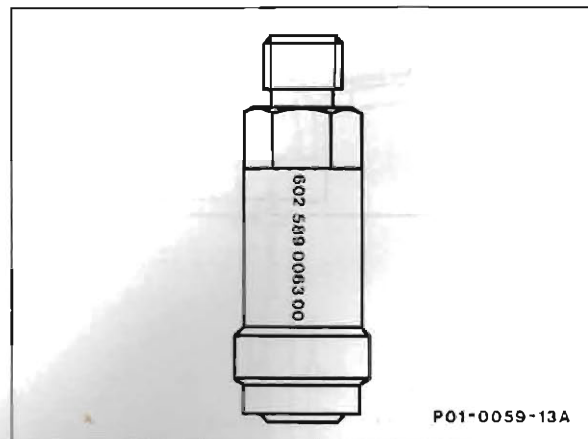
Identification number: 601/30



Torque specifications

	Nm
Threaded ring with internal splines	130
Nozzle holder in prechamber	30

Connection adapter 901 589 47 21 09 is required for compression pressure recorder 001 589 47 21 00 because of the changed threads (M22 × 1.5) in the prechamber.



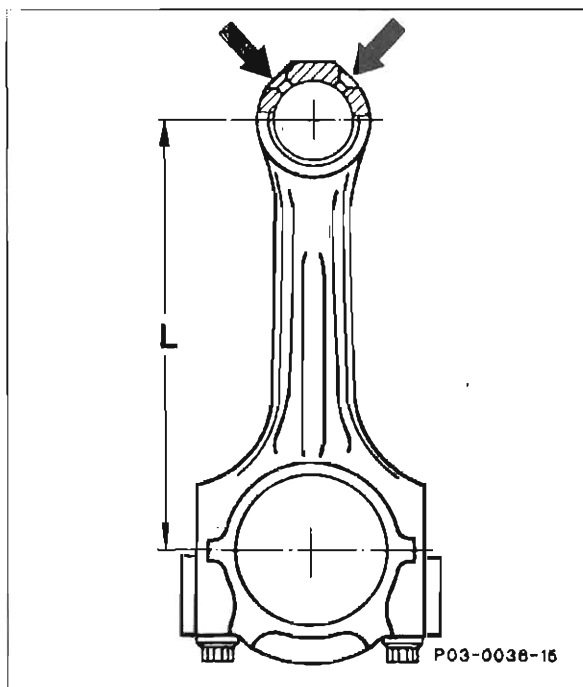
Crankshaft and pistons

Connecting rods, engine 603.970

Dimension L of the connecting rods was shortened by approx. 4 mm to 145 mm.

Engines 602.962, 603.970

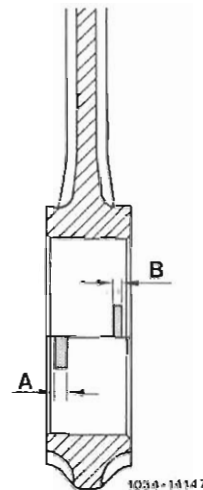
The wrist pin is lubricated through two 4.5 mm dia. bores.



Connecting rod bearing shells, engine 603.970

Because of the higher loads, the upper connecting rod bearing shells are made of a different material than the lower shells.

To prevent misassembly, the upper locating groove is 0.7 mm narrower.



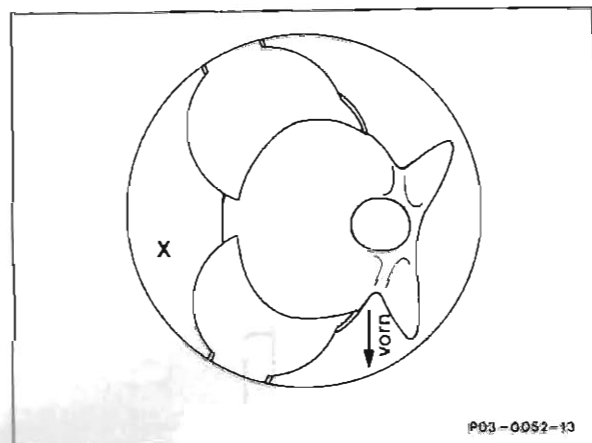
- A 3.2 mm engine 603.960, 603.970
- B 2.5 mm engine 603.970
3.2 mm engine 603.960

Pistons, engine 603.970

The piston cavity consists of a prechamber cavity, flame channels and valve cutouts. The entire piston crown is covered with an aluminum-oxide coating.

The piston skirt and the top land are graphite-treated.

The circular oil channel around the top of the piston has been deleted. For cooling the underside of the piston crown is sprayed with oil (see group 18).



Piston classification

Tolerance step identification: A, X, B

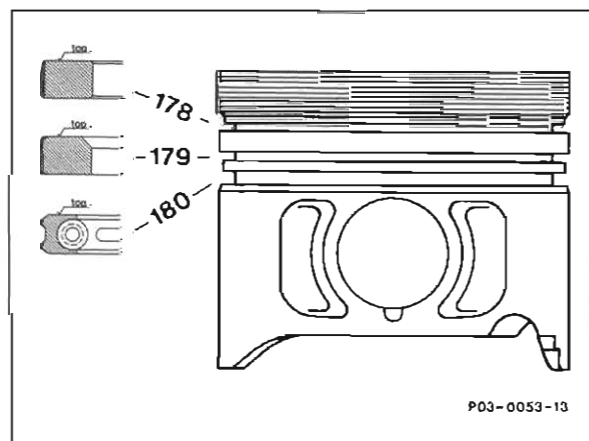
Piston identification number: 16

Piston ring application

178 Square-edged ring with 2 inner bevels, 2.5 mm thick, barrel-faced on one side. Contact surface porous chrome plated.

179 Tapered ring with inner bevel, 2 mm thick, chrome plated contact surface

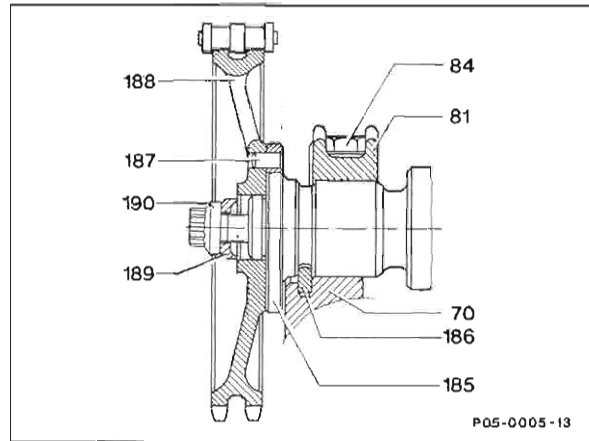
180 Slotted ring with expander spring, 3mm thick, chrome plated contact surface



Camshaft, valves

Camshaft, engines 602.962, 603.970

Modified camshaft sprocket mounting:
Twelve point stretch bolt (190) with M11 thread.



Torque/angle specifications

Initial torque	25 Nm
Final torquing angle	90°

Test and adjustment specifications

Engine	602.962	603.970
Idle speed at 60 – 80° C coolant temperature	680 ± 20 rpm	630 ± 20 rpm
Injection pump timing (reference impulse), test specification	14 ± 0.5° ATDC ¹⁾	14 ± 0.5° ATDC ¹⁾
Boost pressure at 4000 rpm, under load	0.85 – 0.95 bar	0.85 – 0.95 bar
Injection nozzle opening pressure with new injection nozzles	135 – 145 bar	135 – 145 bar
Injection nozzle opening pressure with used injection nozzles	120 bar	120 bar

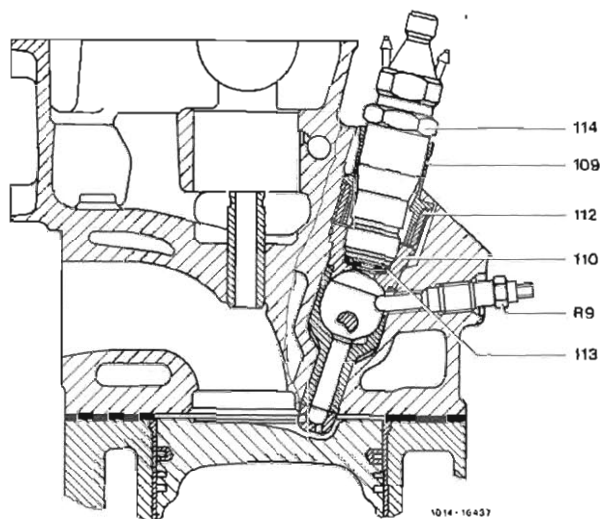
¹⁾ One-time adjustment at 15,000 miles, adjust to 14.5° ATDC (high limit).

Nozzle holders/prechambers

(See also group 01).

The nozzle holder is inclined 5° to the prechamber longitudinal axis (similar to engine 602.911, MY 1989).

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



These changes, together with the prechamber modifications, result in the following improvements:

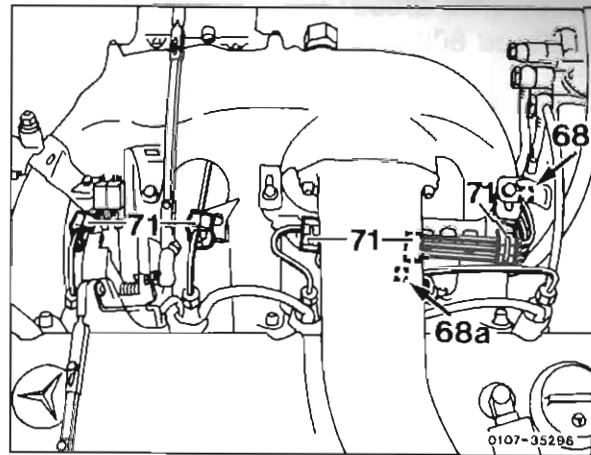
- Improved cold start.
- Better air/fuel mixture because of the shortened glow plugs (23 mm, were 27 mm) and the recess in the lower prechamber and the cavity in the diffuser pin.
- Particulate emissions reduction and improvement in hydrocarbon and carbon monoxide emissions.

Injection lines

Because of the changed position of the nozzle holder, the injection lines are routed differently.

Note:

Because of resonances and vibration, the plastic clips (68 and 68a) must be mounted as close as possible to the bends in the injection lines (arrow). The clips (71) must be securely engaged.



Layout for engine 602.962

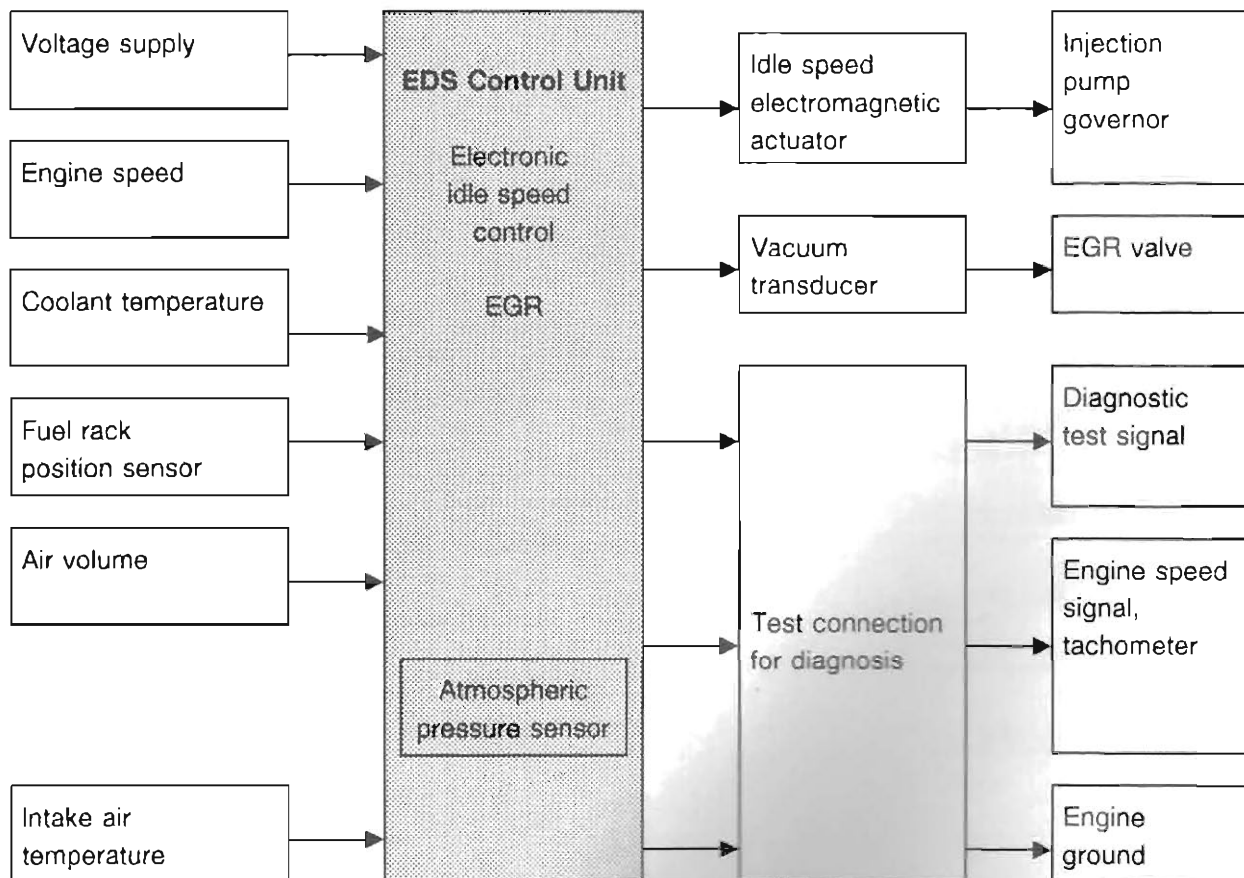
Electronic diesel system (EDS), engines 602.962 and 603.970

The EDS control unit processes the following functions:

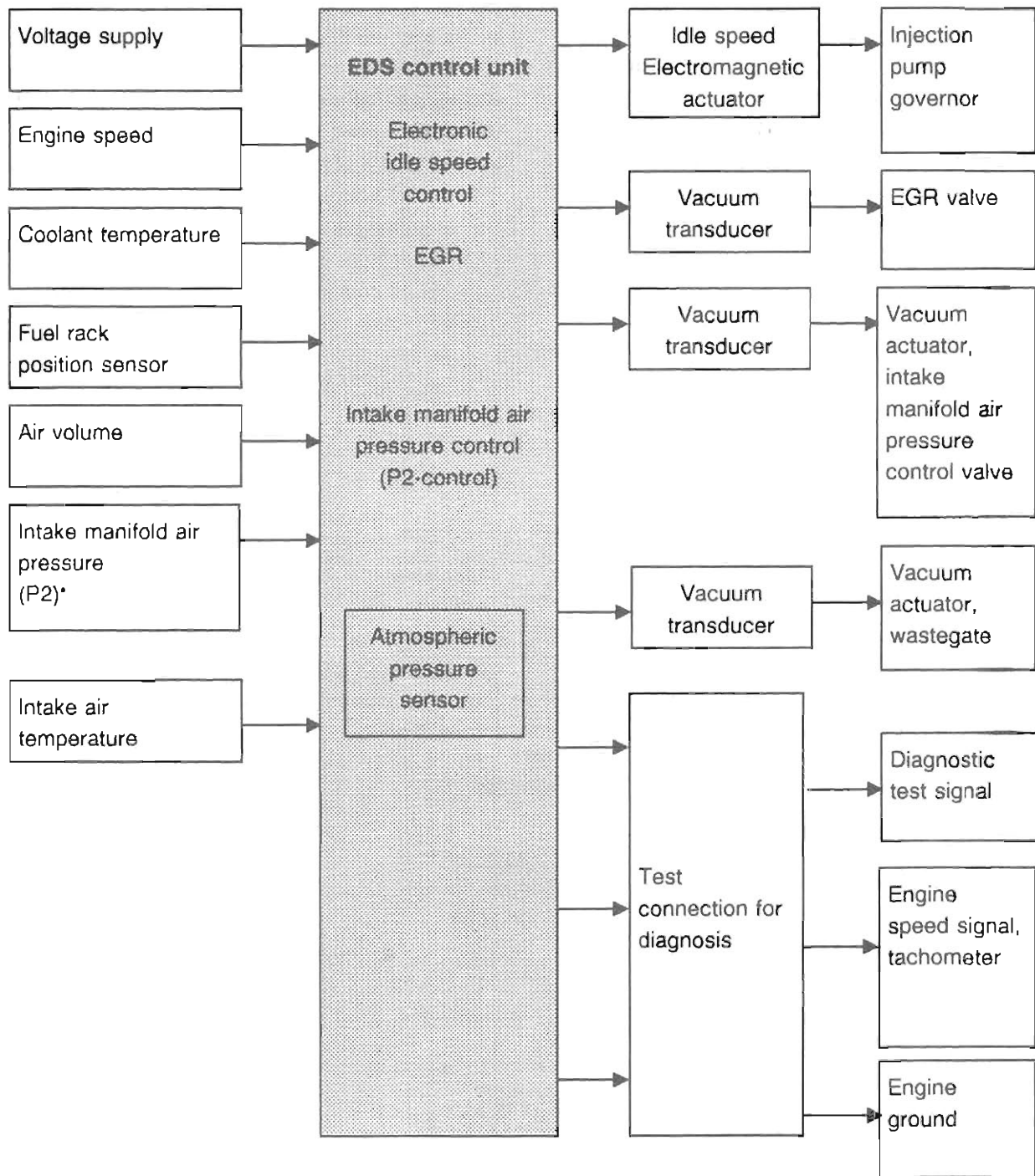
1. Electronic idle speed control (ELR),
2. Exhaust gas recirculation (EGR),
3. Intake manifold air pressure control (P2-control), engine 602.962 only,
4. System diagnostics.

The EDS control unit processes the input signals and supplies a milliamp current to the vacuum transducers and to the electromagnetic actuator for idle speed control on the injection pump. Through additional terminals leading to a test connector, the entire system can be tested via blink code signals.

Block diagram, electronic diesel system (EDS), engine 603.970



Block diagram, electronic diesel system (EDS)
Engine 602.962



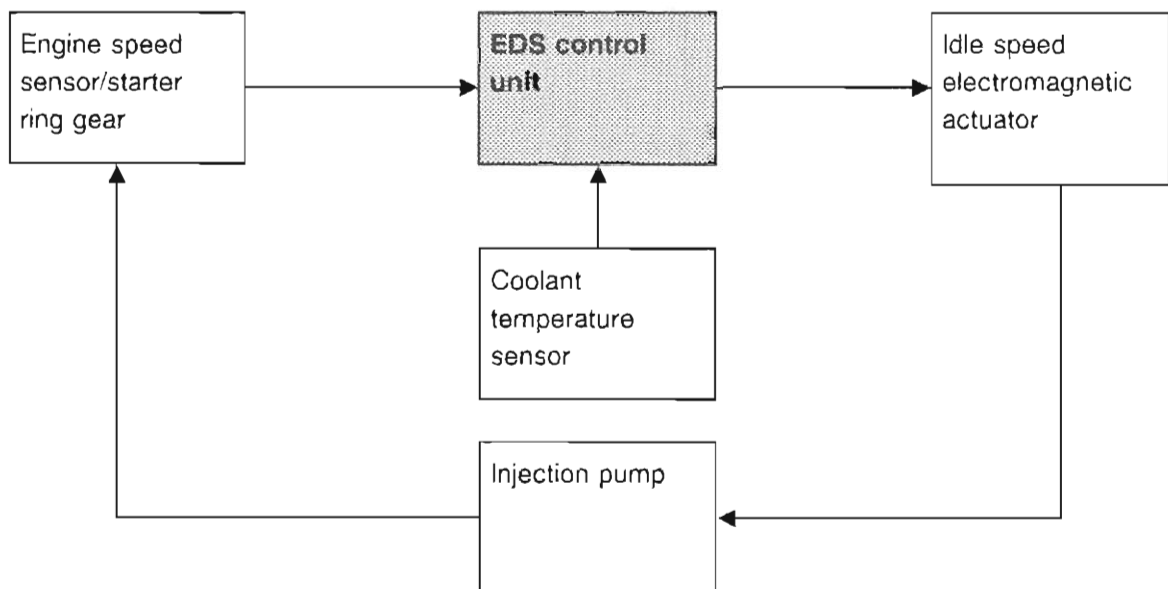
* Pressure between the intake manifold air pressure control valve and the intake valves

1. Electronic idle speed control (ELR)

The engine speed sensor (L3) at the starter ring gear detects the engine speed (144 pulses per revolution) and sends it in the form of an alternating voltage to the EDS control unit. The EDS control unit processes the idle speed signal and compares the actual reading with the specification.

In this way the idle speed is held constant by the electromagnetic actuator independently of engine load. At a coolant temperature below 60° C, the idle speed specification is increased according to a preset reference map.

Block diagram, idle speed control (ELR)



2. Exhaust gas recirculation (EGR)

Exhaust gas recirculation occurs, as long as the following conditions are fulfilled:

Engine 602.962

- Coolant temperature between 80°C and 110°C.
- Engine speed:
 - 680–800 rpm = Reduced EGR
 - 800–3500 rpm = EGR according to map values
 - above 3500 rpm = Decreasing EGR,
- Volume of EGR dependent on atmospheric pressure,
- Volume of EGR dependent on intake air temperature,
- Fuel rack travel less than 9 mm,
- Battery voltage 11–14 volts.

Engine 603.970

- Coolant temperature between 60°C and 110°C,
- Engine speed:
 - 800–2800 rpm = EGR according to map values
 - above 2800 rpm = Decreasing EGR,
- Volume of EGR dependent on atmospheric pressure,
- Volume of EGR dependent on intake air temperature,
- Fuel rack travel less than 9 mm,
- Battery voltage 11–14 volts.

Corresponding to the input signals from the sensors—for examples: fuel rack travel, engine speed etc.—the EDS control unit calculates the corresponding exhaust gas recirculation volume for the operating conditions at the time. The vacuum transducer is actuated by a current and controls a corresponding vacuum to the EGR valve.

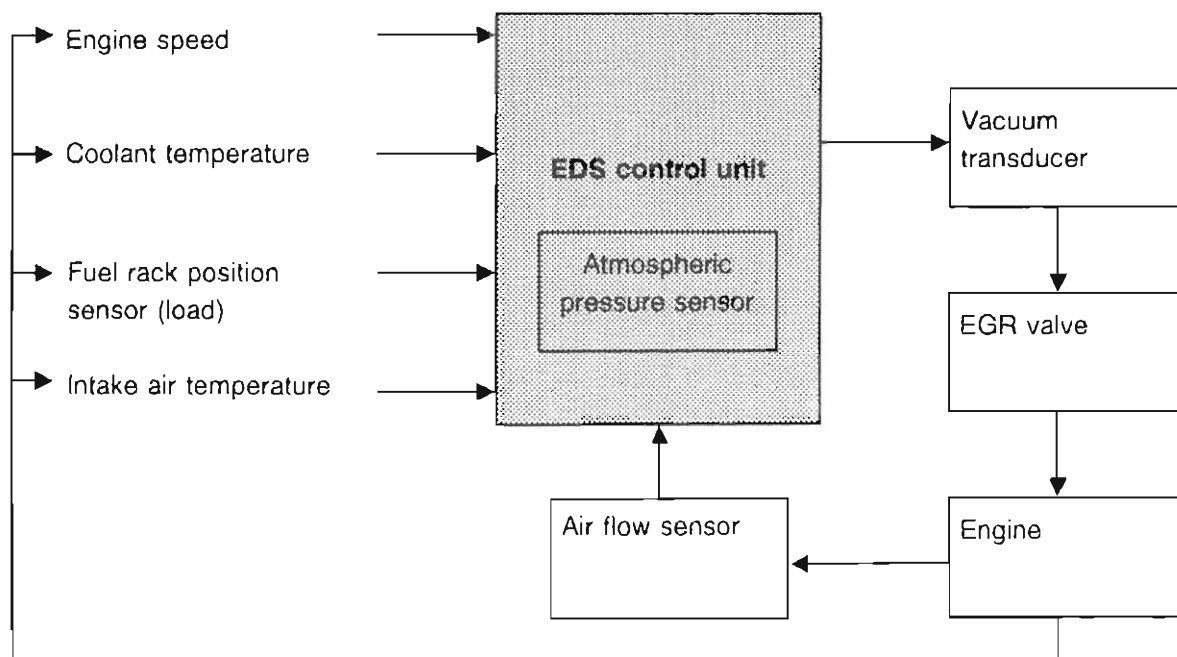
The EGR volume is reduced as engine speed and load increase.

That means:

With an increase of control current the EGR volume rises;

With a decrease of control current the EGR volume declines.

Block diagram, EGR



The EGR system works as an open loop control system, with the EGR valve, vacuum

transducer, air flow sensor, engine speed sensor and EDS control unit.

3. Intake manifold air pressure control (P2-control), engine 602.962

A reference map (for P2-control) is stored in the EDS control unit. The intake manifold air pressure values received by the control unit relative to the injection volume and engine speed generate optimal engine (combustion) management, maximizing performance and minimizing NO_x, HC and particulate emissions.

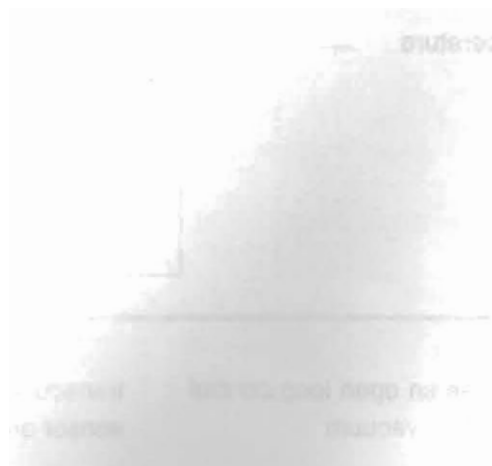
Function

By reducing the intake manifold air pressure (P2) during partial load operation, a reduction in particle emission is achieved.

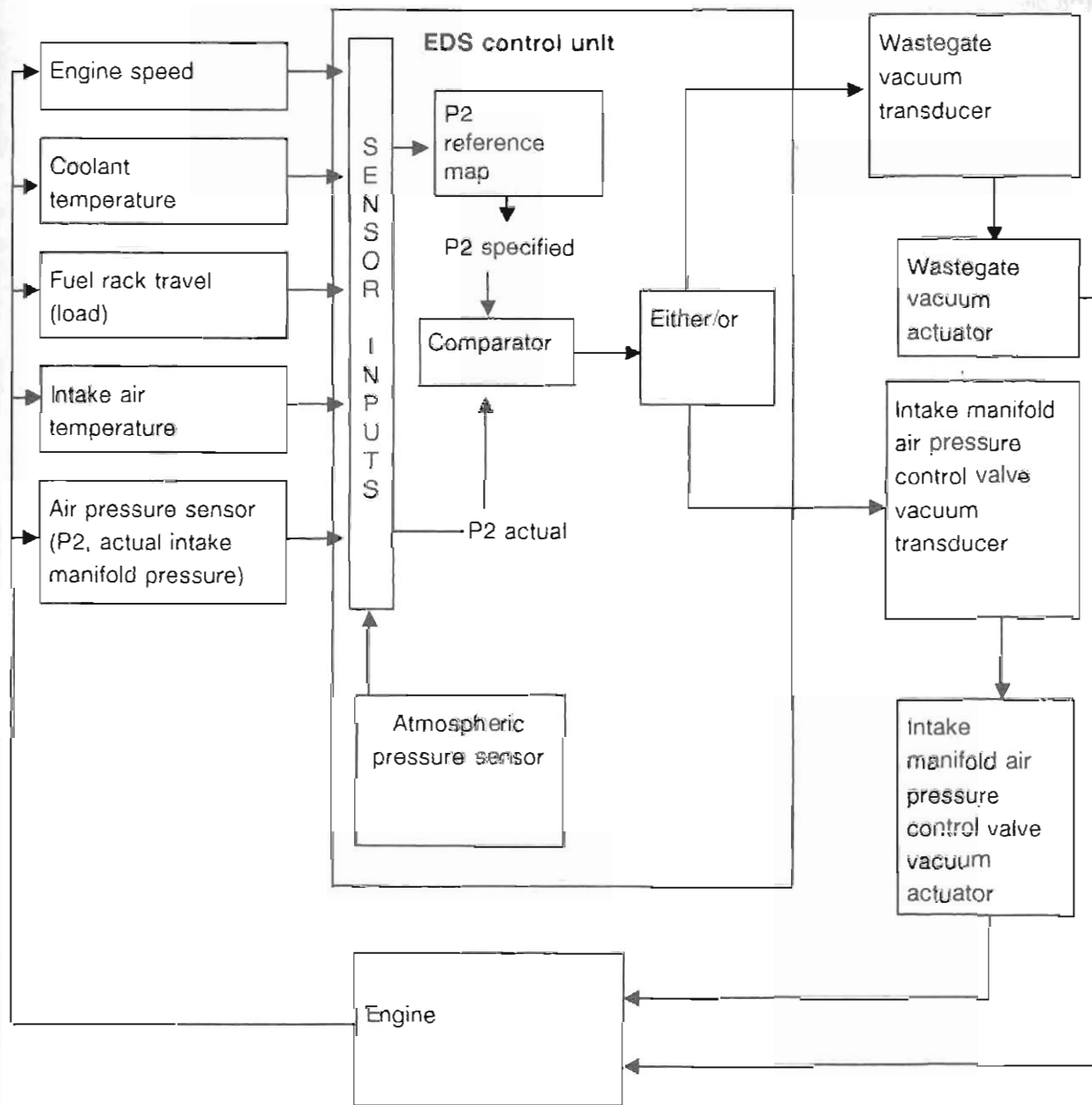
The EDS control unit contains a closed loop circuit which compares "P2 actual" to "P2 specified" (see block diagram). Any pressure difference is equalized by actuation of the wastegate or the intake manifold air pressure control valve. These valves are operated by two vacuum actuators which receive electronically controlled vacuum via the vacuum transducers.

Boost control is dependent on:

- Coolant temperature,
- Intake air temperature,
- Intake air pressure at the valves (P2 pressure),
- Engine speed,
- Fuel rack position.



Block diagram, Intake manifold air pressure control (P2-control), engine 602.962



4. System diagnostics

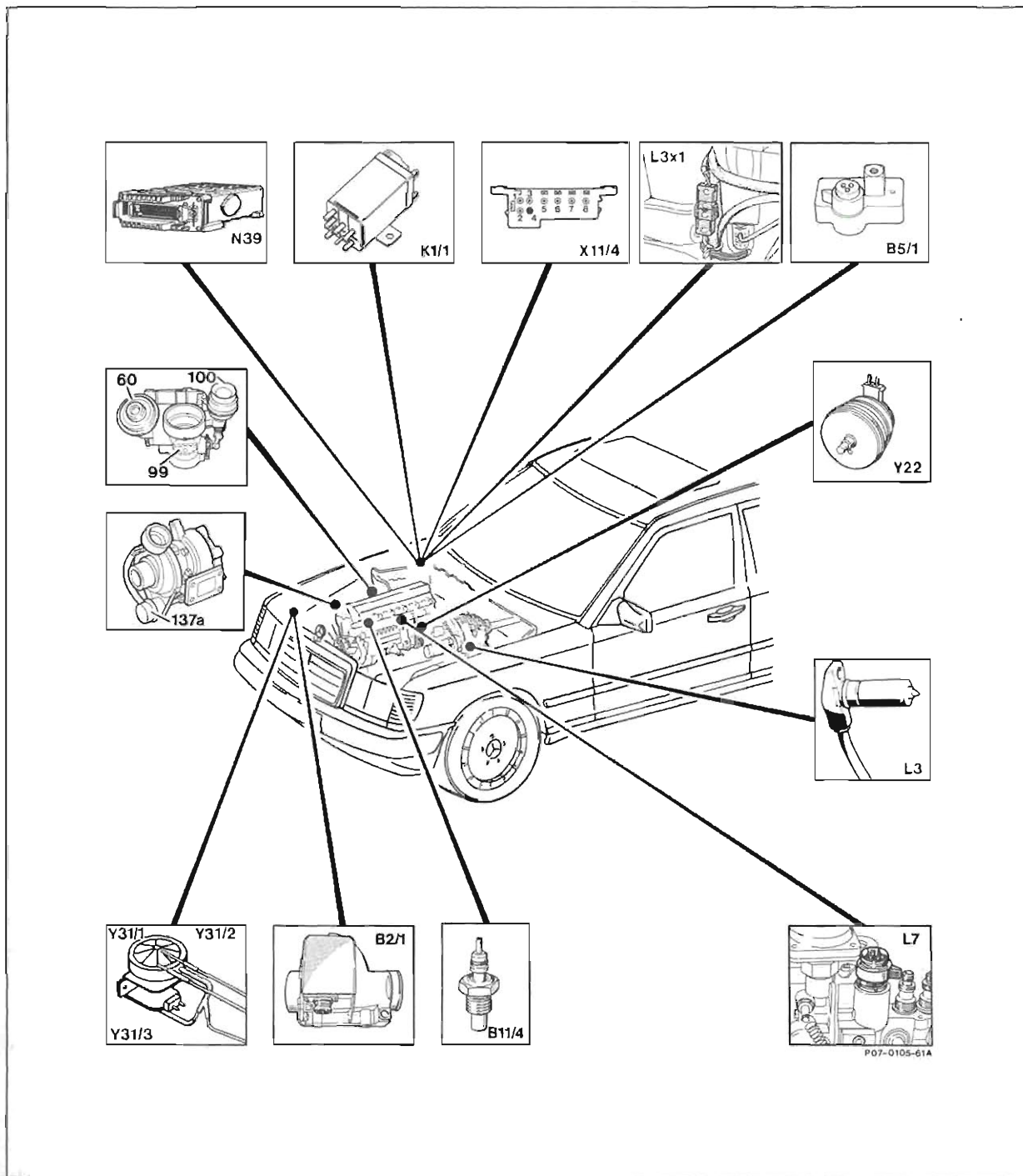
The electronic diesel system is tested and/or system malfunctions are detected and stored by the self-diagnostics program integrated in the EDS control unit.

Temporary malfunctions are stored if they last longer than 4 seconds.

For example, sensor malfunctions (except for the engine speed sensor) are stored, as are short circuits in the actuators and their input wiring.

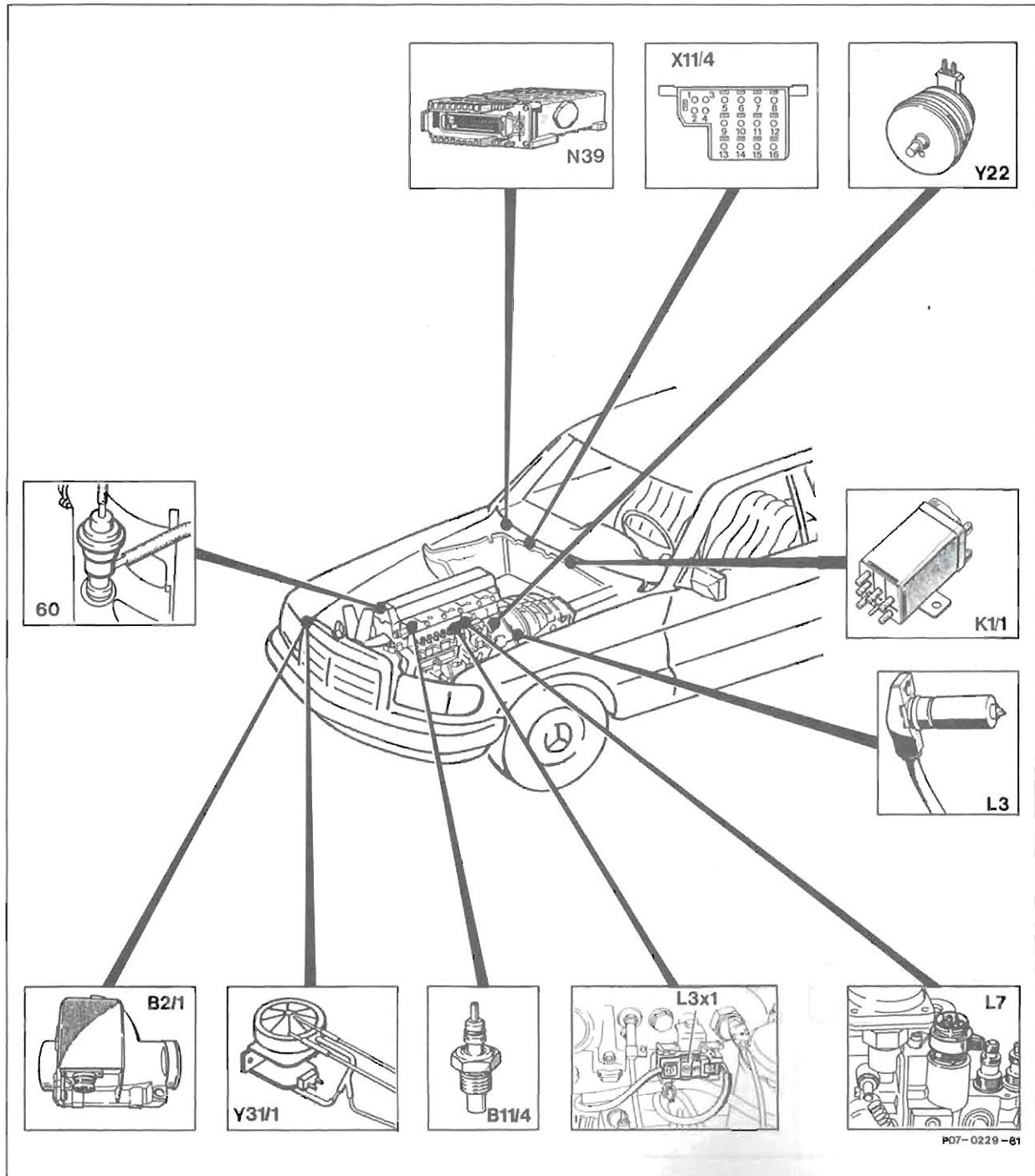
The individual malfunction codes can be read with the impulse counter via the test connection for diagnosis (X11/4), socket 4. Depending on the malfunction code displayed, the defective component or its wiring can be determined.

Component locations,
engine 602.962



- | | | | |
|-------|--|-------|---|
| B2/1 | Air flow sensor with intake air temperature sensor (EDS) | Y22 | Electromagnetic actuator, electronic idle speed control (ELR) |
| B5/1 | Air pressure sensor (EDS) | Y31/1 | EGR valve vacuum transducer |
| B11/4 | Coolant temperature sensor (EDS) | Y31/2 | Intake manifold air pressure control valve vacuum transducer |
| K1/1 | Overvoltage protection relay, 87 E (7-pole) | Y31/3 | Wastegate vacuum transducer |
| L3 | Starter ring gear speed sensor | 60 | EGR valve |
| L3x1 | Connector, starter ring gear speed sensor | 99 | Intake manifold air pressure control valve |
| L7 | Fuel rack position sensor | 100 | Vacuum actuator, Intake manifold air pressure control valve |
| N39 | EDS control unit | 137a | Vacuum actuator, wastegate |
| X11/4 | Test connection for diagnosis (8-pole) | | |

Component locations, engine 603.970



P07-0229-61

B2/1 Air flow sensor with intake air temperature sensor (EDS)
 B11/4 Coolant temperature sensor (EDS)
 K1/1 Overvoltage protection relay, 87 E (7-pole)
 L3 Starter ring gear speed sensor
 L3x1 Connector, starter ring gear speed sensor

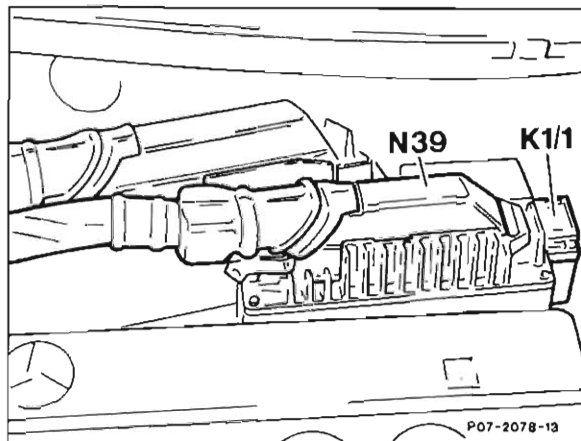
L7 Fuel rack position sensor
 N39 EDS control unit
 X11/4 Test connection for diagnosis (8-pole)
 Y22 Electromagnetic actuator, electronic idle speed control (ELR)
 Y31/1 EGR valve vacuum transducer
 60 EGR valve

Function of the components

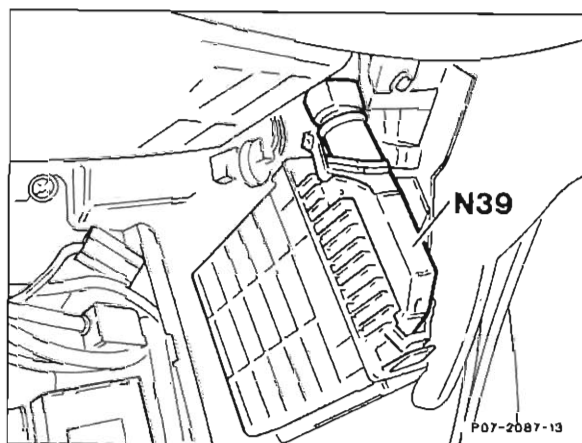
EDS control unit (N39)

The control unit processes the incoming signals and supplies a milliamp current to the vacuum transducers and to the injection pump idle speed electromagnetic actuator. With two additional wires leading to the test connection for diagnosis (X11/4), the entire system can be tested via impulse readout.

Engine 602.962



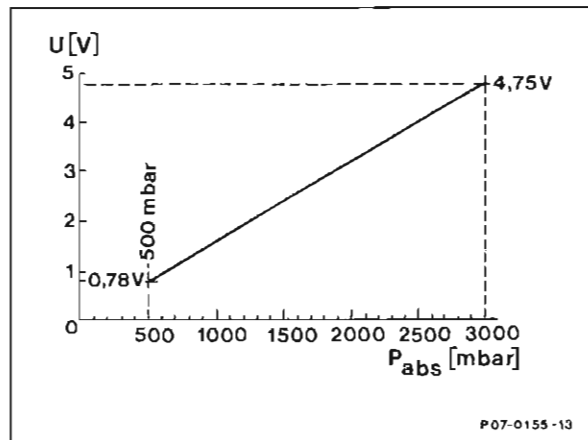
Engine 603.970
Installed on the right side,
vehicle interior



Atmospheric pressure sensor (integrated into the control unit)

The EGR volume is affected via the atmospheric pressure sensor, depending on the altitude and the ambient air pressure. The atmospheric pressure sensor provides the control unit with a decreasing voltage signal with decreasing air pressure (increasing altitude). The control unit adjusts the EGR volume to the ambient air pressure by reducing current to the vacuum transducer.

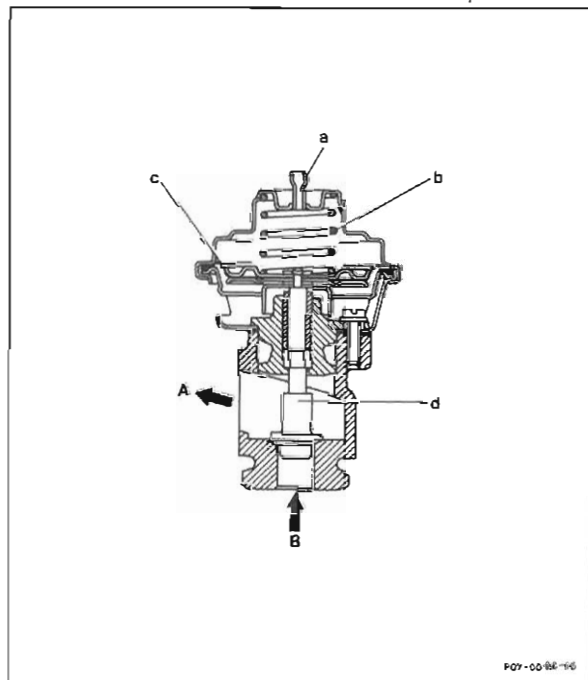
P_{abs} Voltage signal produced vs. absolute pressure in mbar, 5 volts reference input



EGR valve (80)

The EGR valve with the mixture tube (602.962 intake air control housing) is bolted on the right side of the cylinder head. It connects the exhaust manifold via a corrugated tube to the intake crossover pipe. The EGR valve is activated by a controlled vacuum from the vacuum transducer.

- A Exhaust to the intake manifold
- B Exhaust from the exhaust manifold
- a Vacuum connection
- b Spring
- c Diaphragm
- d Valve



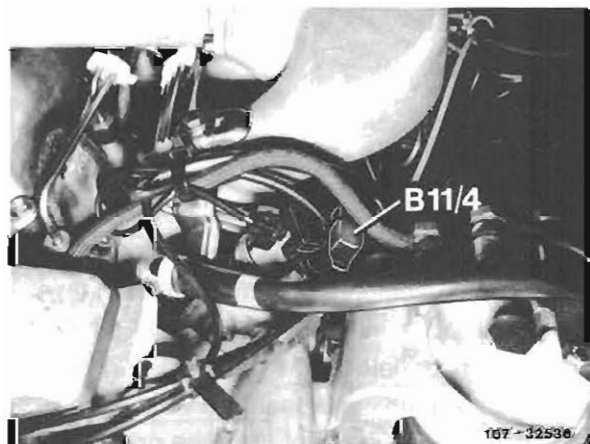
Coolant temperature sensor (EDS)

(B11/4)

Coolant temperature is detected by the coolant temperature sensor (B11/4).

It is monitored by the EDS control unit.

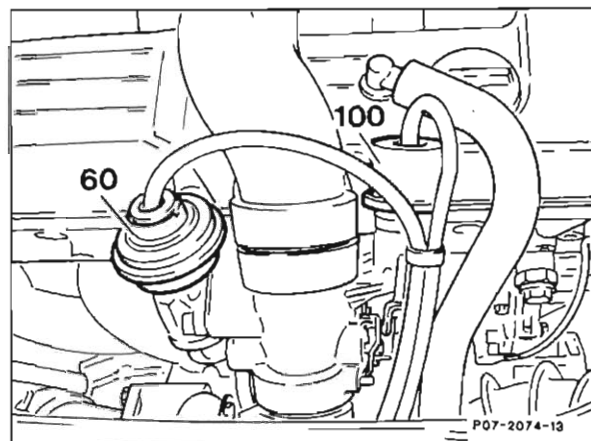
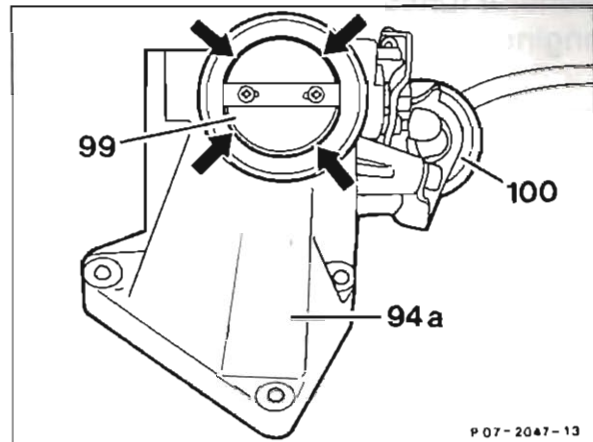
The resistance of the coolant temperature sensor varies, depending on coolant temperature.



Intake manifold air pressure control valve body (94a) with intake manifold air pressure control valve (99) and vacuum actuator (100), engine 602.962

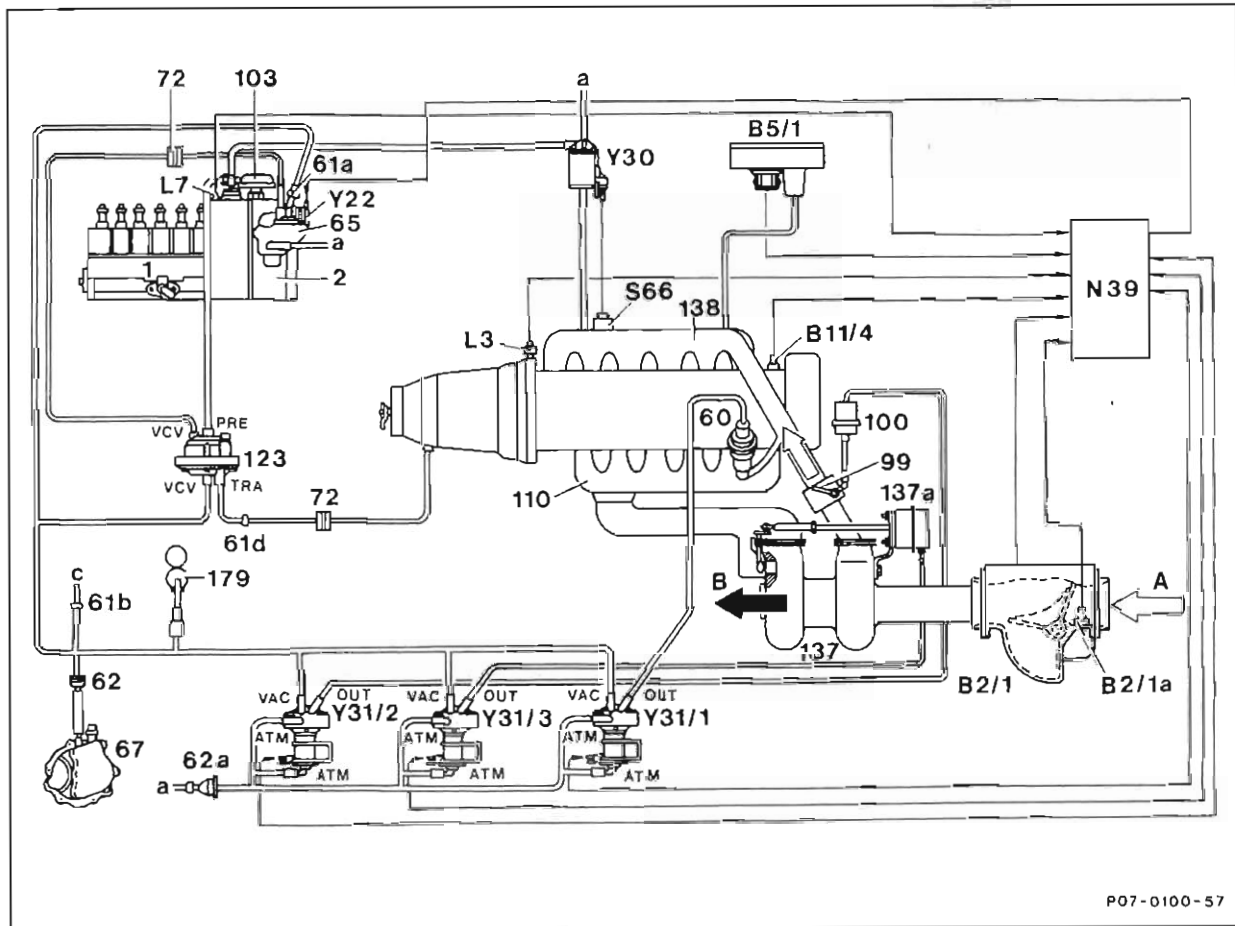
A vacuum-actuated intake manifold air pressure control valve is located in the intake manifold air pressure control valve body to induce a pressure differential between the exhaust and intake manifolds by partially obstructing the air intake during EGR operation. A minimum opening (arrows) is maintained between the intake manifold air pressure control valve and the intake manifold air pressure control valve body. The vacuum actuator (100) is controlled by the intake manifold air pressure control valve vacuum transducer (Y31/2).

(See the functional diagram).



- 60 EGR valve
- 100 Intake manifold air pressure control valve vacuum actuator

General function diagram (EDS), engine 602.962

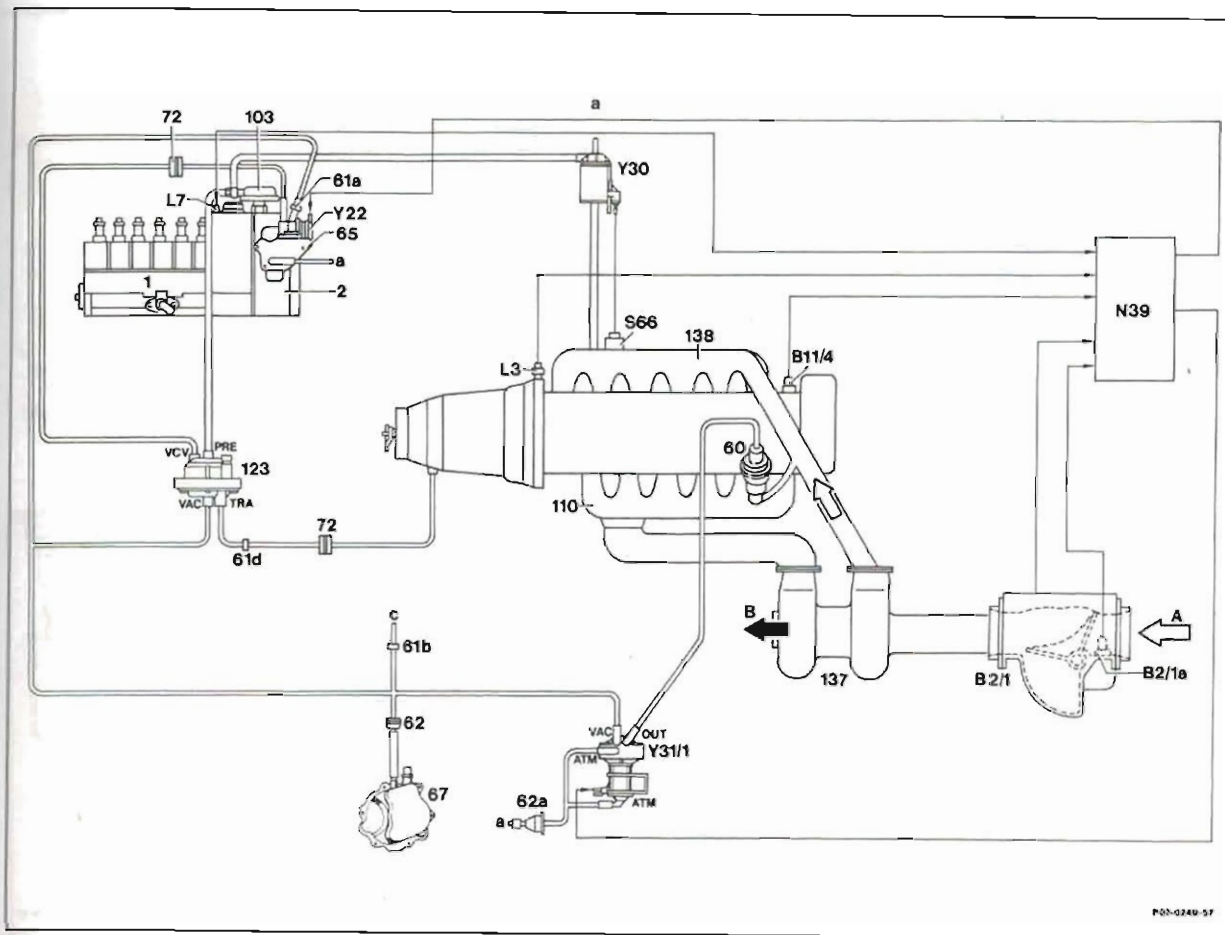


1	Injection pump	N39	EDS control unit
2	Governor	S66	Engine overload protection switch
60	EGR valve	Y22	Electromagnetic actuator, electronic idle speed control (ELR)
61a	Orifice	Y30	Engine overload protection switchover valve
61b	Orifice	Y31/1	EGR valve vacuum transducer
61d	Connector (without orifice)	Y31/2	Intake manifold air pressure control valve vacuum transducer
62	Filter	Y31/3	Wastegate vacuum transducer
62a	Filter	A	Intake air
65	Vacuum control valve	B	Exhaust gas
67	Vacuum pump	a	Vent line to passenger compartment
72	Vacuum damper	c	Remaining vacuum consumers
99	Intake manifold air pressure control valve in control valve body		
100	Vacuum actuator, intake manifold air pressure control valve		
103	Aneroid compensator (ALDA)		
110	Exhaust manifold		
123	Vacuum amplifier		
137	Turbocharger		
137a	Wastegate vacuum actuator		
138	Intake manifold		
179	Vacuum reservoir		
B2/1	Air flow sensor with intake air temperature sensor (EDS)		
B2/1a	Intake air temperature sensor		
B5/1	Air pressure sensor (EDS)		
B11/4	Coolant temperature sensor (EDS)		
L3	Starter ring gear speed sensor		
L7	Fuel rack position sensor		
		PRE	Boost pressure from aneroid compensator (ALDA)
		TRA	to vacuum modulator valve, automatic transmission
		VAC	Vacuum from vacuum pump
		VCV	To vacuum control valve
		ATM	Vent line to passenger compartment
		OUT	from vacuum transducer Y31/1 to EGR valve
		OUT	from vacuum transducer Y31/2 to vacuum actuator, intake manifold air pressure control valve
		OUT	from vacuum transducer Y31/3 to wastegate vacuum actuator

Pressure and vacuum connections at the vacuum transducers and vacuum amplifier

General function diagram (EDS),

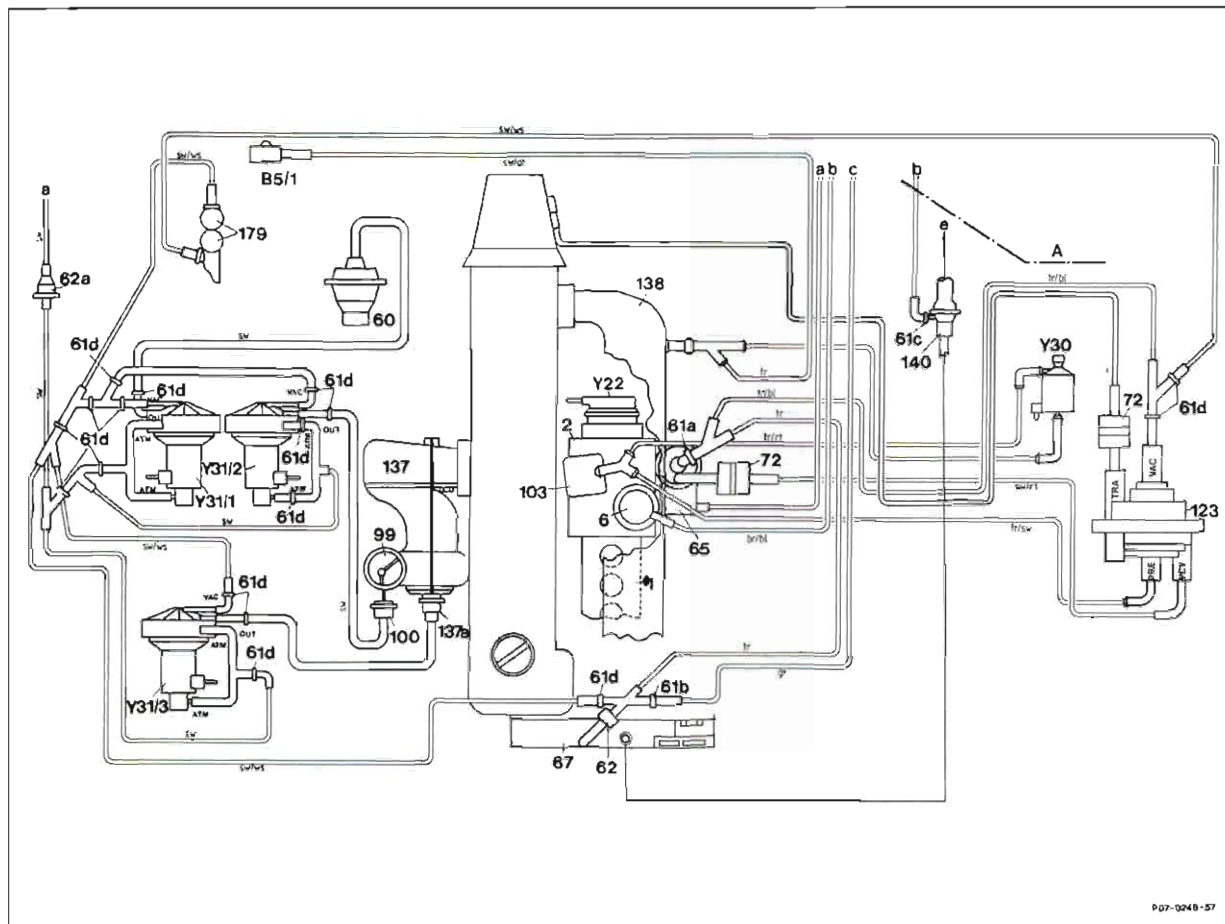
engine 603.970



1	Injection pump	N39	EDS control unit
2	Governor	S66	Engine overload protection switch
60	EGR valve	Y22	Electromagnetic actuator, electronic idle speed control (ELR)
61a	Orifice	Y30	Engine overload protection switchover valve
61b	Orifice	Y31/1	EGR valve vacuum transducer
61d	Connector (without orifice)	A	Intake air
62	Filter	B	Exhaust gas
62a	Filter	a	Vent line to passenger compartment
65	Vacuum control valve	c	other consumers
67	Vacuum pump		
72	Vacuum damper		
103	Aneroid compensator (ALDA)		
110	Exhaust manifold		
123	Vacuum amplifier		
137	Turbocharger		
138	Intake manifold		
B2/1	Air flow sensor with intake air temperature sensor (EDS)		
B2/1a	Intake air temperature sensor		
B11/4	Coolant temperature sensor (EDS)		
L3	Starter ring gear speed sensor		
L7	Fuel rack position sensor		
		PRE	Boost pressure from aneroid compensator (ALDA)
		TRA	to vacuum modulator valve, automatic transmission
		VAC	Vacuum from vacuum pump
		VCV	to vacuum control valve
		ATM	Vent line to passenger compartment
		OUT	To EGR valve
			Pressure and vacuum connections at the vacuum transducer and vacuum amplifier

Vacuum line layout (EDS),

engine 602.962

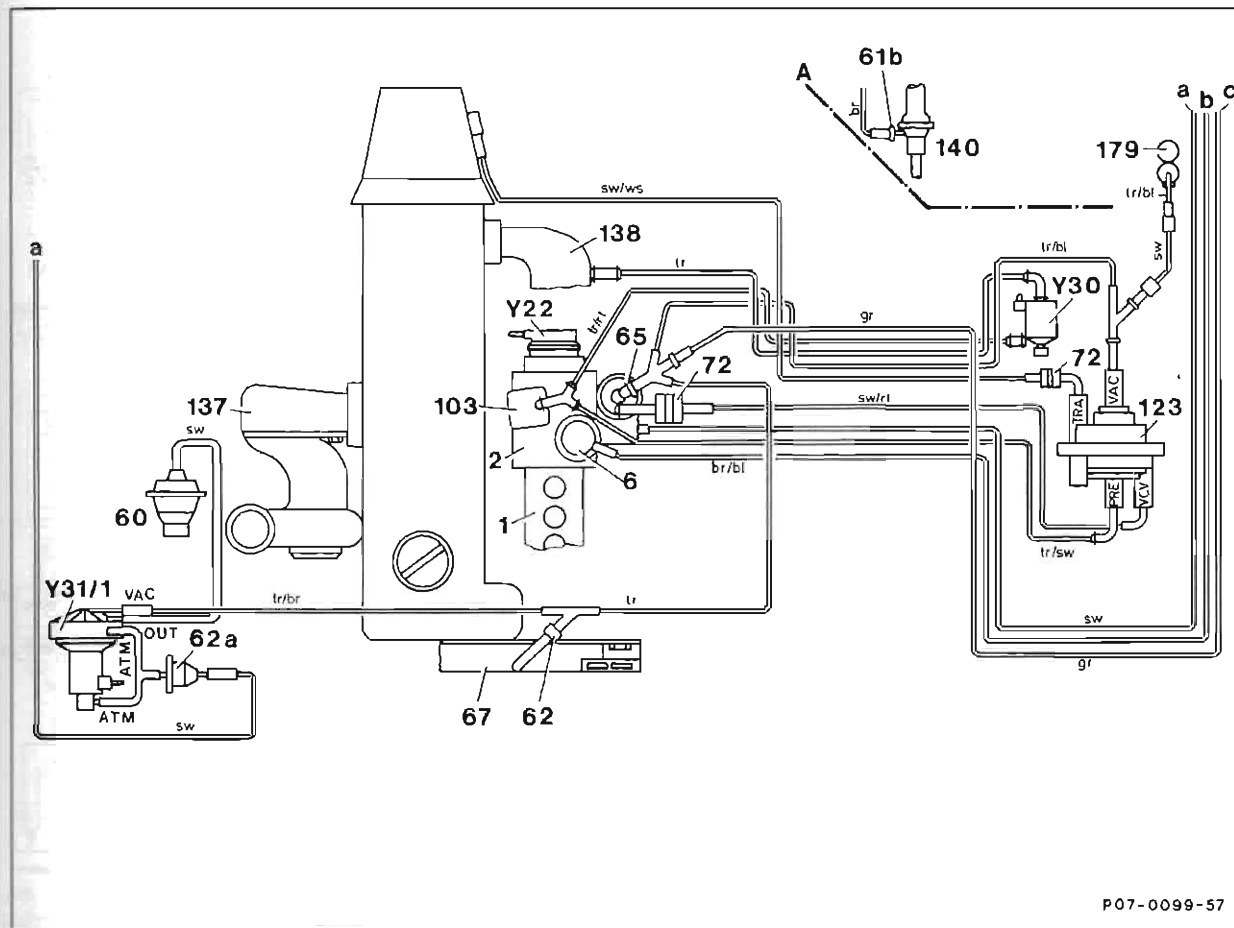


P07-0248-57

1	Injection pump	Y30	Engine overload protection switchover valve
2	Governor	Y31/1	EGR valve vacuum transducer
6	Vacuum shut-off unit	Y31/2	Intake manifold air pressure control valve vacuum transducer
60	EGR valve	Y31/3	Wastegate vacuum transducer
61a	Orifice	A	Bulkhead
61b	Orifice	a	Vent line to passenger compartment
61d	Connector (without orifice)	b	Key shut-off
62	Filter	c	Remaining consumers
62a	Filter	e	Brake booster
65	Vacuum control valve		
67	Vacuum pump		
72	Vacuum damper		
99	Intake manifold air pressure control valve in control valve body		
100	Vacuum actuator, intake manifold air pressure control valve		
103	Aneroid compensator (ALDA)		
123	Vacuum amplifier		
137	Turbocharger		
137a	Wastegate vacuum actuator,		
138	Intake manifold		
140	Brake booster check valve		
179	Vacuum reservoir		
B5/1	Air pressure sensor (EDS)		
Y22	Electromagnetic actuator, electronic idle speed control (ELR)		
		TRA	to vacuum modulator valve, automatic transmission
		VAC	Vacuum from vacuum pump
		VCV	to vacuum control valve
		ATM	Vent line to passenger compartment
		OUT	from vacuum transducer (Y31/1) to EGR valve
		OUT	from vacuum transducer (Y31/2) to intake manifold air pressure control valve vacuum actuator
		OUT	from vacuum transducer (Y31/1) to wastegate vacuum actuator

Vacuum line layout (EDS),

engine 603.970



P07-0099-57

1	Injection pump
2	Governor
6	Vacuum shut-off unit
60	EGR valve
61b	Orifice
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Vacuum damper
103	Aneroid compensator (ALDA)
123	Vacuum amplifier
137	Turbocharger
138	Intake manifold
140	Brake booster check valve
179	Vacuum reservoir
Y22	Electromagnetic actuator, electronic idle speed control (ELR)

Y30	Engine overload protection switchover valve
Y31/1	EGR vacuum transducer

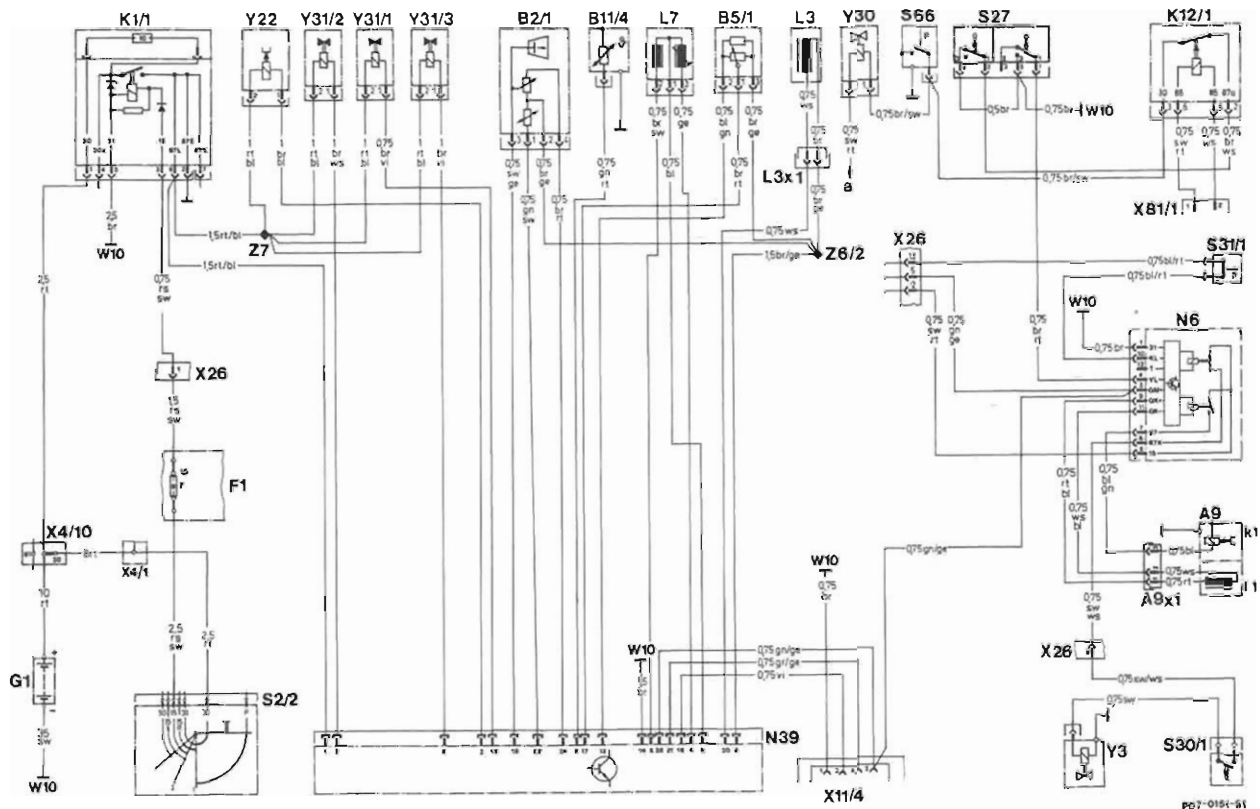
A	Bulkhead
a	Vent line to passenger compartment
b	Key shut-off
c	Other consumers

Pressure and vacuum connections at the vacuum transducer and vacuum amplifier

TRA	to vacuum modulator valve, automatic transmission
VAC	Vacuum from vacuum pump
VCV	to vacuum control valve
ATM	Vent line to passenger compartment
OUT	to EGR valve

Electric wiring diagram (EDS),

engine 602.962

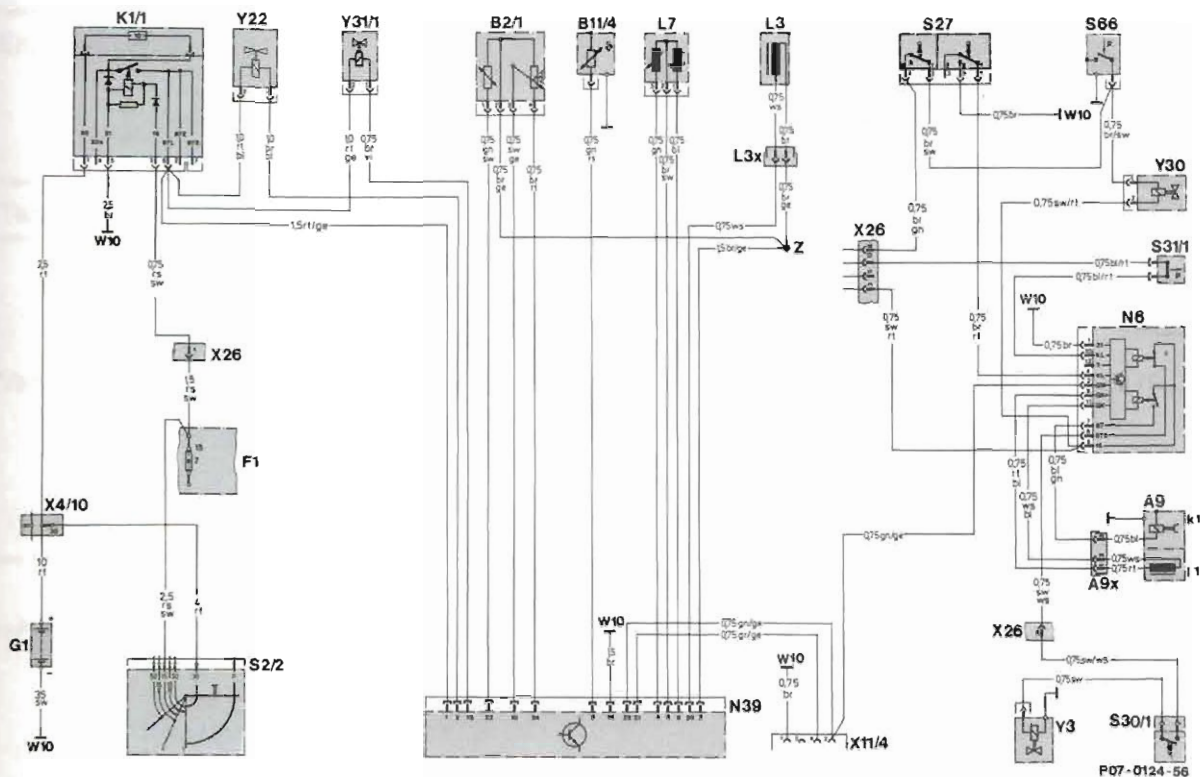


pg7-0151-51

A9	A/C compressor	S31/1	Refrigerant pressure switch, 2 function (off: 2.0/30.0 bar; on: 2.6/22.0 bar)
A9k1	Electromagnetic clutch	S66	Engine overload protection switch
A9i1	RPM sensor	W10	Ground, battery
A9x1	Connector, A/C compressor	X4/1	Terminal block, terminal 30 interior (2-pole)
B2/1	Air flow sensor with intake air temperature sensor (EDS)	X4/10	Terminal block, terminal 30/terminal 61 (battery)
B5/1	Air pressure sensor (EDS)	X11/4	Test connection for diagnosis, impulse readout, 8-pole)
B11/4	Coolant temperature sensor (EDS)	X26	Connector, interior/engine
F1	Fuse and relay box	X81/1	Connector, engine harness/cruise control (1-pole)
G1	Battery	Y3	Kickdown valve (automatic transmission)
K1/1	Overvoltage protection relay, 87 E (7-pole)	Y22	Electromagnetic actuator, electronic idle speed control (ELR)
K12/1	Cruise control/engine overload protection relay	Y30	Engine overload protection switchover valve
L3	Starter ring gear speed sensor	Y31/1	EGR valve vacuum transducer
L3x1	Connector, starter ring gear speed sensor	Y31/2	Intake manifold air pressure control valve vacuum transducer
L7	Fuel rack position sensor	Y31/3	Wastegate vacuum transducer
N6	A/C compressor control unit	Z6/2	Connector sleeve, ground supply (solder joint in connector)
N39	EDS control unit	Z7	Connector sleeve, terminal 87 (solder joint in harness)
S2/2	Glow/starter switch	a	Auxiliary fan relay, socket 4, terminal 15
S27	A/C compressor/boost cut-out microswitch		
S30/1	Kick-down switch		

Electric wiring diagram (EDS),

engine 603.970



A9	A/C compressor	S27	A/C compressor/boost cut-out microswitch
A9k1	Electromagnetic clutch	S30/1	Kick-down switch
A9I1	RPM sensor	S31/1	Refrigerant low pressure switch, 2 function (off 2.0/30.0 bar, on 2.6/22.0 bar)
A9x1	Connector, A/C compressor	S66	Engine overload protection switch
B2/1	Air flow sensor with intake air temperature sensor (EDS)	W10	Ground, battery
B11/4	Coolant temperature sensor (EDS)	X4/10	Terminal block, terminal 30/terminal 61 (battery)
F1	Fuse and relay box	X11/4	Test connection for diagnosis (impulse readout, 8-pole)
G1	Battery	X26	Connector, interior/engine
K1/1	Oversvoltage protection relay, 87 E/87 L (7-pole)	Y3	Kickdown valve (automatic transmission)
K12/1	Cruise control/engine overload protection relay	Y22	Electromagnetic actuator, electronic idle speed control (ELR)
L3	Starter ring gear speed sensor	Y30	Engine overload protection switchover valve
L3x1	Connector, starter ring gear speed sensor	Y31/1	EGR valve vacuum transducer
L7	Fuel rack position sensor	Z	Connector sleeve (solder joint in harness)
N6	A/C compressor control unit		
N39	EDS control unit		
S2/2	Glow/starter switch		

P07-0124-56

Testing the electronic diesel system (EDS)

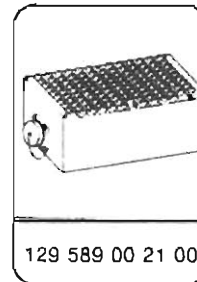
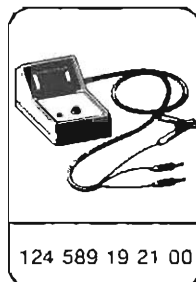
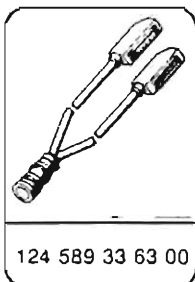
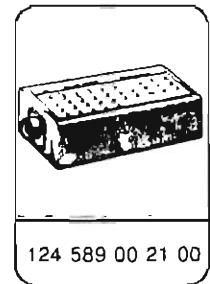
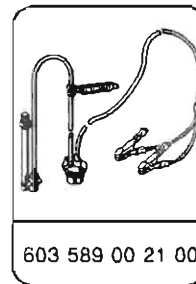
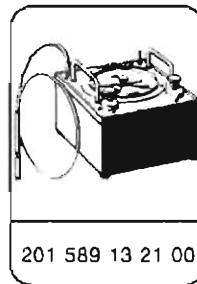
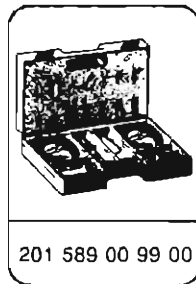
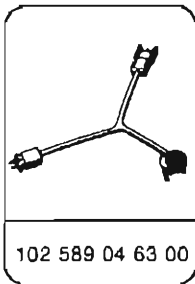
Test conditions:

- Coolant temperature 60 – 80° C,
- Air conditioning off,
- Gearshift lever in Park,
- Overvoltage protection relay fuse intact,
- Battery voltage approx. 12 volts at the overvoltage protection relay between sockets 1 and 5,
- Observe the control unit's part number, see table.

Caution:

Do not disconnect battery, overvoltage protection relay or EDS control unit before or during the test, otherwise the stored malfunction will be erased from memory.

Special tools



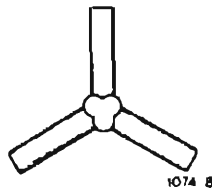
Equipment

Multimeter 1) Fluke Model 23 with 80i-410 current probe
Sun DMM-5

Engine analyzer 1) Bear DACE (Model 40-960)
Sun EMT-1019/Master 3
Sun MCM-2110
Sun MEA-1500MB

Tachometer 1) All-Test 3610-MB

Vacuum Y-connector



117 078 01 45

1) Available through the MBNA Standard Equipment Program

Testing with the impulse counter

Notes on impulse readout

If the impulse readout displays no malfunctions when there is a driveability complaint, then the following function tests should be performed: Electronic idle speed control (ELR), EGR system and (on the 602 engine) P2-control system.

Readout number 1 means no malfunction was detected in the electronic system. All other numbers are correlated to a particular component or faulty circuit.

The numbers from 1 to 13 (for engine 603) or 1 to 15 (for engine 602) appear on the display screen of the impulse counter.

- If the U-Batt LED illuminates after hookup, then the impulse counter and the supply voltage to the impulse counter are in order.

Testing

- Connect the impulse counter according to the connection diagram (p. 47).

Note:

The U-Batt LED in the display must illuminate; if not:

- Check the impulse counter's fuse.
 - Check from test connector (X11/4) socket 1 to battery positive (should be 11 – 14 volts).
 - Check from test connector (X11/4) socket 4 to socket 1 (should be 6 – 12 volts).
- Engine at idle speed.
 - Push the Start button between 2 and 4 seconds.

- Scan the impulse readouts displayed and write them down. Readout 1 means no malfunctions stored. Any number greater than 1 means one or more malfunctions are stored in the system.
- Push the Start button again, between 2 and 4 seconds. If there are no malfunctions in the system, the previous display will be repeated. If a malfunction is stored, its malfunction code will be displayed.
- Repeat the scan test until the first malfunction is displayed again.
- Run engine at 900 rpm for at least 5 seconds and push Start button again for 2 to 4 seconds while maintaining engine speed at 900 rpm.
- Correct the malfunctions written down (impulse readouts), following the troubleshooting sequence.
- Perform tests of the individual components.

Erasing the malfunction memory

After a malfunction has been repaired, the impulse display must be erased this way:

- Push the Start button and read out the malfunction that has been removed. Then hold the Start button for 6 to 8 seconds.

Note:

- Each malfunction displayed must be erased one at a time.
- Once a malfunction is removed and the display erased, the malfunction code does not appear as a displayed malfunction readout any longer.
- If there is a readout of any number greater than 1, there are additional malfunctions in the system.

Malfunction table, engine 602.962

The number appearing in the impulse display indicates whether a component is faulty, which one, as well as whether control circuit components are defective.

Impulse readout	Component/malfunction circuit
1 ¹⁾	All functions in order
2	Fuel rack position sensor (L7)
3	Air flow sensor (B2/1)
4	EDS control unit (N39), atmospheric pressure sensor
5 ²⁾	EGR valve vacuum transducer (Y31/1) or a malfunction in the EGR control circuit
6	EDS control unit (N39), internal voltage supply
7	Starter ring gear speed sensor (L3)
8	Coolant temperature sensor (EDS) (B11/4)
9	Intake air temperature sensor (B2/1a)
10	not used
11 ³⁾	Idle speed control actuator or EGR valve vacuum transducer (Y31/1)
12	not used
13	EDS control unit (N39) defective (internal malfunction memory)
14	Air pressure sensor EDS (B5/1) defective
15	Intake manifold air pressure control valve vacuum transducer (Y31/2), wastegate vacuum transducer (Y31/3), or malfunction in the intake manifold air pressure control circuit

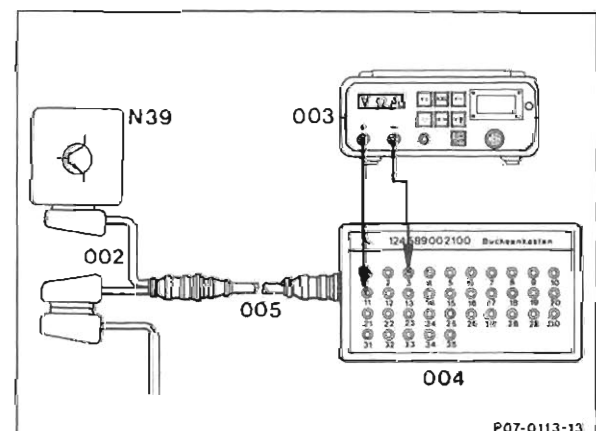
¹⁾ If there are nonetheless driveability complaints, perform the function tests for electronic idle speed, EGR system and P2-control.

²⁾ Displayed only after 900 rpm for at least 5 seconds. This malfunction is not stored.

³⁾ Displayed only if there is a short circuit.

Socket box connection diagram

002	25-pole test cable	124 589 33 63 00
003	Multimeter	
004	35-pole socket box	124 589 00 21 00
005	Test cable extension	124 589 34 63 00
N39	EDS control unit	



Test program with socket box,
engine 602.962



Socket box



Voltage measurement (DC volts)



Multimeter



Resistance measurement (Ohms)




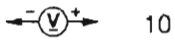
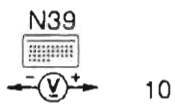




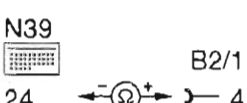
socket



plug


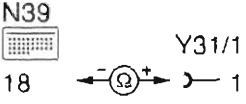



Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
1.0/1		-	-	-	No malfunctions stored
2.0/2	Fuel rack position sensor (L7)	 4 5 4 6 4 3 4 1	Ignition: OFF , unplug EDS control unit.	$50 \pm 4 \Omega$ $25 \pm 2 \Omega$ $\infty \Omega$ $\infty \Omega$	Replace the fuel rack position sensor or the injection pump. Wiring
2.1	Fuel rack position sensor (L7)	 2 3 2 1	Ignition: OFF , connector at the fuel rack position sensor (L7) unplugged (Turn the lock counter- clockwise and unplug the connector).	$50 \pm 4 \Omega$ $25 \pm 2 \Omega$	Replace the fuel rack position sensor or the injection pump.
2.2	Wiring	L7 4 3 L7 5 2 L7 6 1	Ignition: OFF , unplug the connector at the fuel rack position sensor (L7).	less than 1Ω less than 1Ω less than 1Ω	Open circuit Open circuit Open circuit

Test program with socket box, engine 602.962, continued

Test step/ Impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
3.0/3	Air flow sensor (B2/1)	 3 24	EDS control unit (N39) connected, ignition: ON	5 ± 0.5 volts	Air flow sensor Short circuit to ground, EDS control unit
		 3 10		less than 0.5 volts	Wiring. If the nominal value is in order but a malfunction was nevertheless stored, a possible cause is that the air flow sensor stuck shortly during the startup. The air flow sensor may have to be replaced.
		 3 10	Engine at idle speed	1.7 ± 0.2 volts 1)	Air flow sensor
3.1	Air flow sensor (B2/1)	 3 24	Ignition: OFF , unplug the EDS control unit (N39)	500 – 1200 Ω	Air flow sensor
		 3 10	Air flow sensor plate, rest position	50 – 200 Ω	Air flow sensor
		 3 10	Air flow sensor plate, fully deflected	560 – 1100 Ω	Air flow sensor
3.2	Wiring	 N39 B2/1 10 ← Ω → 3	Unplug the connector at the air flow sensor (B2/1)	less than 1 Ω	Open circuit
		 N39 B2/1 24 ← Ω → 4		less than 1 Ω	Open circuit
4.0/4		–	–	–	Replace EDS control unit (atmospheric pressure sensor defective)

1) Voltage increases with increasing engine rpm.

Test program with socket box, engine 602.962, continued




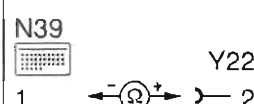
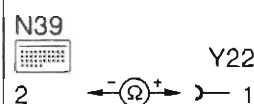


Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
5.0/5 ¹⁾	EGR valve vacuum transducer (Y31/1)		Engine at 900 \pm 50 rpm	more than 3 volts ²⁾	
	EGR valve	Vacuum at the EGR valve	approx. 300 mbar ²⁾		Supply line (black/white) leaking Vent line (black) plugged, vent filter (62a) clogged Supply line (black/white) or vacuum line (black rubber) plugged or leaking. Vacuum transducer (Y31/1) , wiring, EDS control unit, air flow sensor, EGR valve
5.1	Wiring	 	Ignition: OFF , unplug the connector at the vacuum transducer (Y31/1)	less than 1 Ω	Open circuit
				less than 1 Ω	Open circuit
6.0/6		-	-	-	Internal supply voltage. Replace the EDS control unit.
7.0/7	Starter ring gear speed sensor (L3)		Engine at idle speed, EDS control unit unplugged	more than 3 volts ³⁾	Starter ring gear speed sensor, gap, dirt, wiring
7.1	RPM signal		Engine at idle speed, EDS control unit plugged in	more than 3.5 volts	Short circuit in wire from N39 to (X11/4) or EDS control unit (N39)

¹⁾ Displayed only after 900 rpm for at least 5 seconds. This malfunction is not stored.

²⁾ Briefly go to full throttle. Vacuum and voltage fall. The test specifications are approximate values.

³⁾ Voltage rises with increasing rpm.

Test program with socket box, engine 602.962, continued

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
11.0/11 ¹⁾	Electro- magnetic actuator, electronic idle speed control (Y22)		EDS control unit plugged in, ignition: ON	11–14 volts	Actuator (Y22), wiring Note: Do not perform test during pre- or afterglow.
			Engine at idle speed	2.5 ± 0.5 volts ²⁾	EDS control unit (N39)
11.1	Wiring		Ignition: OFF , EDS control unit unplugged	4 ± 1 Ω	Actuator (Y22), wiring
11.2			Unplug the connector at the actuator (Y22), ignition: OFF	less than 1 Ω	Open circuit
				less than 1 Ω	Open circuit
14.0/14	Pressure sensor (EDS) (B5/1)		EDS control unit plugged in, ignition: ON	more than 5 volts	Pressure sensor, pressure lines, electrical wiring
14.1	Pressure sensor (EDS) (B5/1)		0 mbar	more than 1.5 volts	Pressure sensor, pressure lines, electrical wiring
		Pressure tester with the vacuum Y-connector at the pressure sensor	Start engine, momentary full throttle	Voltage climbs as pressure climbs.	

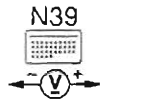
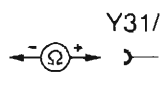
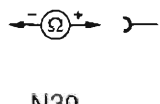

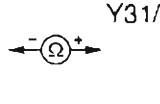
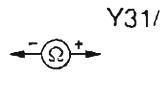
¹⁾ Displayed only if there is a short circuit.

²⁾ Approximate value. Voltage declines when engine speed increases.

Test program with socket box, engine 602.962, continued

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
14.2	Pressure sensor (EDS) (B5/1)		EDS control unit unplugged, ignition: OFF	1.4 k Ω \pm 0.2 k Ω	
14.3	Wiring			less than 1 Ω	Open circuit
14.4	Wiring		EDS control unit unplugged, ignition: OFF	less than 1 Ω	Open circuit
14.5	Wiring		EDS control unit unplugged, ignition: OFF	less than 1 Ω	Open circuit

Test program with socket box, engine 602.962, continued

Test step/ Impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
15.0/15	Intake manifold air pressure control valve vacuum transducer (Y31/2)		Engine at idle speed, EDS control unit plugged in	approx. 0.4 volt below 100 mbar	Vacuum transducer, vacuum lines, EDS control unit
	Intake manifold air pressure control valve vacuum actuator	Vacuum test unit with vacuum Y-connector at the vacuum transducer (Y31/2) outlet (OUT)	Slowly raise engine speed to approx. 2000 rpm	As vacuum increases, voltage increases.	
15.1	Wiring		Ignition: OFF , EDS control unit unplugged, connector at Y31/2 unplugged	less than 1 Ω	Open circuit
15.2	Wiring		Connector at Y31/2 unplugged	less than 1 Ω	Open circuit
15.3	Wastegate vacuum transducer (Y31/3)		Engine at idle speed, EDS control unit plugged in	approx. 4 volts below 300 mbar	Vacuum transducer, vacuum lines, EDS control unit
	Wastegate vacuum actuator	Vacuum test unit with vacuum Y-connector at the vacuum transducer (Y31/3) outlet (OUT)	Slowly raise the engine speed to approx. 2000 rpm	Voltage falls as vacuum falls.	Vacuum transducer, vacuum lines, EDS control unit
15.4	Wiring		Ignition: OFF , EDS control unit unplugged	less than 1 Ω	Open circuit
				less than 1 Ω	Open circuit

Coolant and intake air temperature sensors (engine 602.962)

Temperature, °C	Resistance, $\pm 10\%$	Voltage signal, $\pm 10\%$
20	2.5 k Ω	3.85
30	1.7 k Ω	3.47
40	1.18 k Ω	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

Function tests, electronic idle speed control (ELR), EGR, P2-control, engine 602.962

Note:

This test is to be performed if there is a driveability complaint, but no malfunctions are displayed by the impulse readout.

Scope of test	Test connection, test unit	Test conditions	Nominal value	Possible cause/remedy
1.0 Idle speed control	Tachometer with TDC sensor	Engine at idle speed, coolant temperature approx. 80° C	680 ± 20 rpm	Actuator, injection pump, starter ring gear speed sensor (L3), EDS control unit (N39). See test steps 7 and 11.
		Connector unplugged from actuator	610 ± 20 rpm	Adjust engine speed at injection pump. Injection pump
2.0 EGR control circuit	Connect vacuum tester with vacuum Y-connector at EGR valve.	With engine at 900 ± 50 rpm and about 300 mbar, briefly go to full throttle.	Vacuum decreases.	Test vacuum transducer (Y31/1) and air flow sensor (B2/1) mechanically. EDS control unit (N39), EGR valve
3.0 EGR valve	Connect vacuum tester directly to EGR valve.	Engine shut off, draw 300 mbar vacuum. Pull off vacuum line.	EGR valve closes audibly.	Replace EGR valve

Scope of test	Test connection, test unit	Test conditions	Nominal value	Possible cause/remedy
4.0 Wastegate control	Connect vacuum tester (020) with vacuum Y-connector at outlet of vacuum transducer (Y31/3)	Engine at idle speed	Greater than 300 mbar	Vacuum supply, vacuum lines, vacuum transducer (Y31/3), EDS control unit (N39)
Wastegate vacuum actuator		Raise engine speed slowly to approx. 2000 rpm.	Vacuum decreases.	
4.1 Intake manifold air pressure control valve vacuum actuator (100)	Connect vacuum tester (020) with vacuum Y-connector at intake manifold air pressure control valve vacuum actuator (100)	Engine at idle speed	Above 100 mbar	Vacuum supply, vacuum lines
		Raise engine speed slowly to approx. 2000 rpm.	Vacuum increases.	Vacuum transducer (Y31/2), pressure line to the air pressure sensor (B5/1), EDS control unit

Malfunction table, engine 603.970

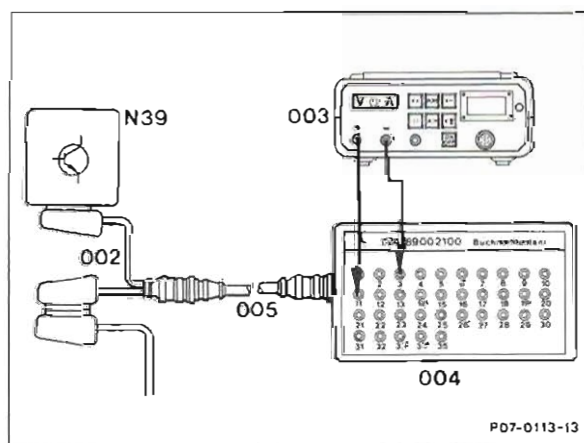
The number appearing in the impulse display indicates whether a component is faulty, which one, as well as whether control circuit components are defective.

Impulse readout	Component/malfunction circuit
1 ¹⁾	All functions in order
2	Fuel rack position sensor (L7)
3	Air flow sensor (B2/1)
4	EDS control unit (N39), atmospheric pressure sensor
5 ²⁾	EGR valve vacuum transducer (Y31/1) or a malfunction in the EGR control circuit
6	EDS control unit (N39), internal voltage supply
7	Starter ring gear speed sensor (L3)
8	Coolant temperature sensor (EDS) (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Voltage supply
11 ³⁾	Idle speed control actuator or EGR valve vacuum transducer (Y31/1)
12	not used
13	EDS control unit (N39) defective

- ¹⁾ If there are nonetheless driveability complaints, perform the function tests for electronic idle speed, EGR system.
²⁾ Displayed only after 900 rpm for at least 5 seconds. This malfunction is not stored.
³⁾ Displayed only if there is a short circuit.

Socket box connection diagram

002	25-pole test cable	124 589 33 63 00
003	Multimeter	
004	35-pole socket box	124 589 00 21 00
005	Test cable extension	124 589 34 63 00
N39	EDS control unit	



PD7-0113-13

Test program with socket box, engine 603.970



Socket box



DC voltage measurement (volts)



Multimeter



Resistance (Ohms)









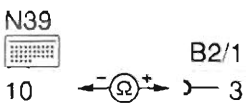
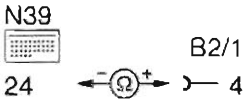
Socket




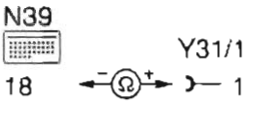
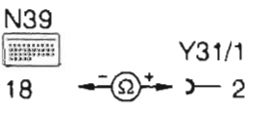


Pin

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
1.0/1		-	-	-	No malfunctions stored.
2.0/2	Fuel rack position sensor (L7)	<p>N39</p> <p>4 5</p> <p>4 6</p> <p>4 3</p> <p>4 1</p>	Ignition: OFF , unplug EDS control unit.	$50 \pm 4 \Omega$ $25 \pm 2 \Omega$ $\infty \Omega$ $\infty \Omega$	Replace fuel rack position sensor or injection pump. Wiring
2.1	Fuel rack position sensor (L7)	<p>L7</p> <p>2 3</p> <p>L7</p> <p>2 1</p>	Ignition: OFF , connector at fuel rack position sensor (L7) unplugged	$50 \pm 4 \Omega$	Replace fuel rack position sensor or injection pump.
			(Turn lock counter- clockwise, unplug connector).	$25 \pm 2 \Omega$	Replace fuel rack position sensor or injection pump.

Test program with socket box, engine 602.962, continued

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
3.0/3	Air flow sensor (B2/1)		EDS control unit (N39) plugged in,	5 ± 0.5 volts	Air flow sensor, Short circuit to ground, EDS control unit
			Ignition: ON	less than 0.5 volt	Wiring. If the nominal value is in order but a malfunction was nevertheless stored, a possible cause is that the air flow sensor stuck shortly during startup. The air flow sensor may have to be replaced. EDS control unit (N39)
			Engine at idle speed	$1.4 \pm$ 0.2 volts	Air flow sensor
3.1	Air flow sensor (B2/1)		Ignition: OFF , EDS control unit (N39) unplugged	500- 1200 Ω	Air flow sensor
			Air flow sensor plate, rest position	50- 200 Ω	Air flow sensor
			Air flow sensor plate, fully deflected	560- 1100 Ω	Air flow sensor, wiring
3.2	Wiring		Unplug connector at air flow sensor (B2/1).	less than 1 Ω	Open circuit
				less than 1 Ω	Open circuit

Test program with socket box, engine 602.962, continued


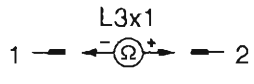
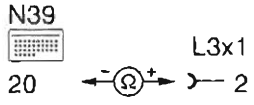



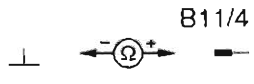
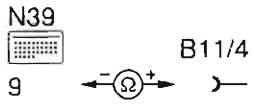
Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
5.0/5 ²⁾	EGR valve vacuum transducer (Y31/1)	 <p>Vacuum at EGR valve</p>	Engine at 900 ± 50 rpm	more than 3 volts ⁴⁾	Supply line (tr/br) leaking
5.1	Wiring	 	Ignition: OFF Unplug connector at vacuum transducer (Y31/1)	less than 1 Ω	Open circuit
6.0/6		-	-	-	Internal voltage supply, replace EDS control unit (N39).
7.0/7	Starter ring gear speed sensor (L3)		Engine at idle speed, EDS control unit unplugged	more than 3 volts ¹⁾	Speed sensor, gap, dirt, wiring
7.1	Engine speed signal		Engine at idle speed, EDS control unit plugged in	more than 2.8 volts	Short circuit in wire from N39 to X11/4 or EDS control unit (N39)

1) Voltage increases with increasing engine speed.

2) Displayed only after 900 rpm for at least 5 seconds. This malfunction is not stored.

4) Briefly go to full throttle. Vacuum and voltage decrease. The test specifications are approximate values.


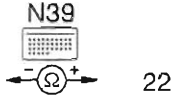
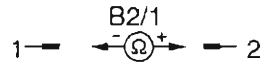
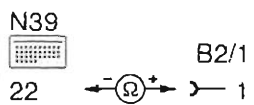
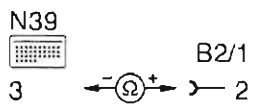

Test program with socket box, engine 602.962, continued

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
7.2	Starter ring gear speed sensor (L3)	 	Ignition: OFF , EDS control unit unplugged	Beru ⁵⁾ 527 Ω ± 10% VDO 1900 Ω ⁵⁾ ± 10%	Speed sensor, wiring
7.3	Wiring	 		less than 1 Ω	Open circuit
8.0/8	Coolant temperature sensor (EDS) (B11/4)		EDS control unit plugged in, ignition: ON	³⁾	Coolant temperature sensor, wiring, EDS control unit
8.1	Coolant temperature sensor (EDS) (B11/4)	 	Ignition: OFF , EDS control unit unplugged	³⁾	Coolant temperature sensor, wiring
8.2	Wiring		Ignition: OFF , EDS control unit unplugged	less than 1 Ω	Open circuit

³⁾ See table (p. 67) charting coolant temperature and intake air temperature sensors, resistances, and voltage signal.

⁵⁾ Measured at 20°C ambient temperature (for every 10°C difference in ambient temperature, the resistance varies by approx. 4%).


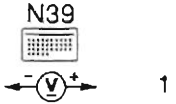

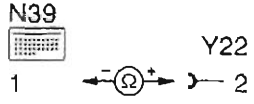
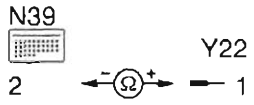
Test program with socket box, engine 602.962, continued

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
9.0/9	Intake air temperature sensor (B2/1a)		EDS control unit plugged in, ignition: ON	³⁾	Intake air temperature sensor, wiring, EDS control unit
9.1	Intake air temperature sensor (B2/1a)		Ignition: OFF , EDS control unit unplugged	³⁾	Wiring to intake air temperature sensor, temperature sensor
			Unplug connector at air flow sensor (B2/1)	³⁾	Intake air temperature sensor
9.2	Wiring		Ignition: OFF , EDS control unit unplugged, unplug the connector at the air flow sensor (B2/1)	less than 1 Ω	Open circuit
				less than 1 Ω	Open circuit
10.0/10	Voltage supply		Engine at 1500 rpm (approx.)	11-14 volts	Voltage regulator, voltage more than 18 volts

¹⁾ Displays only a short circuit.

³⁾ See table (p. 67) charting coolant temperature and intake air temperature sensors, resistances, and voltage signal.

Test program with socket box, engine 602.962, continued

Test step/ impulse readout	Scope of test	Test connections	Test conditions	Nominal value	Possible cause/remedy
11.0/11 ¹⁾	Electro- magnetic actuator, electronic idle speed control (Y22)		EDS control unit plugged in, ignition: ON Note: Don't perform test during pre- or afterglow.	11-14 volts	Electromagnetic actuator, electronic idle speed control, Wiring, EDS control unit
			Engine at idle speed	2.5 ± 0.5 volts ²⁾	EDS control unit (N39) Wiring electromagnetic actuator, idle speed control
11.1	Wiring		Ignition: OFF , EDS control unit unplugged	$4 \pm 0.5 \Omega$	Electromagnetic actuator, idle speed control, Wiring
11.2			Unplug the connector at electro- magnetic actuator, electronic idle speed control (Y22), ignition: OFF	$< 1 \Omega$	Open circuit
				$< 1 \Omega$	Open circuit

¹⁾ Displays only a short circuit.

²⁾ Approximate value. Voltage decreases with an increasing engine speed.

Coolant and intake air temperature sensors (engine 603.970)

Temperature, °C	Resistance, $\pm 10\%$	Voltage, $\pm 10\%$
20	2.5 k Ω	3.85
30	1.7 k Ω	3.47
40	1.18 k Ω	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

Function tests, electronic idle speed control (ELR), EGR, engine 603.970

Note:

This test is to be performed if there is a driveability complaint, but no malfunctions are displayed on the impulse readout.

Scope of test	Test connections/ test instrument	Test conditions	Nominal value	Possible cause/remedy
Idle speed control	Tachometer with TDC sensor	Engine at idle speed, coolant temperature approx. 80° C	630 ± 20 rpm	Actuator, Injection pump, engine speed sensor (L3), EDS control unit. See test steps 7 and 11.
		Connector unplugged from actuator	580 ± 20 rpm	Adjust engine speed at the injection pump. Injection pump
EGR control circuit	Connect vacuum tester with Y-connector at EGR valve	With engine at 900 ± 50 rpm and approx. 300 mbar vacuum, briefly go to full throttle.	Vacuum decreases	Test vacuum transducer (Y31/1) and air flow sensor (B2/1) mechanically. EDS control unit, EGR valve
EGR valve	Connect vacuum tester directly to EGR valve.	Engine shut off, apply 300 mbar vacuum; pull off vacuum line.	EGR valve closes audibly.	Replace EGR valve.

Turbocharger

Turbocharger survey

Engine	Identification	Boost pressure at full load, 4000 rpm, gear lever position 3
602.962	Garrett TB 025	0.85 – 0.95 bar (13.75 – 14.25 psi)
603.970	Garrett T3	0.85 – 0.95 bar (13.75 – 14.25 psi)

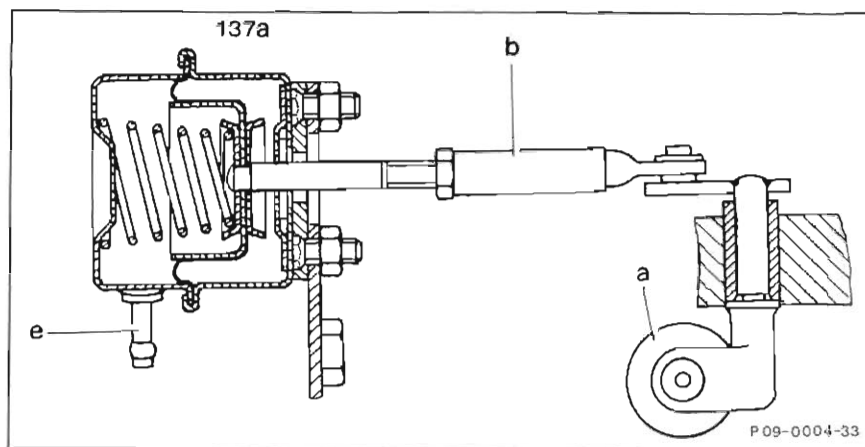
Wastegate vacuum actuator, engine 602.962

During intake manifold air pressure control the wastegate (a) from the turbocharger is opened with controlled vacuum from the vacuum

transducer (Y31/2). The wastegate is activated through control linkage (b).

Engine 602.962
Garrett TB 025

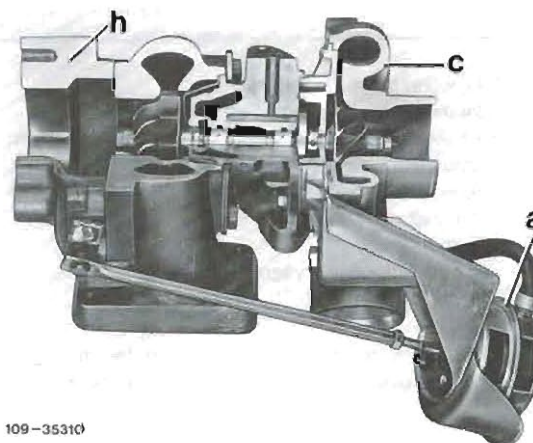
- 137a Wastegate control vacuum actuator
a Wastegate
b Control linkage
e Control line connection



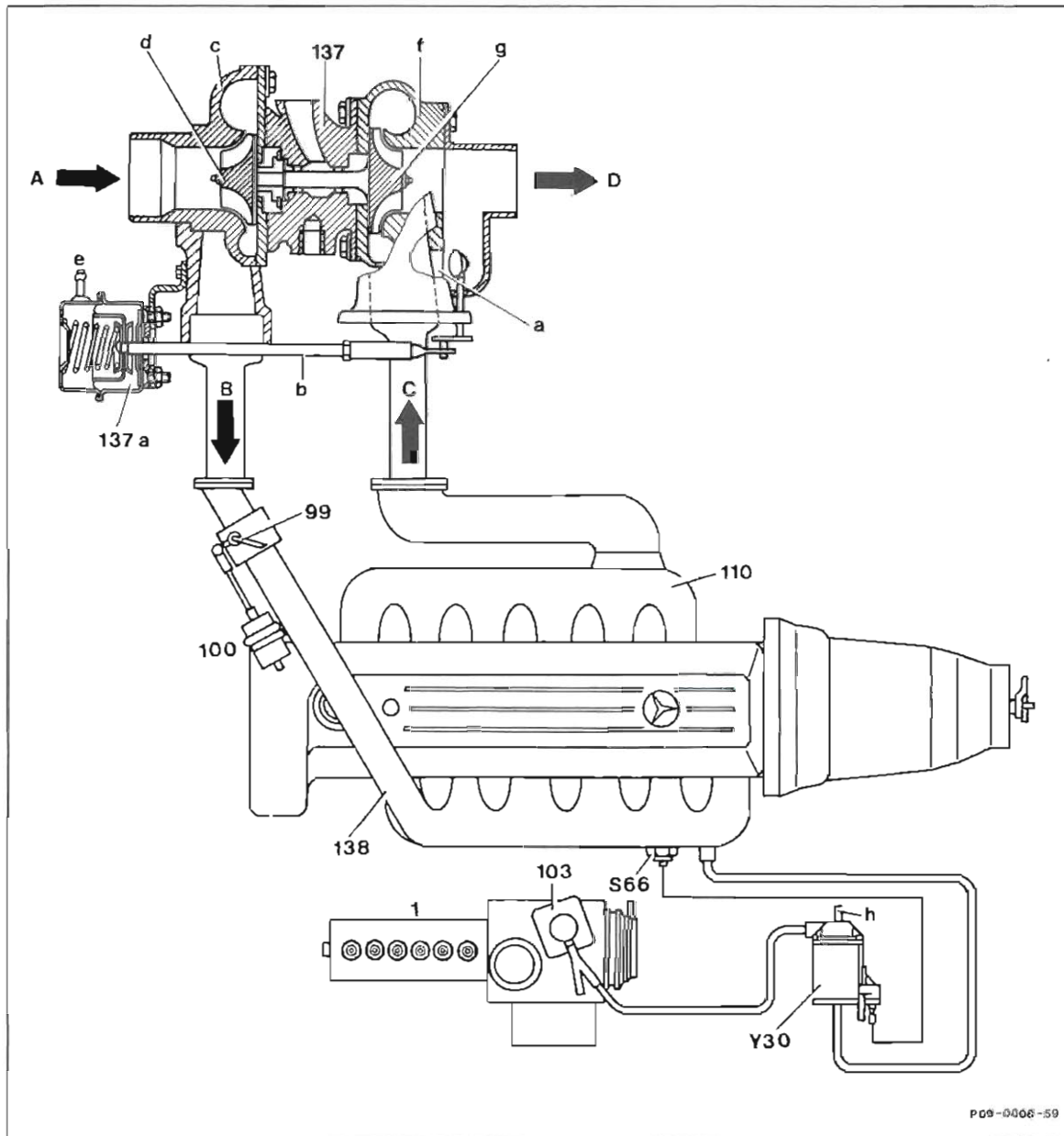
Wastegate, engine 603.970

Engine 603.970,
Garrett T3

- a Wastegate control actuator
c Compressor housing
h Turbine housing

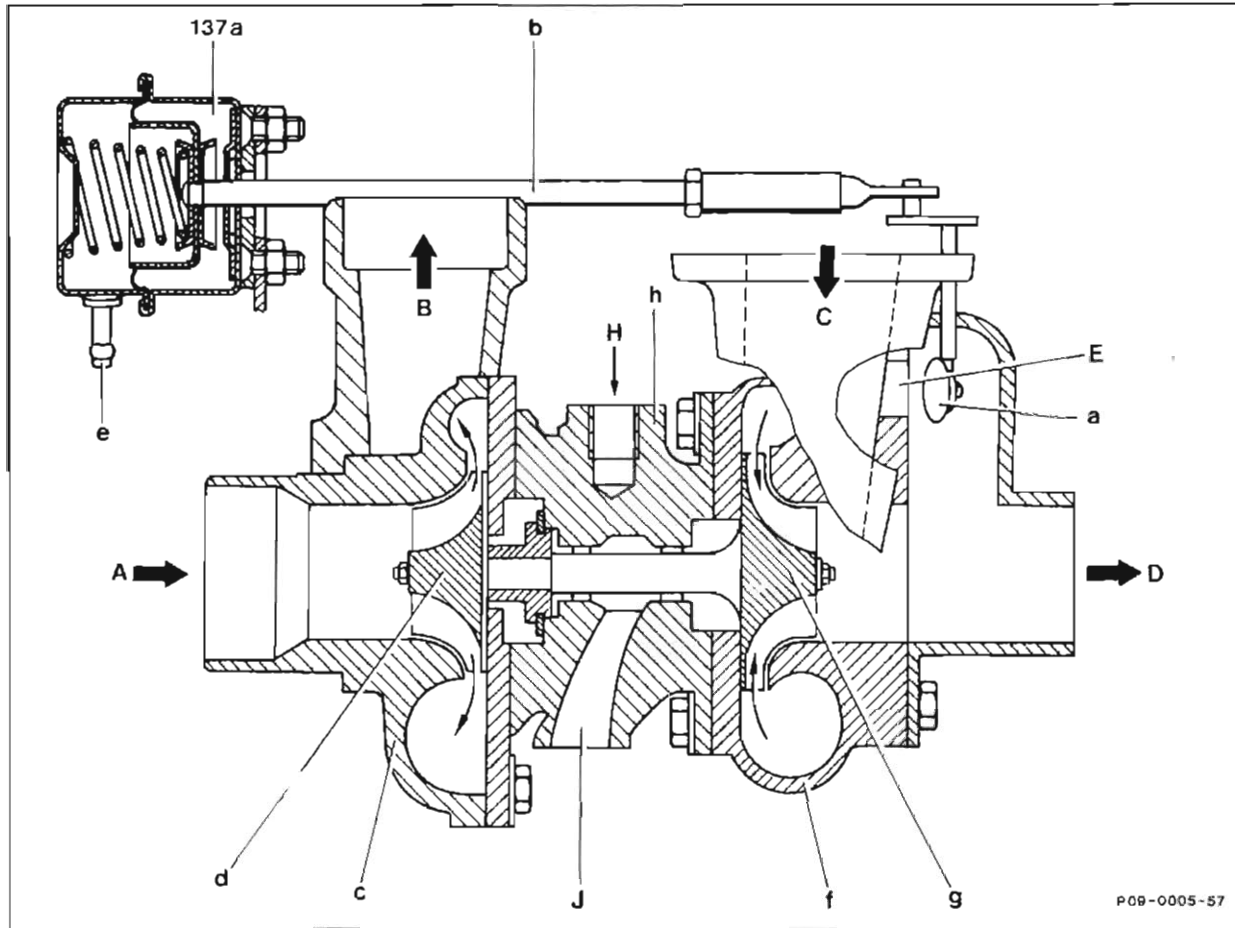


Function diagram, intake manifold air pressure control,
engine 602.962



P09-0066-59

1	Injection pump	A	Compressor intake (fresh air)
99	Intake manifold air pressure control valve	B	Compressor outlet (turbocharged air)
100	Intake manifold air pressure control valve vacuum actuator	C	Exhaust to turbine
103	Aneroid compensator (ALDA)	D	Exhaust outlet
110	Exhaust manifold	a	Wastegate passage
137	Turbocharger	b	Control linkage
137a	Wastegate control vacuum actuator	c	Compressor housing
138	Intake manifold	d	Compressor
S66	Engine overload protection pressure switch	e	Vacuum control line connection
Y30	Engine overload protection switchover valve	f	Turbine housing
		g	Turbine
		h	Vent

Function chart, turbocharger,
engine 602.962

137a Wastegate control vacuum actuator

A Compressor intake (fresh air)

B Compressor outlet (turbocharged air)

C Exhaust to turbine

D Exhaust outlet

E Wastegate passage

H Oil supply pipe

J Oil return pipe

a Wastegate

b Control linkage

c Compressor housing

d Compressor

e Vacuum control line connection

f Turbine housing

g Turbine

h Turbocharger housing

Belt drive

Poly-V-belt, engine 603.970

Because of the smaller coolant pump pulley, the poly-V-belt length was shortened to 2120 mm.

Electrical system, engine

Preglow system

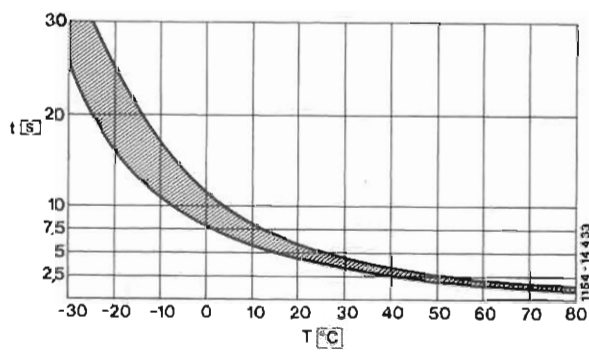
The preglow system differs from model year 1987 engines 602.961 and 603.960 in the following points:

- 30 seconds preglow and 60 seconds maximum afterglow.
- Pin type glow plugs (23 mm, were 27 mm).

Preglow time

The preglow time until the glow plug indicator lamp turns off depends on the coolant temperature (see chart).

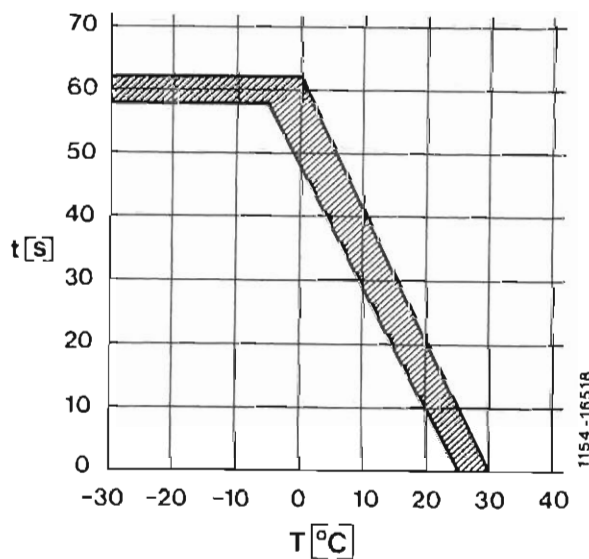
t = Preglow time in seconds
 T = Coolant temperature T in °C



Afterglow time

To improve warmup characteristics, the glow plugs are left on after the engine is running, up to a maximum of 60 seconds depending on the coolant temperature (see chart).

t = Afterglow time in seconds
 T = Coolant temperature T in °C



Preglow circuit protection

In place of the 80 amp melting fuse, an electronic preglow system short circuit protection mechanism is provided. If a short circuit occurs, the current circuit is interrupted. After the short circuit is repaired, the relay is operational again. To reset it, the key in the steering lock must be turned back to position 0.

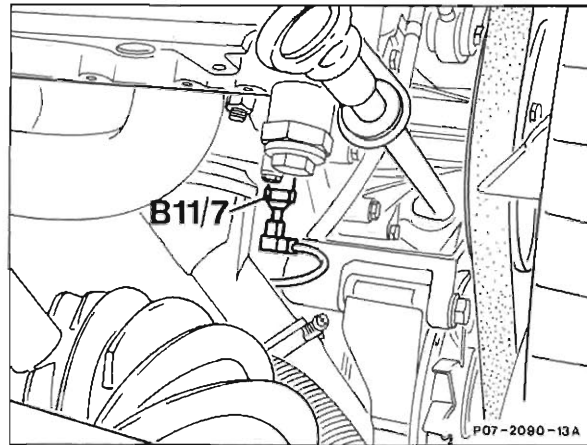
Preglow indicator malfunction display

Preglow indicator lamp	Possible cause	Remedy
OFF during preglow <i>and/or</i> ON after engine is running for approx. 1 minute	1. One or several glow plugs defective, or 2. Defective preglow time relay	Check the current draw of the individual glow plugs. Replace the preglow time relay.
ON constantly [Engine starts normally]	Preglow time relay sticks	Replace the preglow time relay.
OFF constantly [Engine does not start or is hard to start. Blue smoke]	1. Short circuit at one or more glow plugs. 2. Open circuit to preglow indicator lamp or defective bulb. 3. Preglow time relay defective.	Check the current draw of the individual glow plugs. Check bulb and wiring for continuity. Replace the preglow time relay.

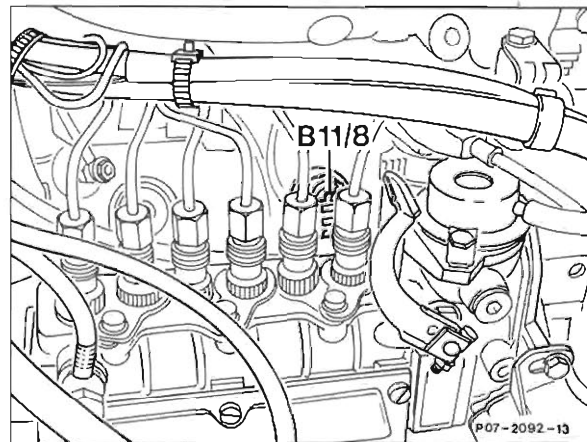
Coolant temperature sensors

A coolant temperature sensor (B11/7 for engine 602 or B11/8 for engine 603) is installed to control the pre- and afterglow time.

In the coolant pump outlet (B11/7),
engine 602.962



In the cylinder head (B11/8),
engine 603.970

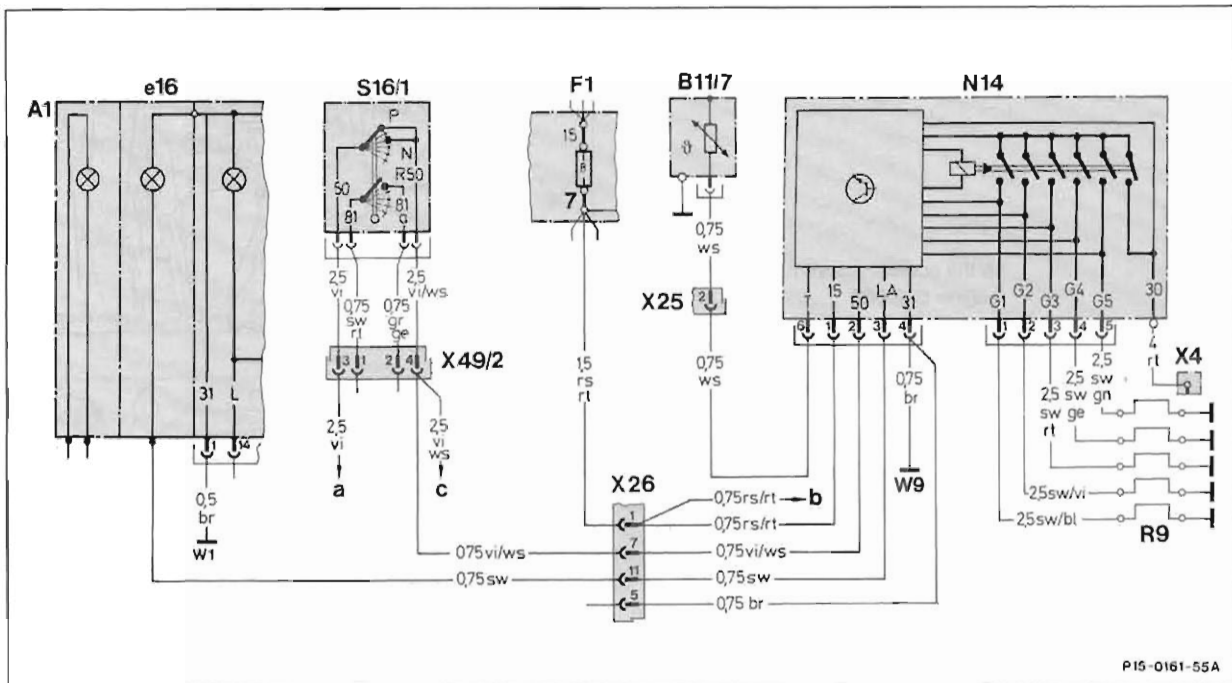


Pin type glow plugs

Pin type glow plugs with 23 mm heating elements are installed. Previous elements were 27 mm.

Identification: Transparent insulators with a ring groove. In addition there is a groove around the hexagonal surface.

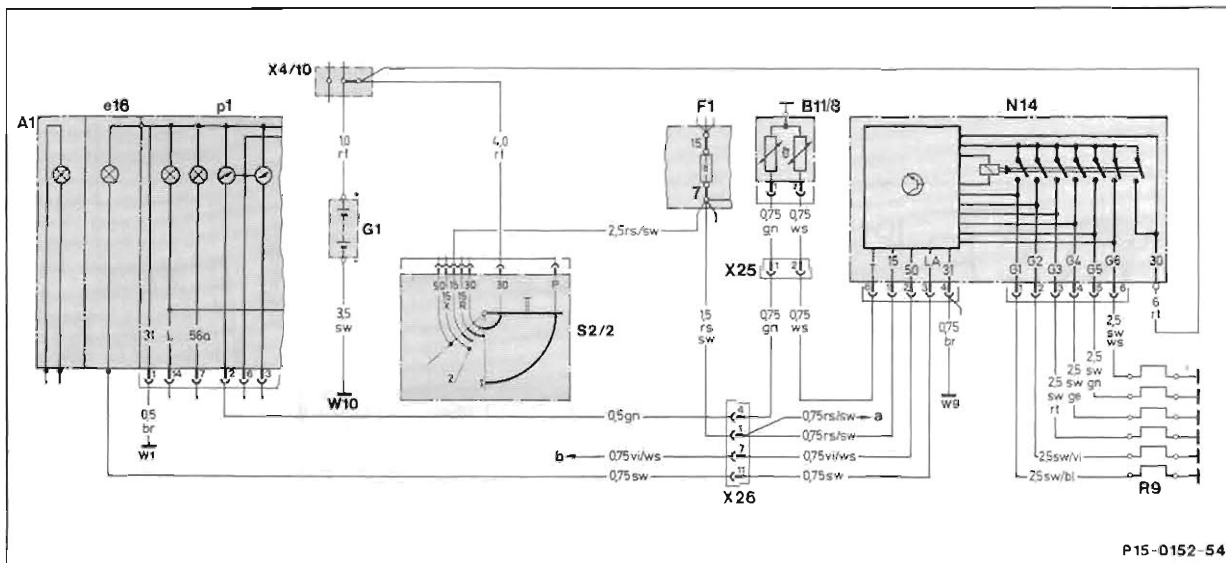
Electric wiring diagrams, preglow system,
engine 602.962



P15-0161-55A

A1e16	Preglow indicator lamp	X25	Connector, preglow harness
B11/7	Preglow system temperature sensor	X26	Connector, interior/engine (12-pole)
F1	Fuse and relay box	X49/2	Connector, backup lamp/starter lock-out switch
N14	Preglow time relay	a	S2/2 Glow/starter switch, terminal 50
R9	Glow plugs	b	K1/1 Overvoltage protection relay, 87 E (7-pole), socket 3
S16/1	Starter lock-out/backup lamp switch	c	X27 Connector, starter wiring harness, socket 2
W1	Main ground (behind instrument cluster)		
W9	Ground, at left headlamp unit		
X4	Terminal block, terminal 30, fuse and relay box (2-pole)		

Electric wiring diagrams, preglow system,
engine 603.970



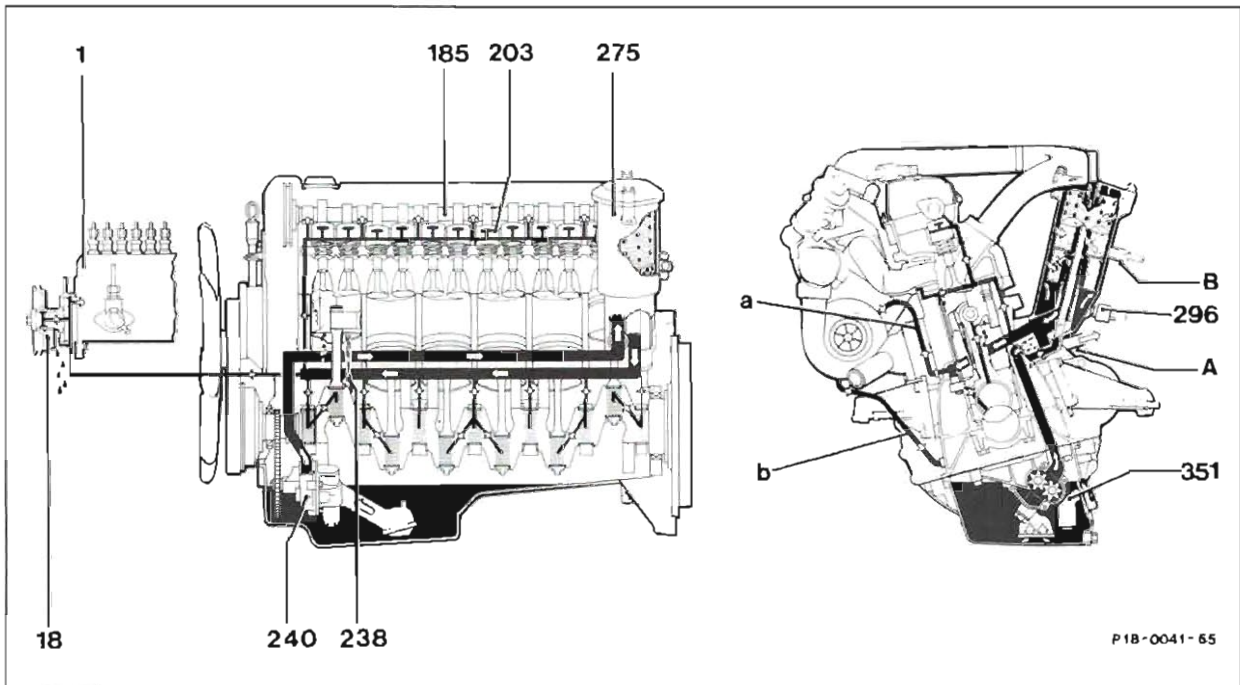
A1 Instrument cluster
 A1e16 Preglow indicator lamp
 A1p1 Coolant temperature gauge
 B11/8 Coolant temperature sensor (coolant gauge/preglow system)
 F1 Fuse and relay box
 G1 Battery
 N14 Preglow time relay
 R9 Glow plugs
 S2/2 Glow/starter switch
 W1 Main ground (behind instrument cluster)

W9 Ground, at left headlamp unit
 X4/10 Terminal block, terminal 30/terminal 61 (battery)
 X25 Connector, preglow harness
 X26 Connector, interior/engine (12-pole)
 a Overvoltage protection relay (socket 3)
 b X27 Connector, starter wiring harness, socket 2

P15-D152-54

Engine lubrication

Oil circuit

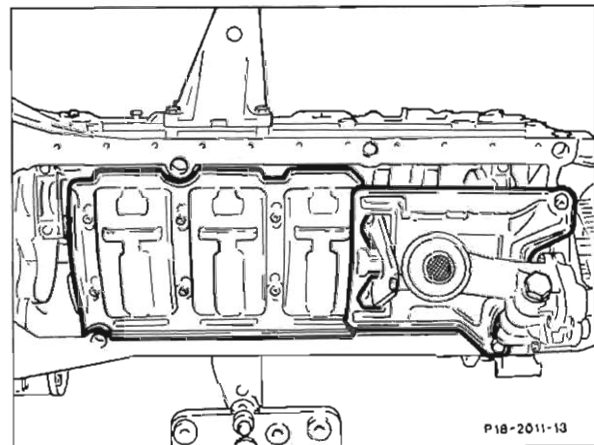


- 1 Injection pump
- 18 Injection advance mechanism
- 185 Camshaft
- 203 Valve tappet
- 238 Oil spray nozzle
- 240 Oil pump

- 275 Oil filter
- 296 Oil pressure switch
- 351 Oil level sensor
- A Unfiltered oil to the air/oil cooler
- B Unfiltered oil from the air/oil cooler

Oil baffles

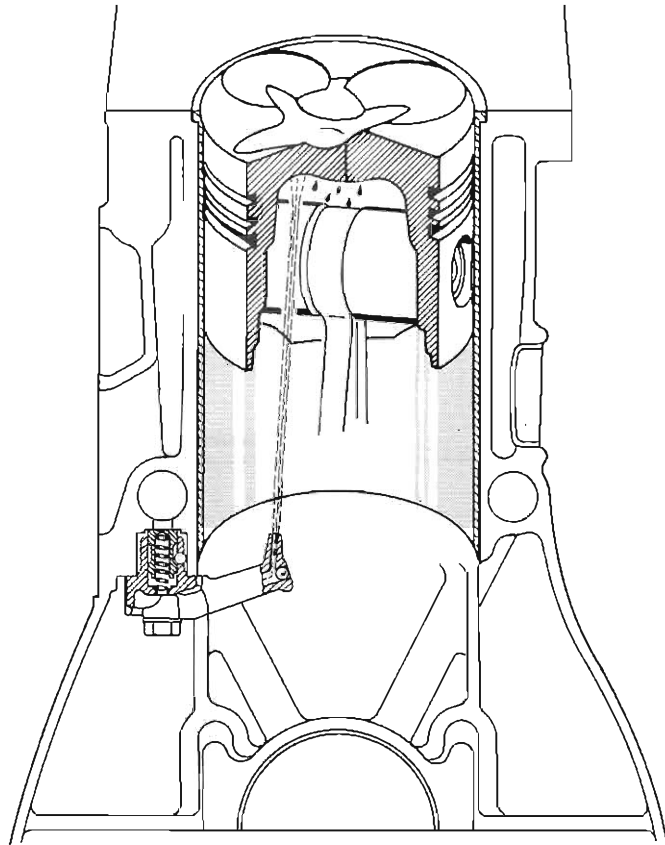
The modified oil pan requires 2 oil baffles under the crankshaft, fastened by the crankshaft main bearing cap bolts. This way, oil splashing is prevented.



Oil spray nozzles

Note:

The oil spray nozzles may **not** be exchanged with those of engines 602.911, 603.960 or 602.961(changed direction of spray)!



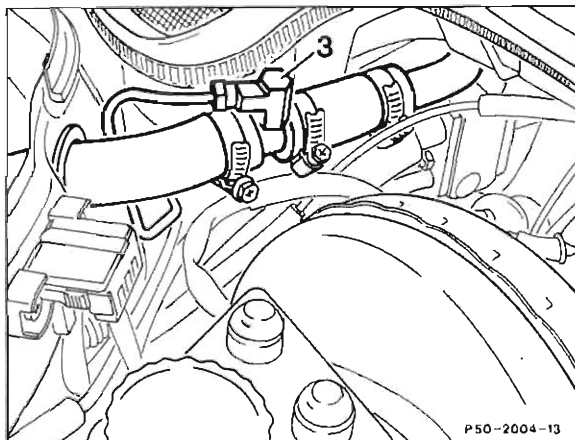
1183-13626/1

Engine cooling

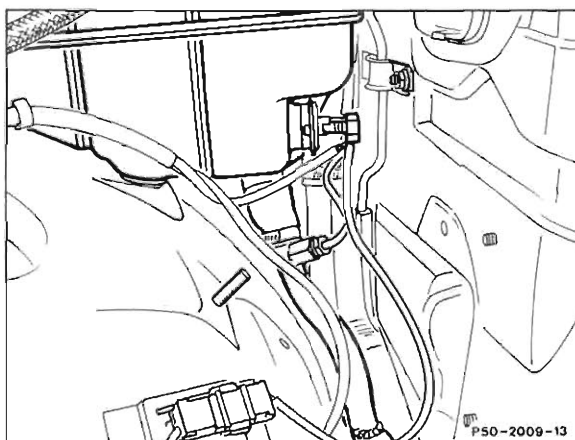
Gas bubble separator, engine 602.962

To better remove gas bubbles from the cooling system, a bypass tube is installed between the heater core inlet and the heater core return pipe to the coolant expansion tank.

Bypass tube in inlet pipe



Bypass tube in return pipe



Coolant pump pulley, engine 603.970

The coolant pump pulley is smaller in diameter.

Ratios

0.79 : 1, engine 603.970

0.90 : 1, engine 603.960



Accelerator control, cruise control

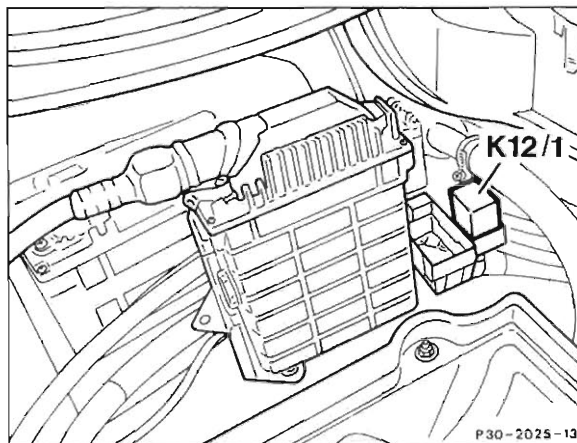
Cruise control,

engine 602.962

The operation and construction of the cruise control is similar to that of model 201.128 (model year 1987).

To avoid affecting cruise control during partial load operation, the engine overload protection switchover valve (Y30) is activated by a new relay (K12/1), eliminating its function during cruise control operation.

K12/1 Cruise control/engine overload protection relay

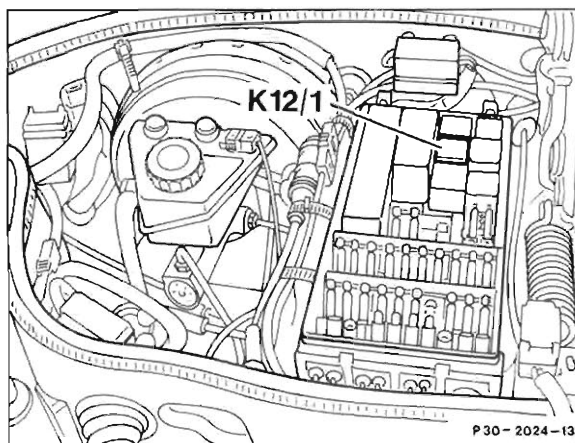


Engine 603.970

The operation and construction of the cruise control is identical to that of engine 603.960 (model year 1987).

To avoid affecting cruise control during partial load operation, the engine overload protection switchover valve (Y30) is activated by a new relay (K12/1), eliminating its function during cruise control operation.

K12/1 Cruise control/engine overload protection relay



Repair note:

Test specifications for reference resistor (part number 007 545 54 32) for engine 602.962

Socket identification at the reference resistor

E-G k Ω	E-F k Ω	E-B k Ω	E-D Ω	D-H Ω	D-C Ω	A-D Ω
980-1032	48.9-50.9	1960-2040	∞	under 10	∞	under 10

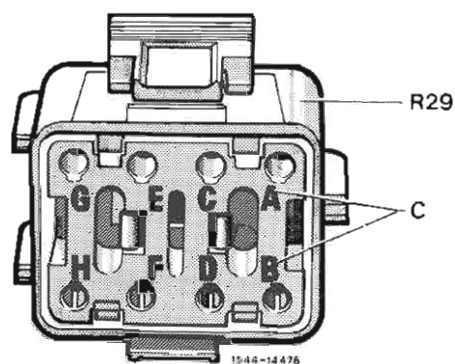
Repair note:

Test specifications for reference resistor (part number 009 545 14 32) for engine 603.970

Socket identification at the reference resistor

E-G k Ω	E-F k Ω	E-B k Ω	E-D Ω	D-H k Ω	D-C Ω	A-D Ω
1660-1720	39.4-41	1470-1530	∞	5.01-5.21	∞	< 10

R29 Cruise control reference resistor
C Socket designation



Note: Pocket multimeters Thorn-Emi Avometer 2003 and Fluke 23-DB are suitable for measuring these data. Sun DMM5 does not have the range, however.

Automatic transmission, model 124.128

General information

These models get transmission 722.418 as standard equipment (see installation survey, test and pressure specifications).

This transmission starts in first gear in every forward gear position, and shifts into first gear when coming to a stop.

Control pressure cable adjustment works as on model 126.125.

Vacuum control for the modulator pressure differs from engine 602 in the pneumatic (vacuum) control.

The temperature dependent transmission control by the temperature switch (S25/6) and the switchover valve (Y29) are deleted (see vacuum diagram, Group 07.1). The intake manifold air pressure acts on the vacuum amplifier also with a cold engine by this modification. When the transmission is cold, the shift quality is controlled by a modification in the valve body.

For the operation of the park interlock mechanism, see the model 129 introduction.

Automatic transmission, Models 126.134/135

General information

These models are fitted with transmission 722.361 as standard equipment (see installation survey, test and pressure specifications).

This transmission starts in first gear in every forward gear position, and shifts into first gear when coming to a stop.

Control pressure cable adjustment works as on model 126.125.

Vacuum control for the modulator pressure differs from engine 603.960 in the pneumatic (vacuum) control.

The temperature dependent transmission control by the temperature switch (S25/6) and the switchover valve (Y29) are deleted (see vacuum diagram, Group 07.1). The boost pressure acts on the vacuum amplifier also with a cold engine by this modification. When the transmission is cold, the shift quality is controlled by a modification in the valve body.

For the operation of the park interlock mechanism, see the model 129 introduction



Suspension

The suspension tuning was revised.

Test and adjustment specifications, model 124.128

Cross-reference, Springs - damper struts/shock absorbers

Model	Front spring part number	Front damper strut part number	Rear spring part number	Rear damper strut part number
124.128	124 321 21 04 124 321 22 04	124 320 27 30	124 324 11 04 124 324 16 04	124 320 12 31

Front axle – point number

Base points ¹⁾	60
Sliding-lifting roof	3

¹⁾ The base points include: automatic transmission, automatic climate control, head lamp cleaning system, electrically adjustable front seats, and driver's airbag.

Cross-reference, front springs - rubber mounts

Total points	Front spring part number	Height of rubber mounts (mm) according to spring color code	
		blue	red
58 – 62	124 321 21 04	18	23
63 – 69	124 321 22 04	8	13

Rear axle – point number

Base points ¹⁾	29
Sliding-lifting roof	3

¹⁾ The base points include: automatic transmission and rear headrests.

Cross-reference, rear springs - rubber mounts

Total points	Rear spring part number	Height of rubber mounts (mm) according to spring color code	
		blue	red
23 – 30	124 324 16 04	13	18
31 – 32	124 324 11 04	8	13

Test and adjustment specifications, models 126.134/135**Cross-reference, springs - shock absorbers**

Model	Front spring part number	Front shock absorber part number	Rear spring part number	Rear damper strut part number
126.134/135	126 321 18 04	126 320 07 30	116 324 08 04 116 324 11 04	126 320 08 31

Front axle – point number

Base points ¹⁾	61
Sliding-lifting roof	2

¹⁾ The base points include: automatic climate control, electrically adjustable front seats, driver's side air bag, electric windows, cruise control.

Cross-reference, front springs/rubber mounts

Total points	Front spring part number	Height of rubber mounts (mm) according to spring color code	
		blue	red
56 – 61	126 321 18 04	8	13
62 – 68	126 321 18 04	13	18

Rear axle – point number

Base points 1)	27
Sliding-lifting roof	3

1) The base points include: electric windows.

Cross-reference, rear springs/rubber mounts

Total points	Rear spring part number	Height of rubber mounts (mm) according to spring color code	
		blue	red
21 – 27	116 324 11 04	13	18
28 – 36	116 324 08 04	8	13



Rear axle

Model 124.128

The rear axle corresponds in design and construction to that of model 124.133.

Gear set and rear axle shaft

Rear axle center piece	Ring gear diameter	185 mm
	Ratio	2.65:1
	Number of teeth	45 : 17
Gear toothed rotor on the pinion gear for ABS	Number of teeth	36
Pinion shaft flange	Diameter	90 mm
Rear axle shaft with constant velocity joint	Ball diameter	22.225 mm
	Inner bolt circle diameter	94 mm
	Shaft diameter	25 mm
	Grease capacity, MB lubricant	120 g

Models 126.134/135

The rear axle had to be adapted to the increased engine torque, and thus models 126.134/135, in contrast with model 126.120, get the rear axle center piece with the 210 mm ring gear diameter. To improve the driving comfort the constant velocity joints of the rear axle shaft are centered to the connecting flange.

Gear set and rear axle shaft

Automatic transmission		4-speed
Rear axle center piece	Ring gear diameter	210 mm
	Gear ratio	2.82:1
	Number of teeth	48 : 17
Number of teeth on the pinion gear shaft for ABS	Number of teeth	34
Pinion shaft flange	Diameter	110 mm
Rear axle shaft with constant velocity joint	Ball diameter	22.225 mm
	Inner bolt circle diameter	94 mm
	Shaft diameter	27 mm
	Grease capacity, MB lubricant	120 g

Wheels, chassis measurement

Crossreference of wheels - tires - recommended tire brands

Model	Rim designation part number (scope)	Summer tires, tubeless		Winter tires, tubeless	
		Designation	Tire brand	Designation	Tire brand
124.128	Light alloy 6 ¹ / ₂ J × 15 H 2 ET 48 124 401 07 02	195/65 R 15 91 H	CONTINENTAL CH 51 MICHELIN MXV PIRELLI P600	195/65 R 15 91 T M + S	CONTINENTAL SUPER CONTACT TS 740 DUNLOP SP WINTER
126.134/ 135	Light alloy 6 ¹ / ₂ J × 15 H 2 ET 21,5 126 400 41 02	205/65 R 15 94 H	MICHELIN MXV	205/65 R 15 94 T M + S	CONTINENTAL SUPER CONTACT TS 740 GOODYEAR ULTRA GRIP 3

The light alloy wheels and the wheel bolts required to attach the wheels are familiar from the previous models 124 and 126.


Tire pressure labels:

Model 124.128

Basic color: silver

Color of lettering: blue

Tire pressure cold tires



normal load	27 psi	27 psi
maximum load	28 psi	33 psi

Warm tires up to: + 4 psi
For driving more than 100 mph: + 8 psi


124 584 47 39 ○

Models 126.134/135

Basic color: silver

Color of lettering: green

Tire pressure cold tires



Summertires	normal load	26 psi*	26 psi*
	maximum load	27 psi*	35 psi*
Wintertires		33 psi	38 psi

* Warm tires up to: + 7 psi
 * For driving more than 100 mph: + 7 psi

126 584 45 39 O

P40-0043-13

Chassis measurement

Chassis measurement, special tools, and test and adjustment specifications are familiar from the previous models 124 and 126.

Driveshaft

Model		124.128	126.134/135
Transmission		automatic	automatic
Driveshaft tube diameter	front	60 mm	60 mm
	rear		45 mm
Drive flange bolt hole diameter		90 mm	110 mm
Flexible coupling	front	axially flexible	torsionally rigid
	rear	torsionally rigid	torsionally rigid



Technical data

Engine

Model	124.128	126.134/135
Engine	602.962	603.970
Operation	4-cycle diesel, MB prechamber design	4-cycle diesel, MB prechamber design
Aspiration	Turbocharged	Turbocharged
Number of cylinders	5	6
Cylinder arrangement	In-line, 15° inclination	In-line, 15° inclination
Bore/stroke	87.0/84.0 mm	89.0/92.4 mm
Effective displacement	2497 cm ³	3449 cm ³
Compression ratio	22:1	22:1
Firing order	1-2-4-5-3	1-5-3-6-2-4
Maximum engine speed	4600 rpm	4250 rpm
Nominal maximum power	90 kW/120 hp (SAE) at 4600 rpm	100 kW/133 hp (SAE) at 4000 rpm
Maximum torque	164 lb-ft/2400 rpm 223 Nm/2400 rpm	228 lb-ft/2000 rpm 310 Nm/2000 rpm
Crankshaft bearings	6 (multi-component anti-friction bearings)	7 (multi-component anti-friction bearings)
Valve arrangement	Overhead	Overhead
Camshaft arrangement	Overhead camshaft (ohc)	Overhead camshaft (ohc)
Oil cooling	Air/oil cooler	Air/oil cooler
Cooling	Pressurized liquid cooling	Pressurized liquid cooling
Fan	Metal fan with visco-fan clutch	Plastic fan with visco-fan clutch
Lubrication	Recirculated, pressurized oil via gear-type pump	Recirculated, pressurized oil via gear-type pump
Oil filter	Combination full flow and bypass filter	Combination full flow and bypass filter
Air filter	Cartridge-type dry air filter	Cartridge-type dry air filter

Service products, filling capacities in approx. liters

Model			124.128	126.134/135
Engine			602.962	603.970
Fuel tank/ Reserve			70/9.0	90/12.5
Engine	Engine oil ¹⁾	During oil and filter change	7.5	8.0
		Oil pan up to the marks on the dipstick: max./min.	6.0/4.0	6.5/4.5
Cooling system with heater	Coolant ¹⁾		9.0	10.0
Brake system	Brake fluid ¹⁾		0.48	0.53
Automatic transmission	Automatic transmission fluid (ATF) ¹⁾	Initial filling	6.6	7.3
		Oil change	5.5	6.2
Rear axle			1.1	1.1
Power steering			1.0	1.3

¹⁾ Refer to latest edition of Factory Approved service Products service information in group 00.

Special tools

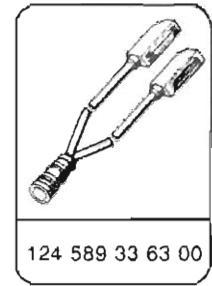
Part number
Description

Group/Category

124 589 33 63 00

07/B

Test cable for CIS-E, EDS and 4MATIC (in
conjunction with socket box tester
124 589 00 21 00 or 129 589 00 21 00)
as of MY 1988



124 589 19 21 00

07/B

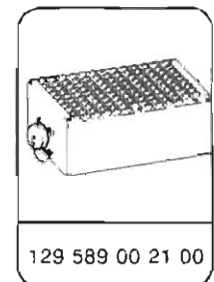
Impulse counter for on-board diagnostic
systems (i. e., CIS-E. climate control. SRS
system.

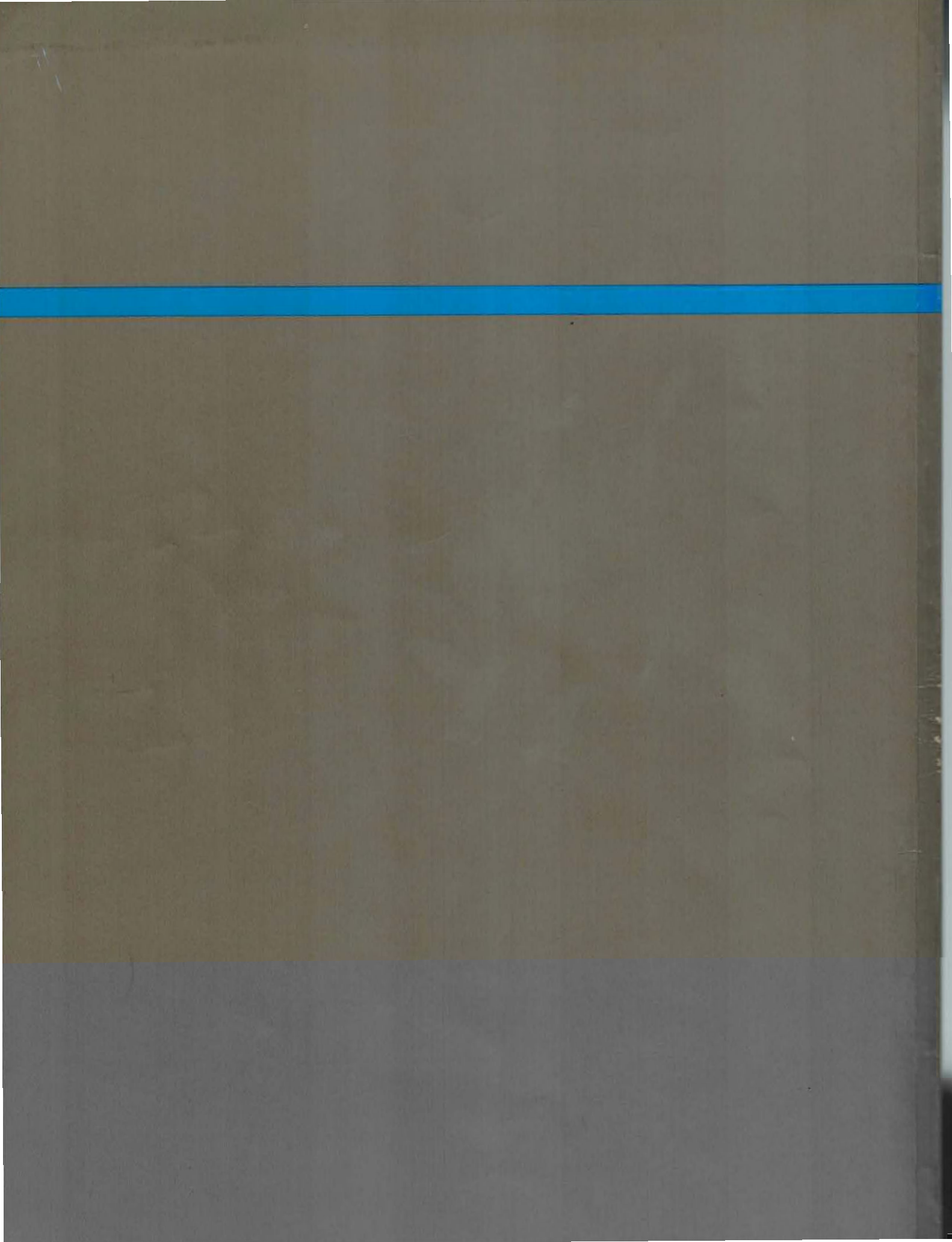



129 589 00 21 00

83/B

Socket box tester (126 terminals);
used for automatic climate control testing
and diagnosis of future systems.
Used in conjunction with test cable(s).





Model Year 1990/91  Models 124.1 and 126.1 Turbodiesels