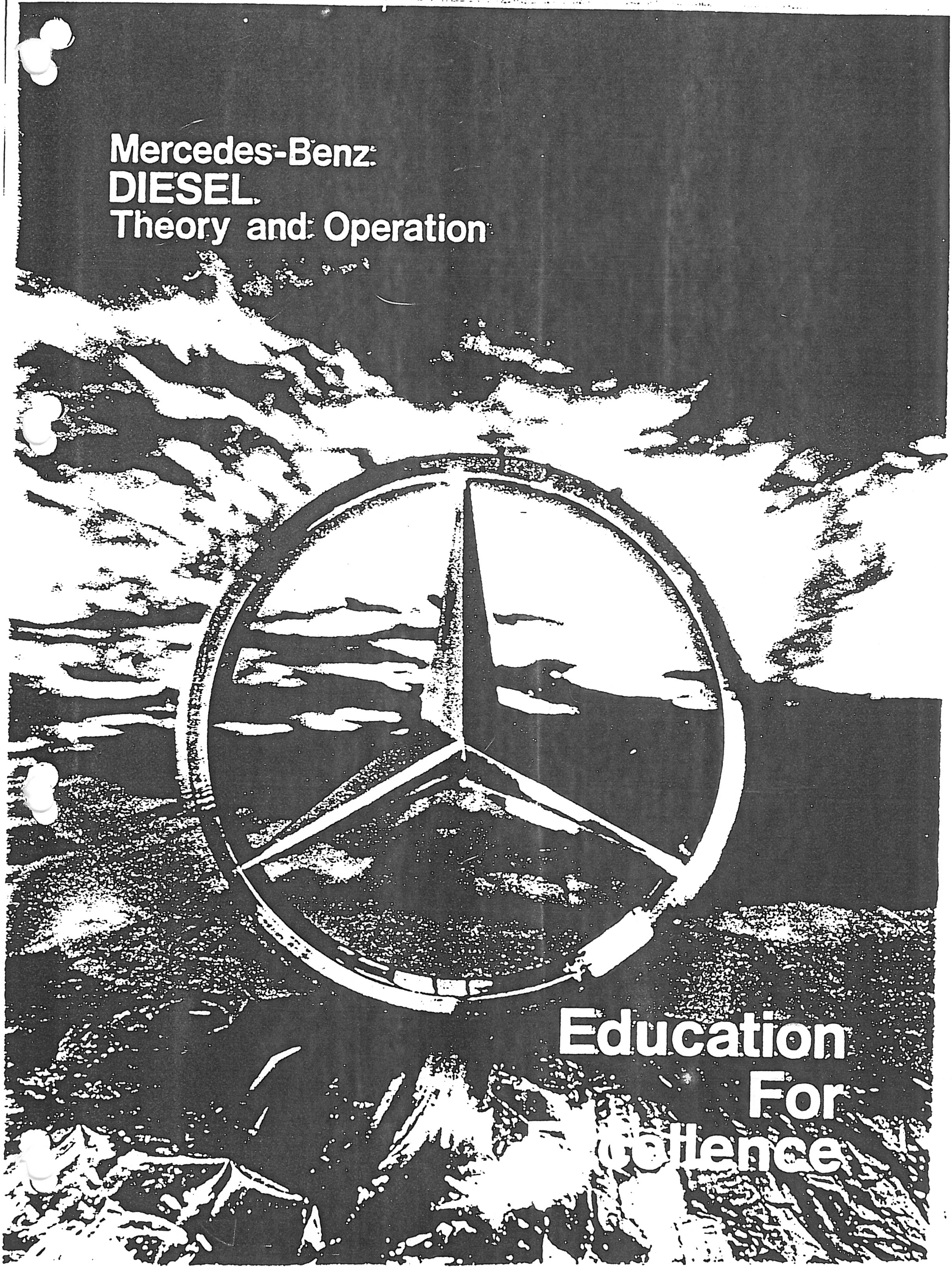
Mercedes-Benz
DIESEL
Theory and Operation



Education
For
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CHECKING VACUUM MODULATOR VACUUM CONTROL SYSTEM.

1. Start engine.

2. Release cold idle speed increase - rotate dash knob clockwise to release.

3. Remove vacuum line (4) black/white from vacuum change over valve, and connect vacuum gauge to valve (15).

4. At idle, vacuum gauge should read approx. 0.7 to 0.8 Bar, if this is not the case:

   a) Lines (2) and (3) as diagram have been installed incorrectly (mixed up).

   b) Vacuum change-over valve adjustment incorrect - refer page 2.

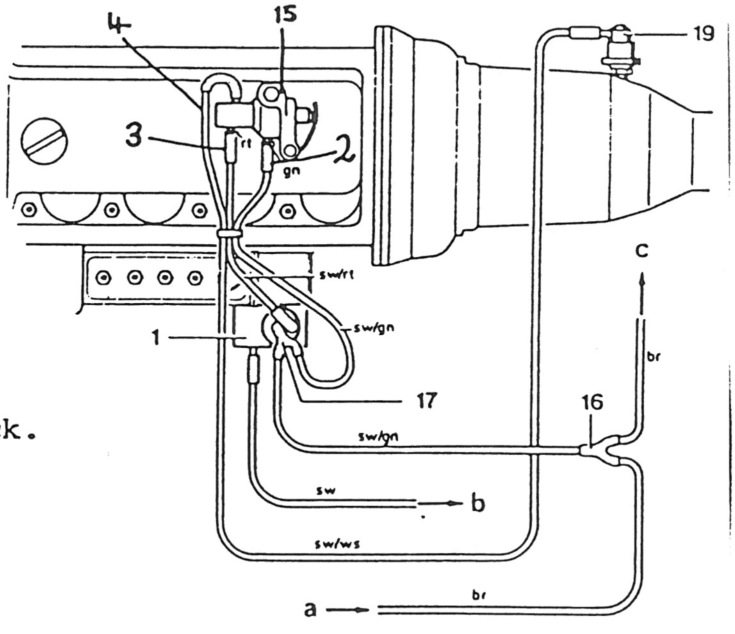
   c) Vacuum lines leaking.

5. Take up free play in throttle linkage without increasing engine speed. Vacuum must drop to approx. 0.4 Bar. Then open throttle - vacuum reading must now decrease.

   If this does not happen:

   (a) System leaks.

   (b) Vacuum control unit out of adjustment or faulty - refer page 3.



1. Vacuum control valve
4. Vacuum line to modulator cell.
15. Changeover valve
16. Distributor
17. Distributor
19. Vacuum box.
a. Vacuum line from pump/brake unit.
b. Vent line to passenger compartment.
c. Vacuum line to steering lock.

br. = brown
gn = green
rt = red
sw = black
ws = white.

6. . Stop engine and open throttle progressively, check whether vacuum drops off uniformly, vacuum should be completely gone as soon as the full throttle stop on injection pump is attained.

   (a) If not, adjust or replace vacuum control valve (1). Refer page 3.

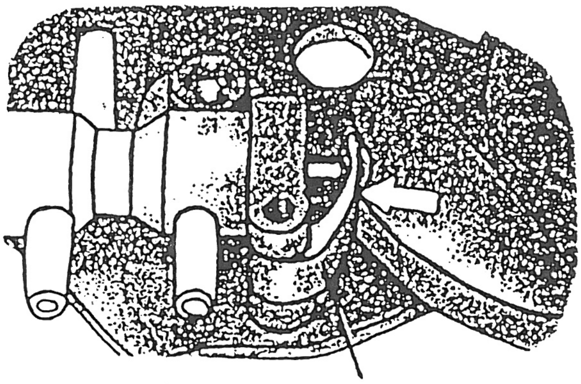
CHECKING CHANGE-OVER VALVE ON DIESEL ENGINE VEHICLES WITH VACUUM MODULATOR.

1. Check accelerator linkages for full throttle - adjust Bowden as required.

   a) Ensure cold idle speed increase is released (turn dash knob clockwise to release).

2. A). CHECKING CHANGE-OVER VALVE ADJUSTMENT.

On vehicles prior to January 1981, as diagram, ensure clearance of '0' to '0.5mm' between throttle regulator cam and plastic leaf of change-over valve - indicated by arrow.

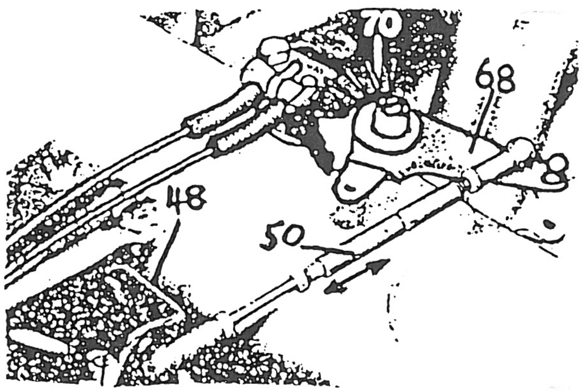


Plastic Leaf

B) CHECKING CHANGE-OVER VALVE ADJUSTMENT.

On vehicles from January 1981, with cover over valve as diagram (item 70).

Disconnect throttle linkage from injection pump, carefully pull bell crank (48) until throttle cam (68) lightly rests against plastic leaf of change-over switch.



C) ADJUSTING BOTH VERSIONS.

Adjust linkage from injection pump until ball joint of rod fits free of tension into bell crank (48), with linkage (50) pulled apart.

ADJUSTMENT OF VACUUM CONTROL VALVE FOR DIESEL ENGINE VEHICLES WITH VACUUM MODULATOR.

1. Check for full throttle - adjust if required on Bowden Cable.

2. Loosen 10mm mounting bolts (2) on vacuum control valve approx. (2) rotations.

3. By hand, move throttle linkages to full throttle position and hold.

4. Turn vacuum control valve clockwise until <u>internal</u> stop is felt.

5. If mounting bolts touch end of adjusting slots before internal stop is reached, a worn driving dog is at fault, fit repair kit, refer Service Information 27/58, for repair instructions and Spare Parts number.

   Refit control valve and adjust as previously mentioned.

6. Hold control valve lightly against internal stop and re-tighten 10mm mounting bolts (2).

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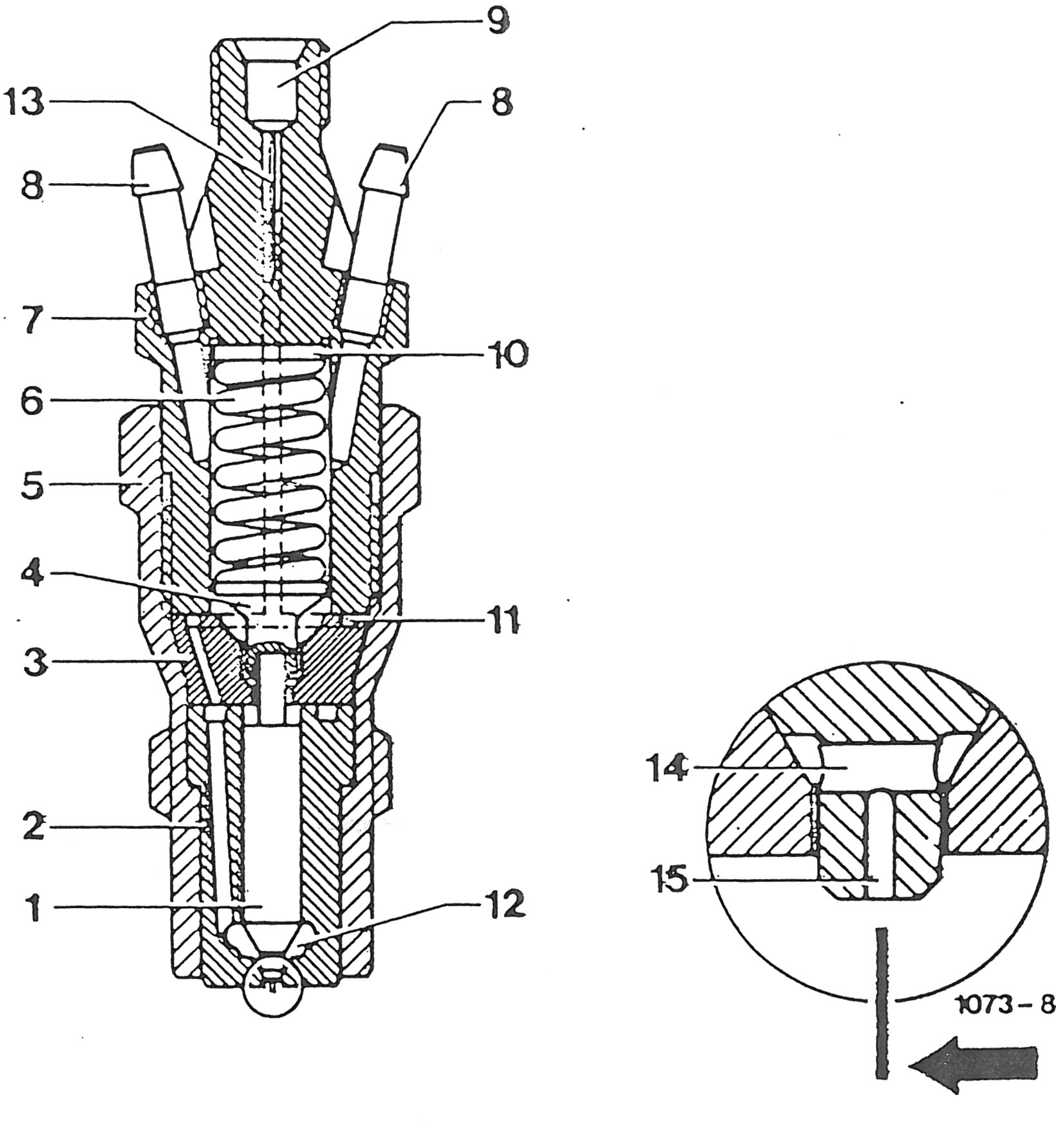

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DIESEL ENGINE OPERATION

COMPARISON OF GASOLINE AND DIESEL ENGINES

Despite the Diesel's distinctive character, many parallels can be drawn between gasoline and Diesel engine design.

Both are internal combustion engines.

For internal combustion to occur, three things must interact in the combustion chamber: AIR, FUEL, and HEAT (for ignition). In the gasoline engine, air and fuel are mixed, and heat for ignition is provided by an electric spark.

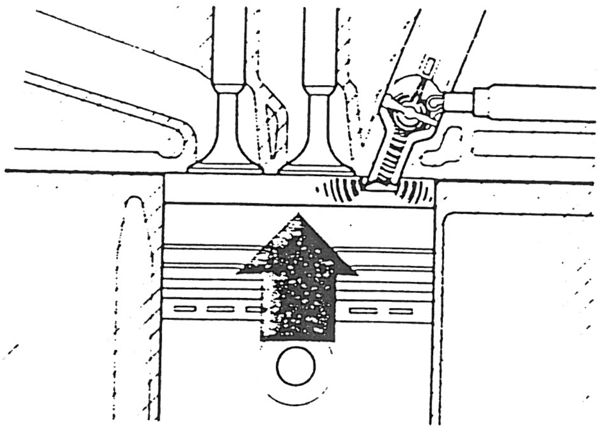


Figure 1

In the Diesel engine, the air is heated and ignition occurs when fuel is injected into the combustion chamber. (Fig. 1.)

The Diesel generates the heat necessary for ignition by compressing air. (Fig. 2.) This principle is illustrated in the warming of a bicycle tire pump when inflating a tire. However, Diesel compression is much greater and temperatures are higher. The compression ratio in the Mercedes Diesel engine is 21:1

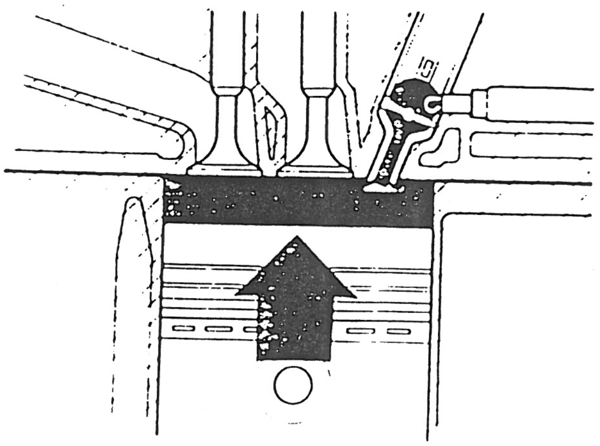


Figure 2

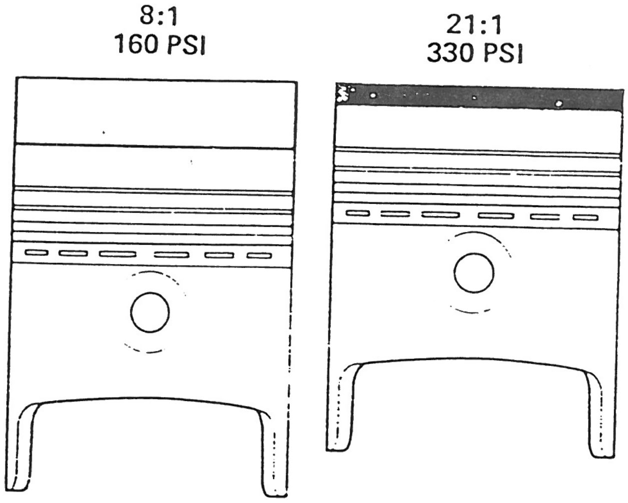
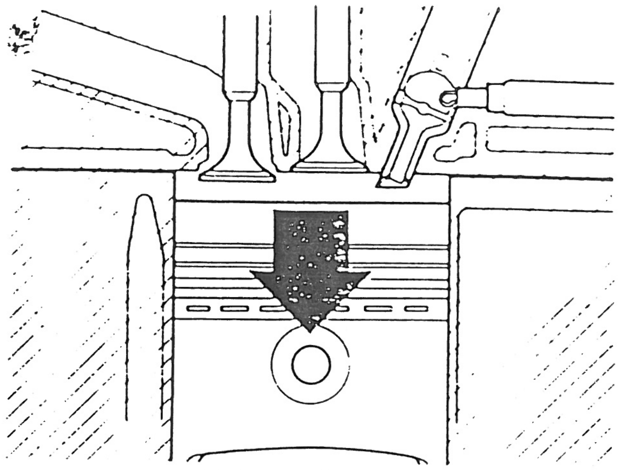


Figure 3

with a compression pressure of about 330 PSI. This compares to a gasoline engine which has a 8:1 compression ratio and a pressure of about 160 PSI. (Fig. 3.)

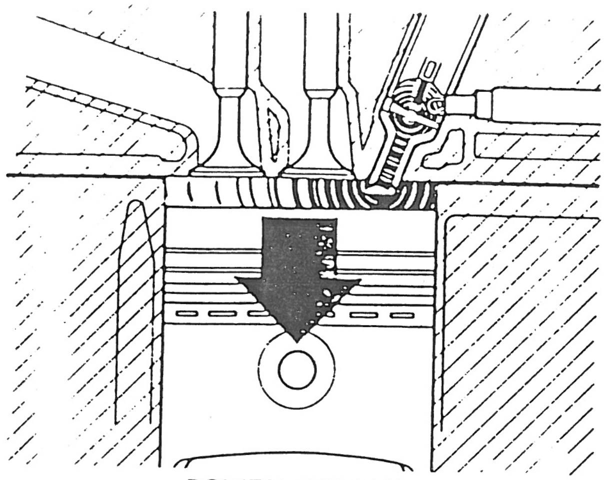
In summary, the basic difference between the gasoline and Diesel engines is that the Diesel operates under much higher compression pressure and does not have an electrical ignition system.

THE DIESEL FOUR STROKE CYCLE



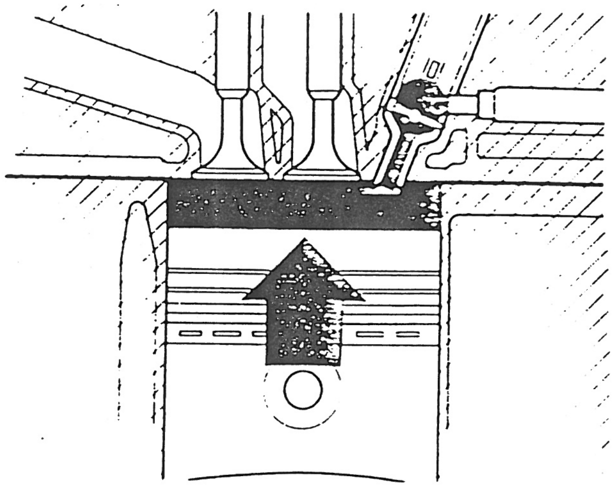
INTAKE STROKE

Figure 4



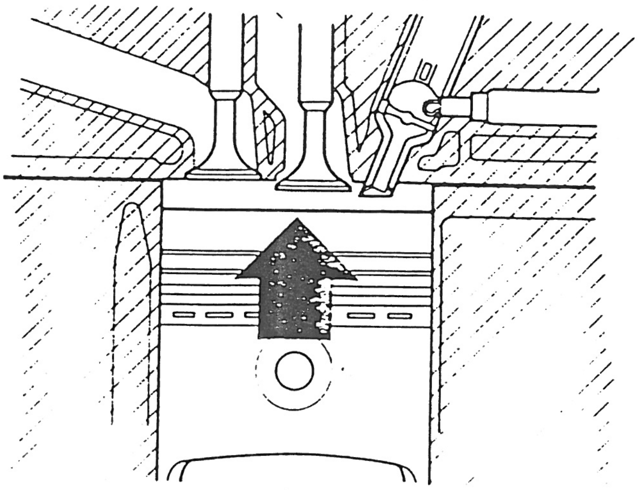
POWER STROKE

Figure 6



COMPRESSION STROKE

Figure 5



EXHAUST STROKE

Figure 7

Just like the Mercedes-Benz gasoline engines, the Mercedes-Benz Diesel uses a four stroke cycle.

Intake Stroke

On the intake stroke of the Diesel, the piston moves downward with the intake valve open. The vacuum, created by the downward stroke, draws air into the cylinder. (Fig. 4.)

Compression Stroke

The crankshaft then moves the piston upward on the compression stroke. Both intake and exhaust valves are closed and the air is heated as it is compressed. (Fig. 5.)

Power Stroke

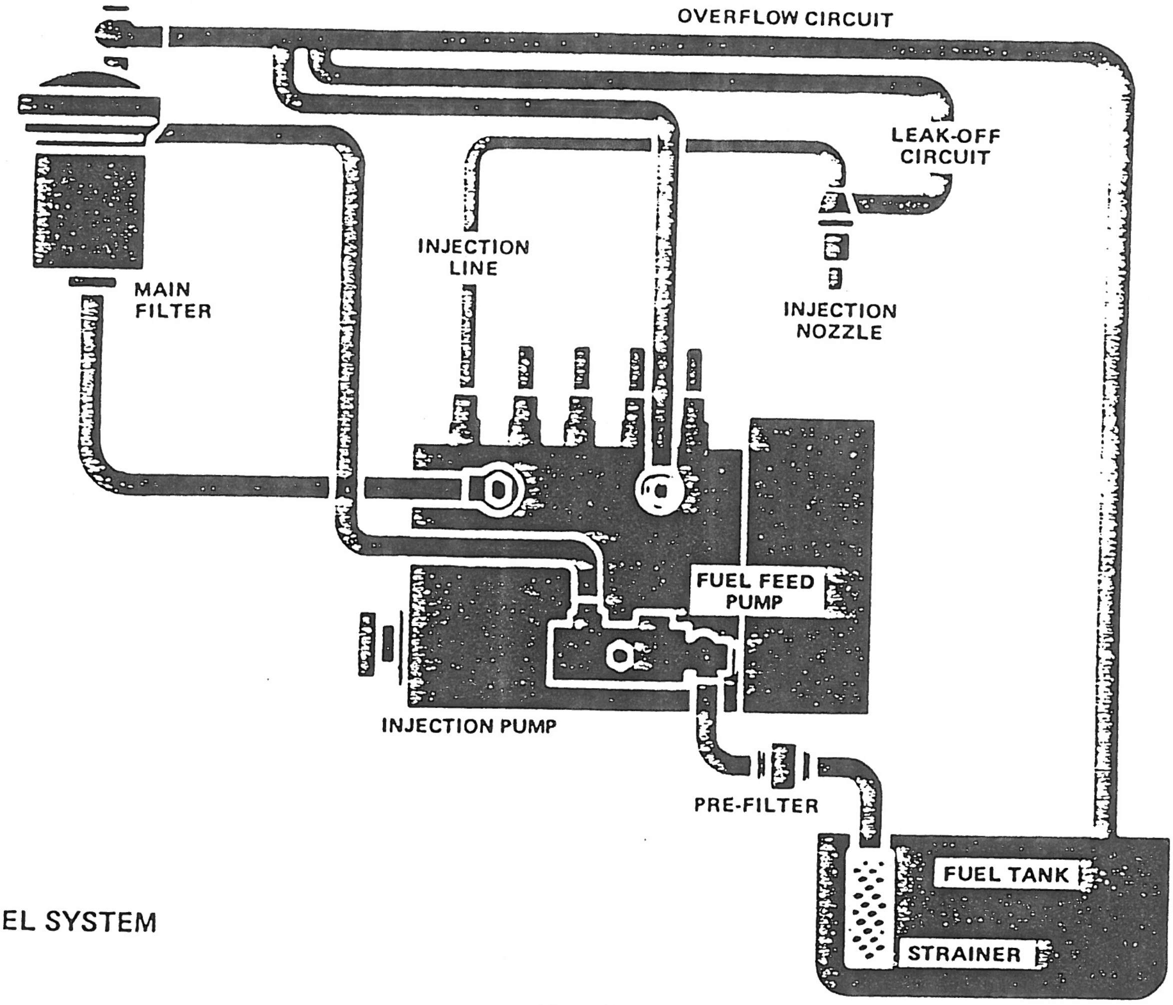
Just before the piston reaches top dead center, fuel is injected into a pre-combustion chamber (see Diesel Combustion chapter) and combustion occurs. This forces the piston down for the power stroke. (Fig. 6.)

Exhaust Stroke

The crankshaft then moves the piston upward, forcing the burned gases out in the exhaust stroke. (Fig. 7.)

FUEL DELIVERY, INJECTION AND CONTROL

SYSTEM GENERAL LAYOUT (Fig. 8.)



FUEL SYSTEM

Figure 8

The fuel feed pump, located on the injection pump, draws fuel from the fuel tank through the tank strainer and the in-line pre-filter. The fuel feed pump then pumps the fuel under low pressure through the main filter to the injection pump.

This three stage filteration is necessary to ensure that no particulate matter in the fuel reaches the injection pump and injectors. Because of the precise tolerances in the injection pump and injectors, these components could malfunction if particulate matter is not filtered out of the fuel.

The fuel feed pump always supplies more fuel than is needed for injection into the engine. This prevents the formation of air bubbles in the fuel lines and provides for a constant delivery pressure to the injection pump. Excess fuel is returned to the fuel tank via the overflow circuit.

Completing the flow to the combustion chamber are the injection nozzles which are connected to the injection pump via individual injection fuel lines. A leak-off circuit from the injection nozzles "tees" into the overflow circuit to return the fuel to the fuel tank.

The system is equipped with a hand primer pump. This is used for priming the system without operating the engine.

FUEL INJECTION PUMP (Fig. 9.)

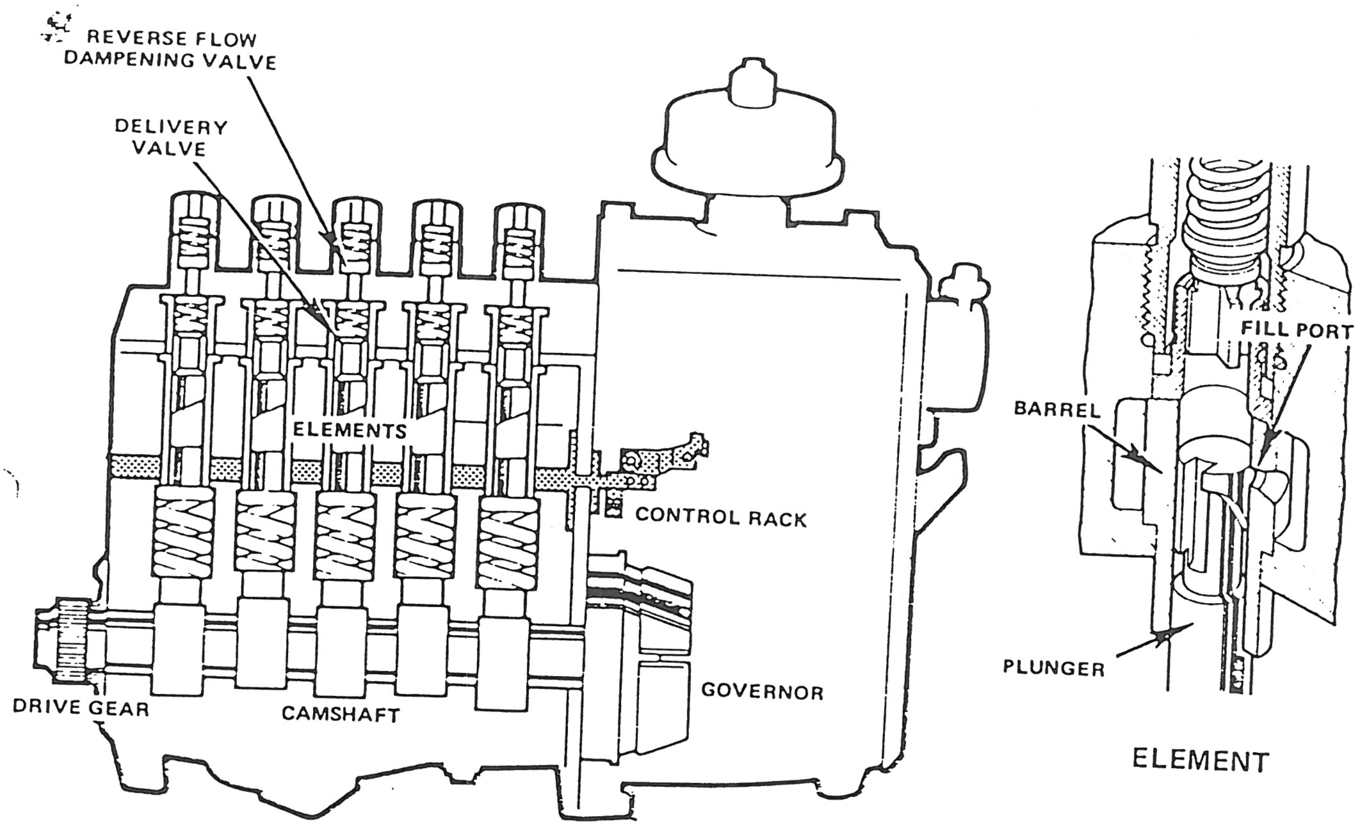


Figure 9

The fuel injection pump is precisely machined to deliver a metered amount of fuel under sufficient pressure to each injection nozzle. The pump consists of: the housing, the camshaft with attached drive gear, the elements, the control rack, the governor, a delivery valve, and a reverse flow dampening valve. Each element consists of a barrel and a plunger.

One element and camshaft lobe are used for each cylinder. A four cylinder Diesel engine injection pump has four elements and a four lobe camshaft, while a five cylinder engine pump has five elements and a five lobe camshaft. An additional lobe on the camshaft is used to actuate the fuel feed pump.

FUEL DELIVERY, INJECTION AND CONTROL

As stated, each element consists of a barrel and a plunger. The plunger has two distinct motions – an up and down stroke, and rotation. (Fig. 10.) The

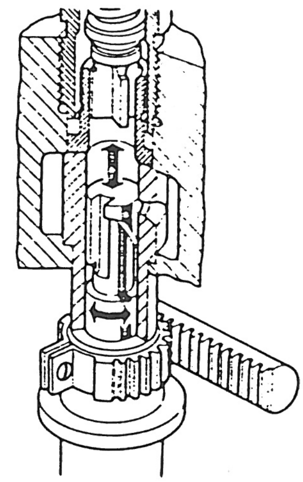


Figure 10

stroke is produced by the injection pump camshaft which is driven through the drive gear by the engine timing chain. This stroke is constant like the lift of an engine intake or exhaust valve. The stroke generates the fuel pressure necessary for injection.

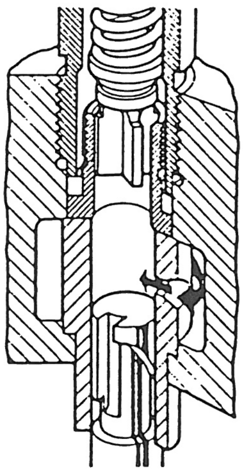


Figure 11

At the bottom of the stroke (Fig. 11.), the plunger uncovers the fill port, allowing fuel to enter and fill the barrel.

Delivery to the injection nozzle does not begin immediately when the plunger first lifts. It begins with complete ciosure of the fill port. (Fig. 12.)

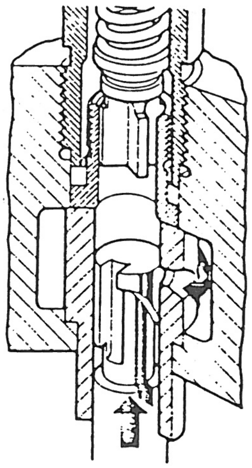


Figure 12

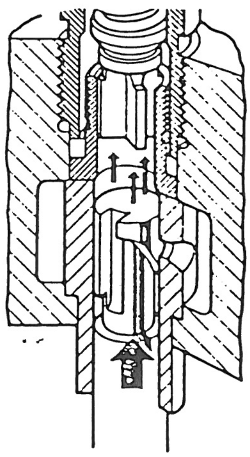


Figure 13

The rising plunger continues delivery to the injection nozzle as long as the fill port is covered. This period is called the EFFECTIVE STROKE of the element. (Fig. 13.)

When the rising plunger uncovers the fill port, pressure is relieved and no additional fuel is delivered to the injection nozzle. This ends the EFFECTIVE STROKE. (Fig. 14.)

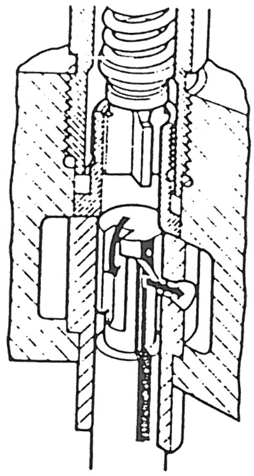


Figure 14

To meter the quantity of fuel delivered, the EFFECTIVE STROKE must be variable. Since the lower control edge is slanted in relation to the upper control edge, turning the plunger will vary the distance over which the fill port is covered. (Fig. 15.)

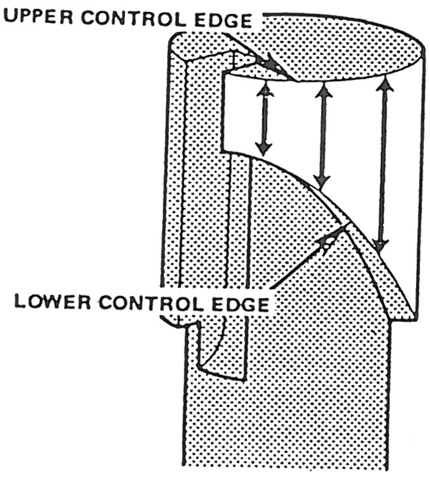


Figure 15

The EFFECTIVE STROKE depends on the distance from the upper control edge to the lower control edge.

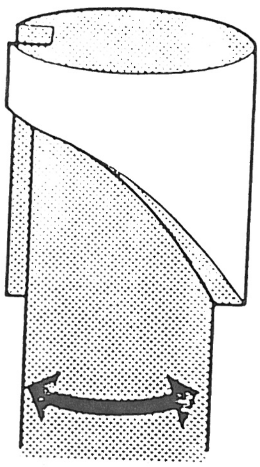


Figure 16

Thus, the metering of the fuel is made possible by the slant of the lower control edge and the turning of the plunger (varying the EFFECTIVE STROKE). (Fig. 16.)

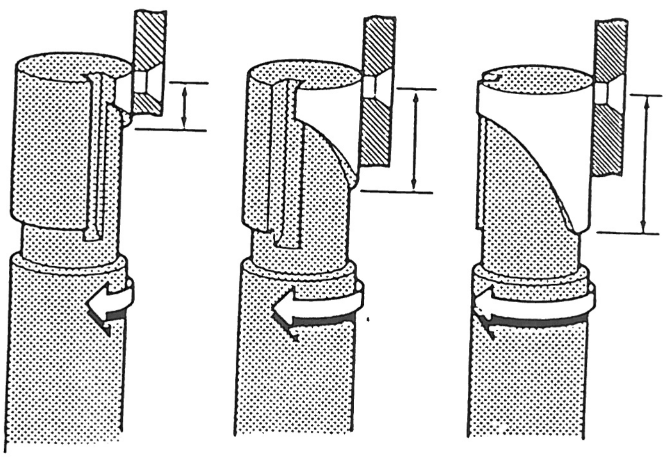


Figure 17

Therefore, while the plunger stroke will always be constant, the EFFECTIVE STROKE can be varied by turning the plunger. As the plunger is turned more and more, the distance over which the fill port is covered becomes greater and the effective stroke (Fig. 17.) becomes longer. The amount of fuel delivered to the injection nozzle increases as the effective stroke becomes longer.

FUEL DELIVERY, INJECTION AND CONTROL

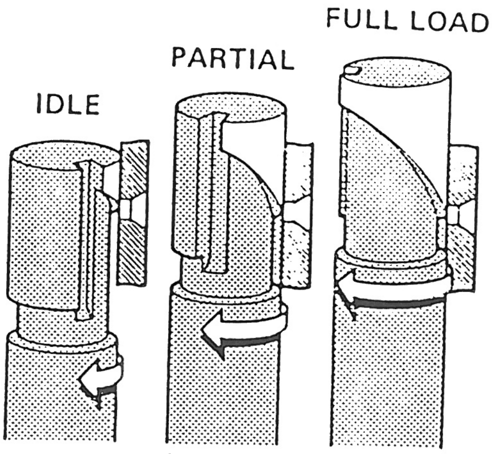


Figure 18

At full engine load, the fill port is covered for the maximum EFFECTIVE STROKE of the plunger and the maximum amount of fuel is delivered to the injection nozzle.

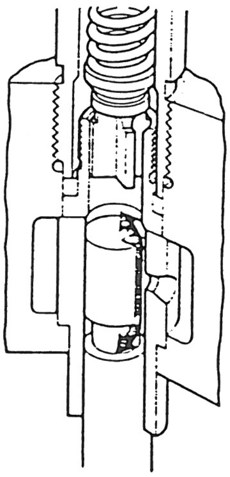


Figure 19

A vertical groove is incorporated on the plunger to allow engine shut down. When the fill port is open to this vertical groove, no pressure can be generated above the plunger. Thus, no fuel is delivered to the injection nozzle. This is the position of the element at engine shut down. (Fig. 19.)

The control rack connects to (meshes with) the plungers (one per cylinder) to provide the turning motion which controls the amount of fuel delivered to the injection nozzles from the injection pump.

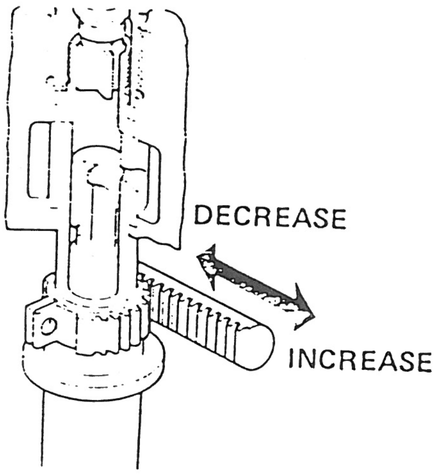


Figure 20

Moving the control rack forward, increases the quantity of fuel delivered, while moving it backwards decreases the quantity of fuel delivered to the injection nozzles. (Fig. 20.)

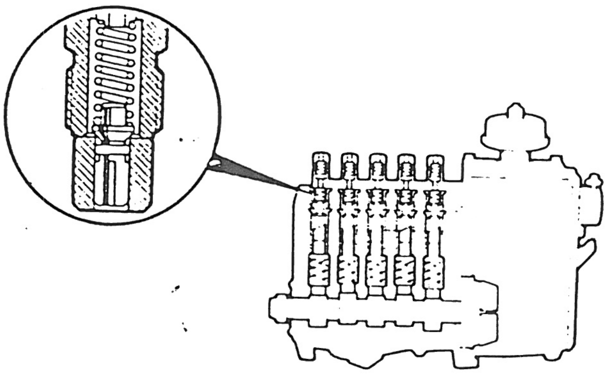


Figure 21

A delivery valve, located just above the barrel is is used to maintain residual pressure in the injection line. (Fig. 21.)

FUEL INJECTION NOZZLES

The fuel injection nozzles inject the fuel, delivered by the injection pump, into the pre-combustion chambers.

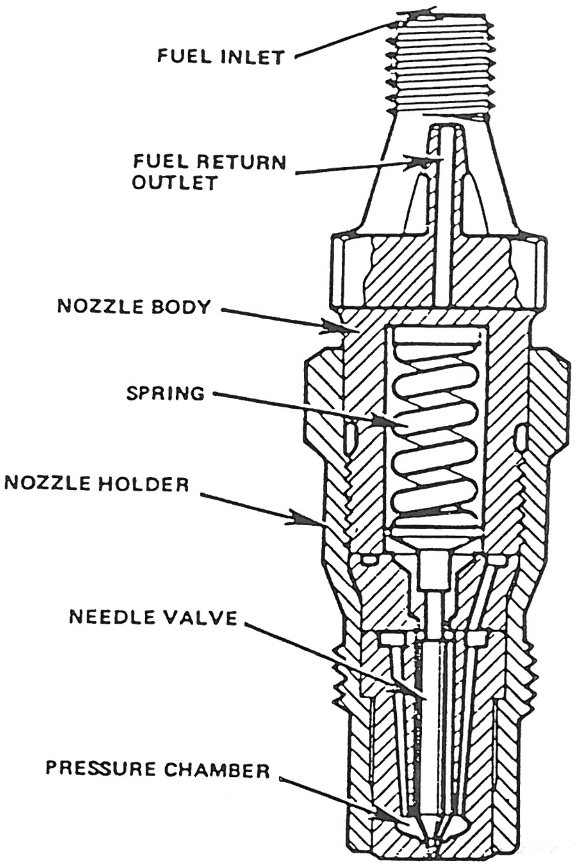


Figure 23

The nozzle assembly is made up of these main components: the nozzle holder, nozzle body, needle valve, pressure chamber, spring, fuel inlet and fuel return outlet. (Fig. 23.)

The nozzle is operated by the fuel pressure produced in the injection pump. The pressurized fuel acts on the face of the nozzle needle within the pressure chamber of the nozzle barrel. When the pressure rises to 1700 PSI, the needle valve is lifted from its seat and fuel is forced through the spray orifice. (Fig. 24.)

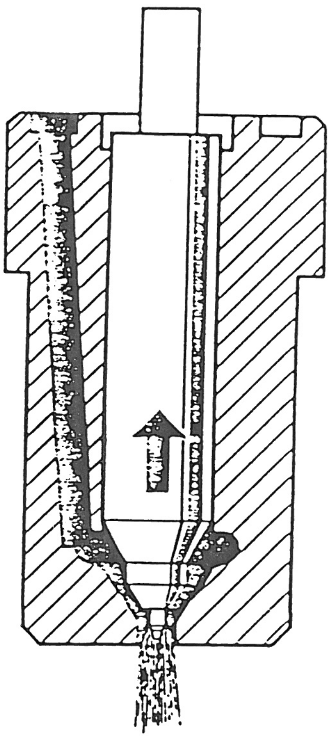


Figure 24

When the pressure in the pressure chamber is relieved by the ending of the effective stroke in the injection pump, the needle valve is forced against its

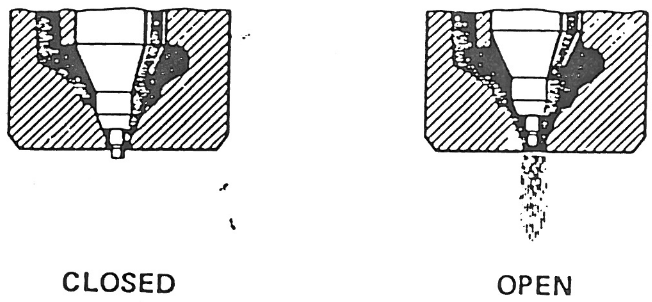


Figure 25

seat by spring pressure. The injector is now closed until the next pressure stroke occurs. (Fig. 25.)

During injection, a small amount of fuel passes by the needle to provide internal lubrication and cooling of the injector. This fuel is returned to the fuel tank through the return outlet and connecting lines. (Fig. 26.)

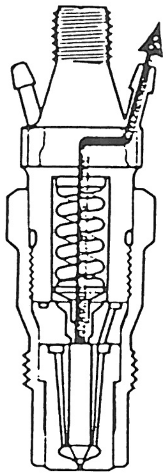


Figure 26

Mercedes-Benz has two injection nozzle variations. The standard design is found in all 1977 and earlier

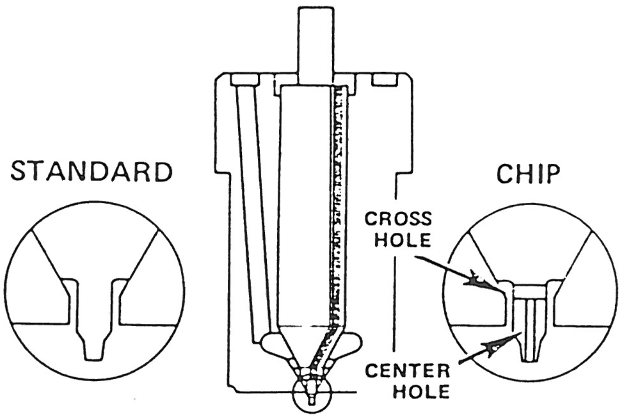


Figure 27

Diesel engines. The later version "CHIP" (center hole in pintle) nozzle is found in all Diesel engines beginning in 1978. (Fig. 27.) The "CHIP" nozzle provides for improved low speed running characteristics.

ENGINE POWER CONTROLS

Two types of systems are used to control the Diesel engine speed. The present system uses a combination of a mechanical linkage connected to the injection pump control rack, and a mechanical governor. An earlier system uses a pneumatic governor to control all engine speeds.

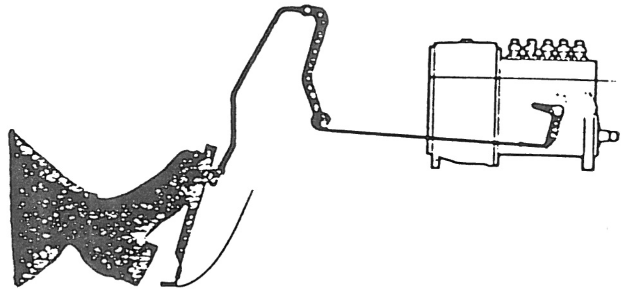


Figure 28

The type with the mechanical governor has the accelerator pedal connected to the injection pump control rack through a linkage which allows the governor to control the engine speed at idle and full load. Therefore, the accelerator pedal controls the engine speed *only between* idle and full load as it mechanically positions the control rack. (Fig. 28.).

Remember, the control rack varies the amount of fuel delivered to the injection nozzles by turning the plungers.

FUEL DELIVERY, INJECTION AND CONTROL

At idle and maximum engine RPM, the mechanical governor (Fig. 29.) positions the control rack via the internal pump linkage. The mechanical governor,

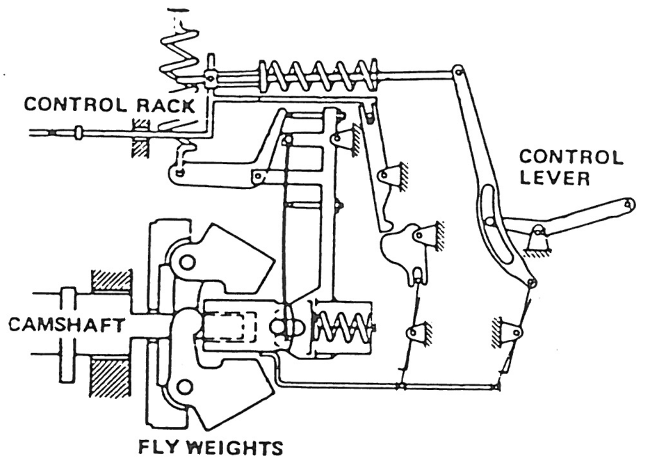


Figure 29

driven off the end of the injection pump camshaft, is a speed sensitive instrument.

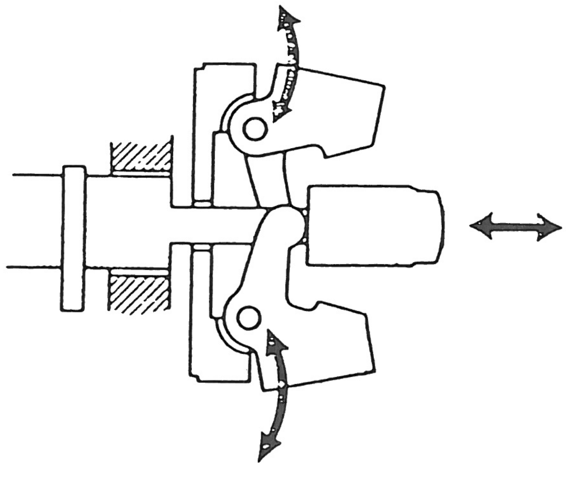


Figure 30

As the engine speed increases, the flyweights move outward similar to a gasoline engine distributor advance mechanism. (Fig. 30.) This movement is transmitted to the control rack which in turn rotates the plungers.

As stated, an earlier control system uses a pneumatic governor to control all engine speeds.

A diaphragm unit on the injection pump is connected to the control rack via the linkage. The air intake manifold uses a throttle butterfly valve. The butterfly is connected to the accelerator pedal linkage (Fig. 31.)

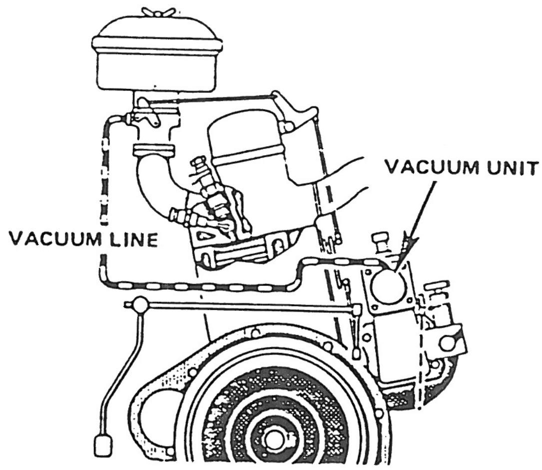


Figure 31

An auxiliary venturi is incorporated at the butterfly to provide a vacuum signal to the diaphragm unit on the injection pump. (Fig. 32.) This signal is transmitted via a vacuum line. (Fig. 31.)

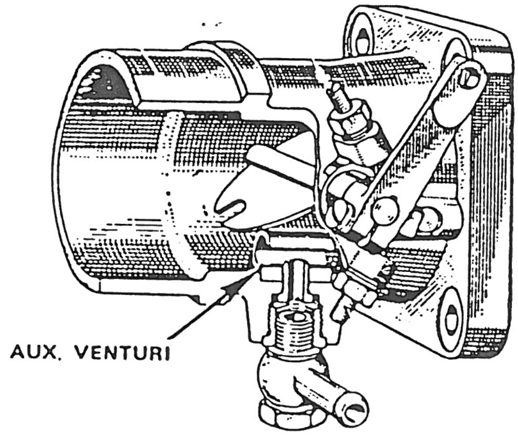


Figure 32

Movement of the throttle butterfly provides changes in the air velocity through the auxiliary venturi. Thus, changes in the throttle butterfly position give a corresponding change in the diaphragm position in the diaphragm unit. (Fig. 33.)

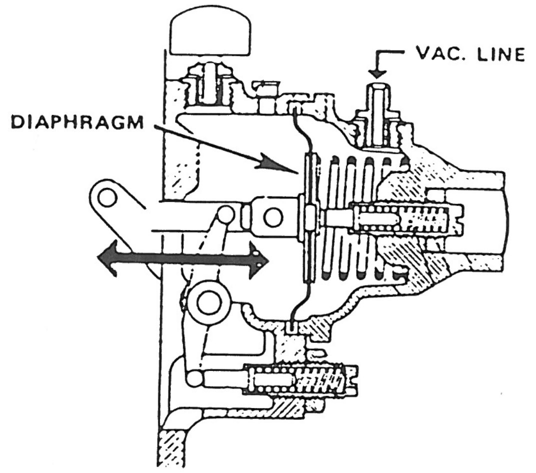


Figure 33

INJECTION TIMING

In order to achieve: high engine performance throughout the RPM range, low noise level at idle and good fuel economy, it is necessary to vary the beginning of fuel injection in relation to engine speed. This can be compared to the necessity for an ignition spark advance on gasoline engines.

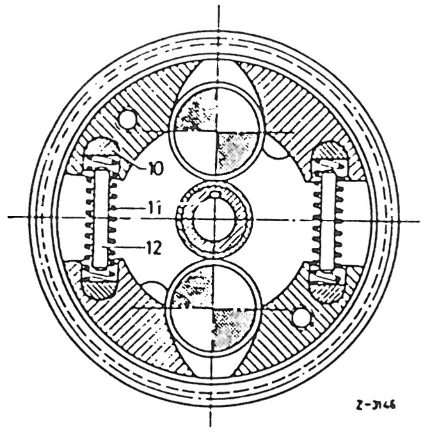


Figure 34

An advance unit, located at the driven end of the injection pump provides this function.

This operates the same way as a gasoline engine distributor advance unit. As the engine speed increases, flyweights move outward changing the position of the injection pump camshaft in relation to the drive sprocket which is driven by the engine timing chain. Fuel injection timing is advanced as engine speed increases and is retarded as engine speed decreases. (Fig. 34.)

FUEL DELIVERY, INJECTION AND CONTROL

SHUT-DOWN

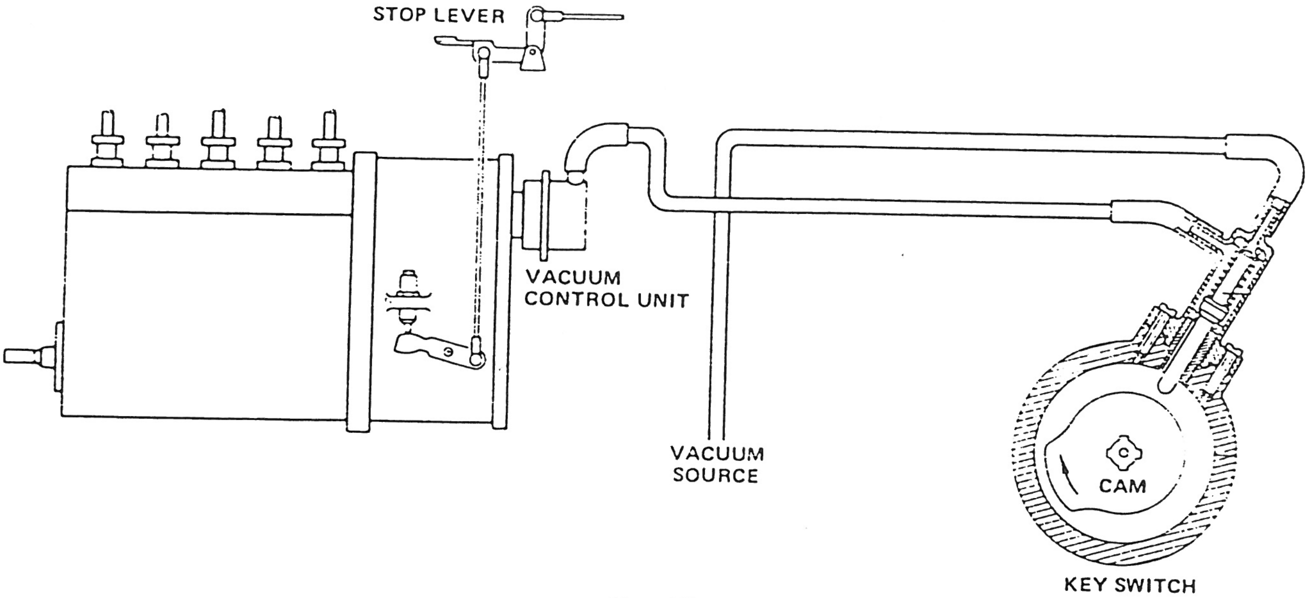


Figure 35

Mercedes-Benz Diesel engines, equipped with a mechanical injection pump governor, have a key switch controlled/vacuum actuated shut-down system. (Fig. 35.) A vacuum actuator on the injection pump is connected to the control rack via internal pump linkage. When the key switch is turned to "OFF," a cam in the key switch actuates a valve and vacuum is applied to the vacuum unit. This pulls the control rack to the "stop" position shutting down the engine. A mechanical "STOP" lever (Fig. 36.) is provided on the engine to allow shut-down if this will not occur when the key is moved to the "OFF" position.

Diesel engines equipped with the vacuum governoring system use a manually operated "STOP/START" control cable to position the control rack to the "STOP" position.

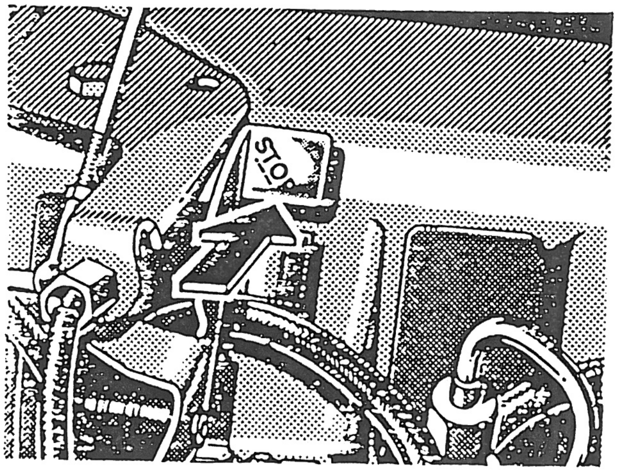


Figure 36

DIESEL COMBUSTION

PRE-COMBUSTION CHAMBER

All Mercedes-Benz passenger car Diesel engines use a pre-combustion chamber (Fig. 37.) to give quiet burning of the fuel injected by the nozzle. The pre-combustion chamber is located between the fuel

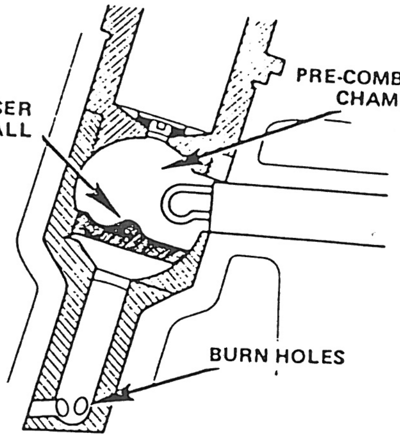


Figure 37

injection nozzle and the main combustion chamber in each cylinder. Each one is made-up of a diffuser ball and burn holes.

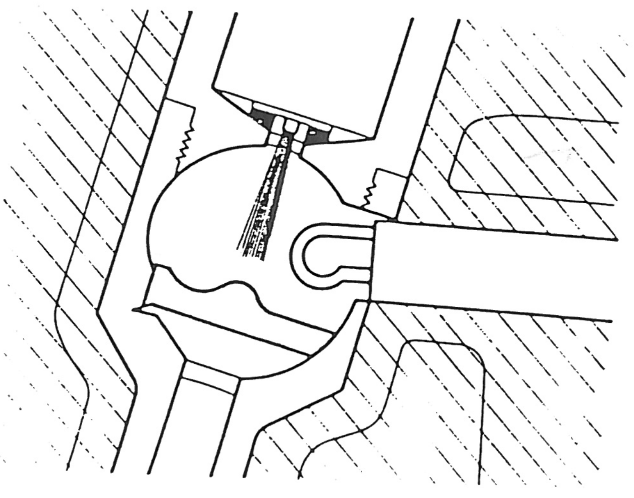


Figure 38

When fuel is injected into the pre-combustion chamber, it is directed at the diffuser ball. (Fig. 38.)

This disperses the fuel into a fine mist which enhances the combustion process. (Fig. 39.)

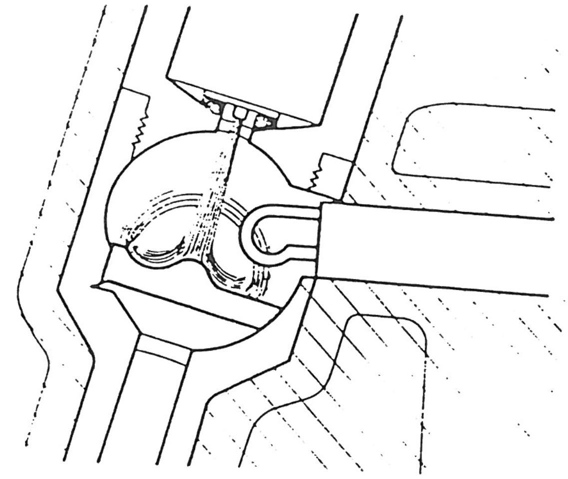


Figure 39

Combustion travels through the burn holes into the main combustion chamber. (Fig. 40.)

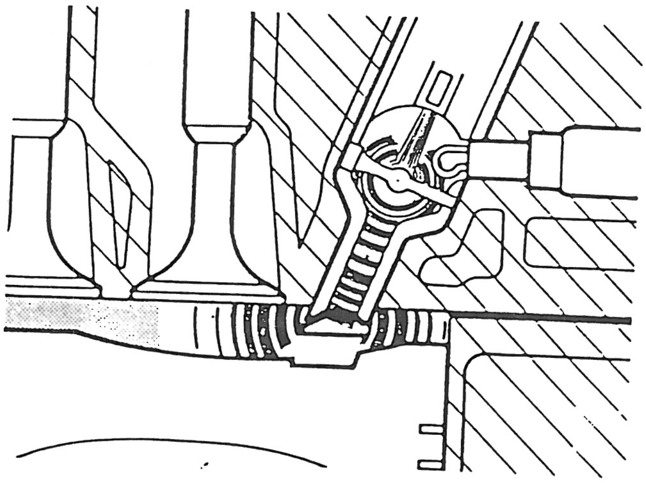


Figure 40

The crown of the Diesel piston has a pocket which provides clearance for the pre-combustion chamber. It is also hollowed out to force the burning gases to swirl in the main combustion chamber. This ensures even combustion. (Fig. 41.)

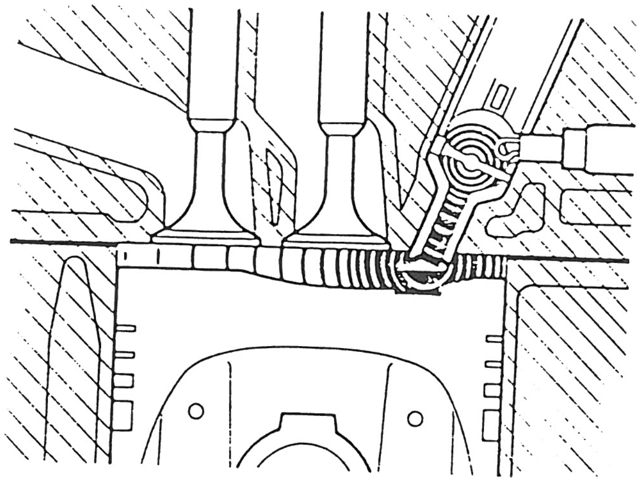


Figure 41

PREGLOW SYSTEM FOR START-UP

As stated earlier, there are three requirements for combustion: (1) air, (2) fuel, (3) heat. In the Diesel engine heat is generated by compression. When the engine is cold, compression alone cannot produce sufficient heat to begin the combustion process. To provide additional heat, Mercedes-Benz uses a Preglow system for start-up.

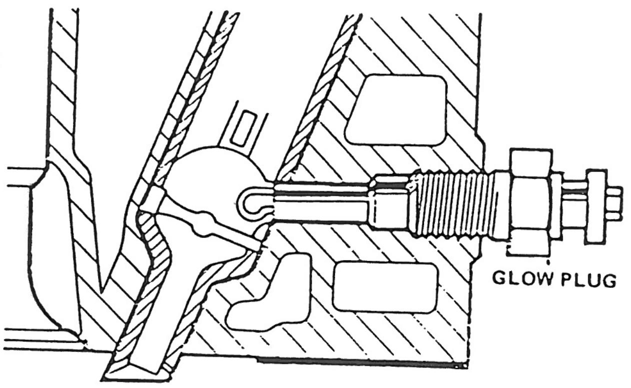


Figure 42

The preglow system uses glow plugs (Fig. 42.) with electrically heated elements (1 per cylinder). These elements generate initial combustion by igniting the fuel at their tips. This occurs *only* for a short period of time – until the cylinder temperature has risen to a point where compression ignition will occur.

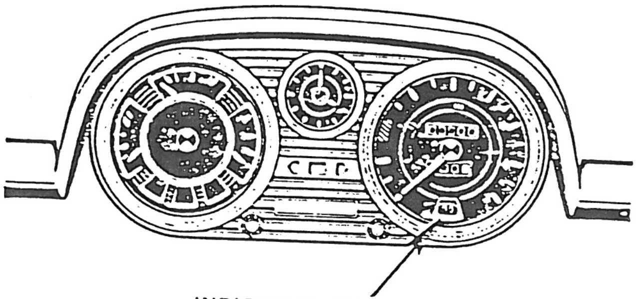


Figure 43

All current Mercedes-Benz Diesel cars use a key operated preglow system. The key start system is energized when the key is turned to the "RUN" position. A light on the dashboard comes on, indicating that the glow plugs are heating. When the glow plugs are sufficiently heated, the indicator light goes out. (Fig. 43.) The engine will now start. Earlier cars used a "START/STOP" cable which, when pulled to the "START" position, applied voltage to the glow plugs.

TRAINING

Mercedes-Benz service

"FOR AUSTRALIA ONLY"

1. VERSION - PREGLOW SYSTEM WITH GLOW PLUG. RESISTANCE CONTROL PULL START KNOB TYPE

ENGINE - 615,616
MODEL - W115.1 AND PREVIOUS MODELS.
IDENTIFICATION - ALL UP TO BEGINNING OF W123.

2ND. VERSION - PREGLOW SYSTEM WITH INDICATOR LAMP.

ENGINE - 615,616
MODEL - W123.1
IDENTIFICATION - PULL START KNOB TYPE FROM BEGINNING OF W123.

3RD. VERSION - KEY START SYSTEM.

ENGINE - 615,616,617
MODEL - W123.1
IDENTIFICATION - GLOW PLUGS CONNECTED IN SERIES AND BUS BARS FITTED.

4TH. VERSION - KEY SYSTEM QUICK START.

ENGINE - 615,616,617.91
MODEL - W123.1 AND 460
IDENTIFICATION - GLOW PLUGS CONNECTED IN PARALLEL (GLOW PENCIL) BUS BARS NOT FITTED PREGLOW TIME RELAY IN ENGINE BAY L/H FITTED FROM AUGUST 1980.

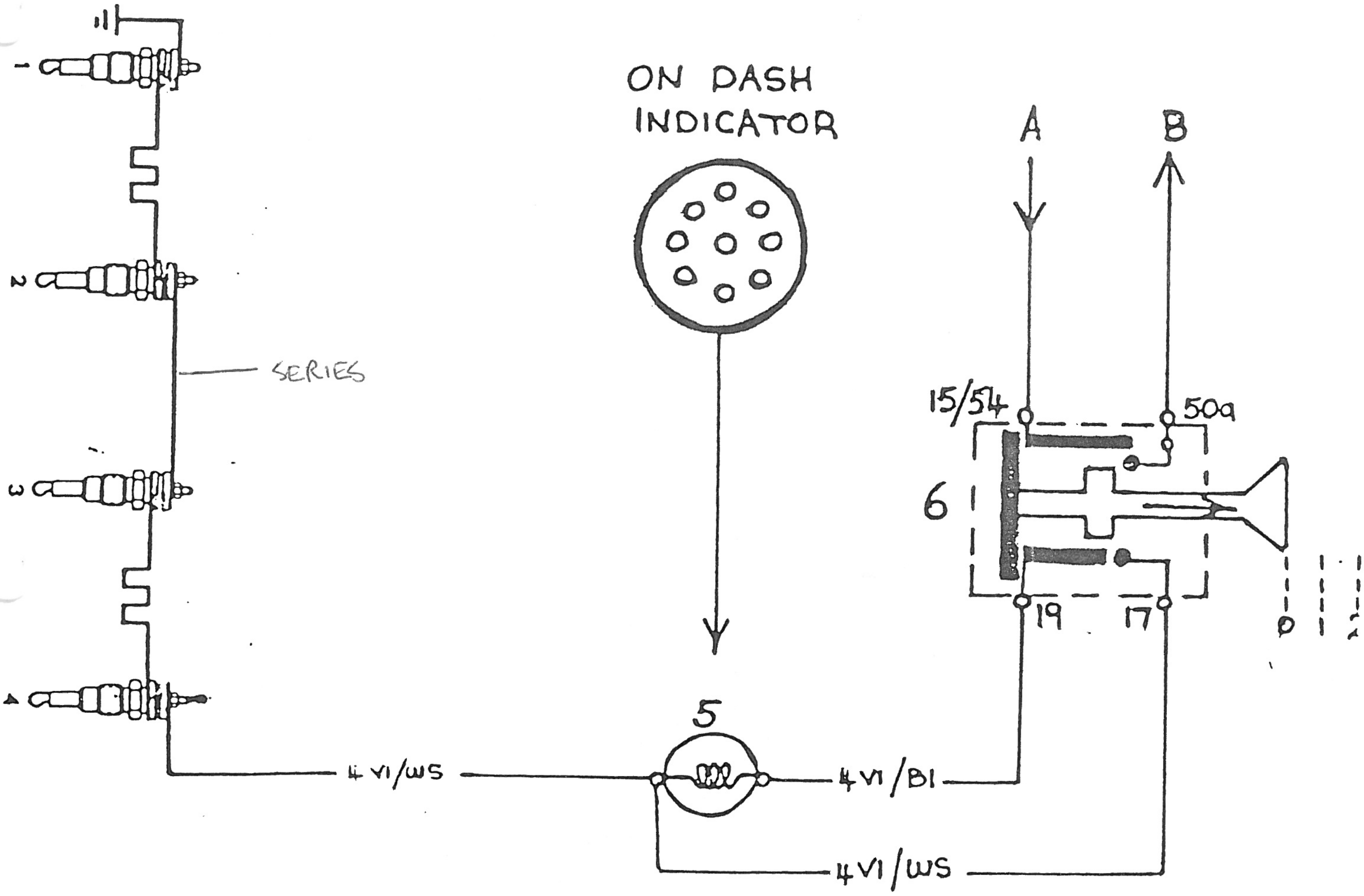
PREGLOW SYSTEM WITH GLOW PLUG

RESISTANCE CONTROL

ENGINE: 615, 616

MODEL: W115.1

IDENTIFICATION: PULL START KNOB TYPE. ALL MODELS UP TO W123.



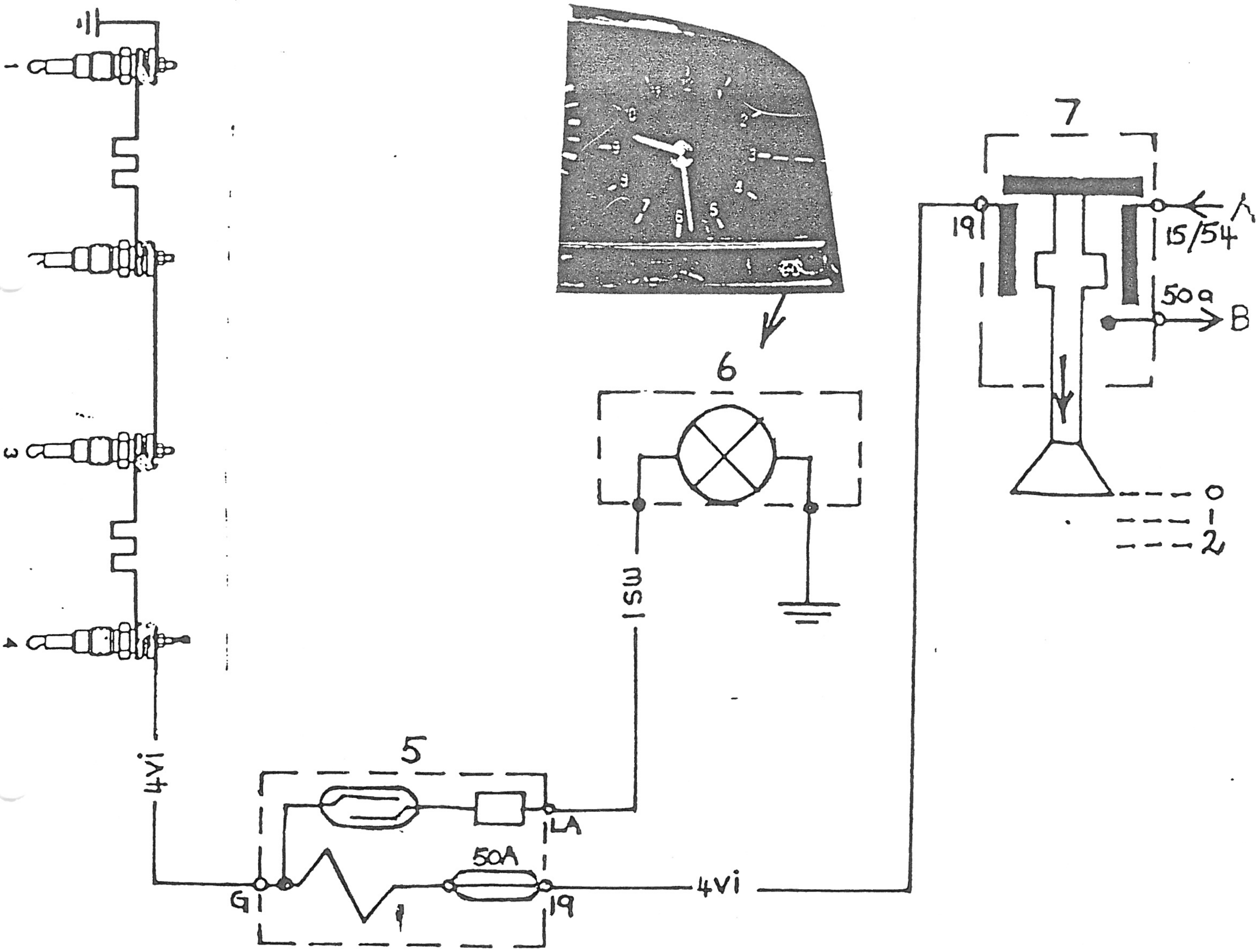
1-4	GLOW PLUGS
5	GLOW PLUG RESISTANCE CONTROL
A	TO STEERING LOCK (KEY SWITCH)
B	TO STARTER MOTOR

PREGLOW SYSTEM WITH INDICATOR LAMP

ENGINE: 615, 616

MODEL: W123.1

IDENTIFICATION: PULL START KNOB TYPE. BEGINNING W123 ONLY.



1-4	GLOW PLUGS
5	FUSE AND REED CONTACT
6	PREGLOW INDICATOR LAMP
7	PREGLOW STARTER SWITCH (PULL KNOB)
A	TO STEERING LOCK (KEY SWITCH)
B	TO STARTER MOTOP.

KEY START SYSTEM

T 30 = CONSTANT BATTERY +

T 31 = ⏚ BROWN (EARTH)

T 15 = IGNITION POWER

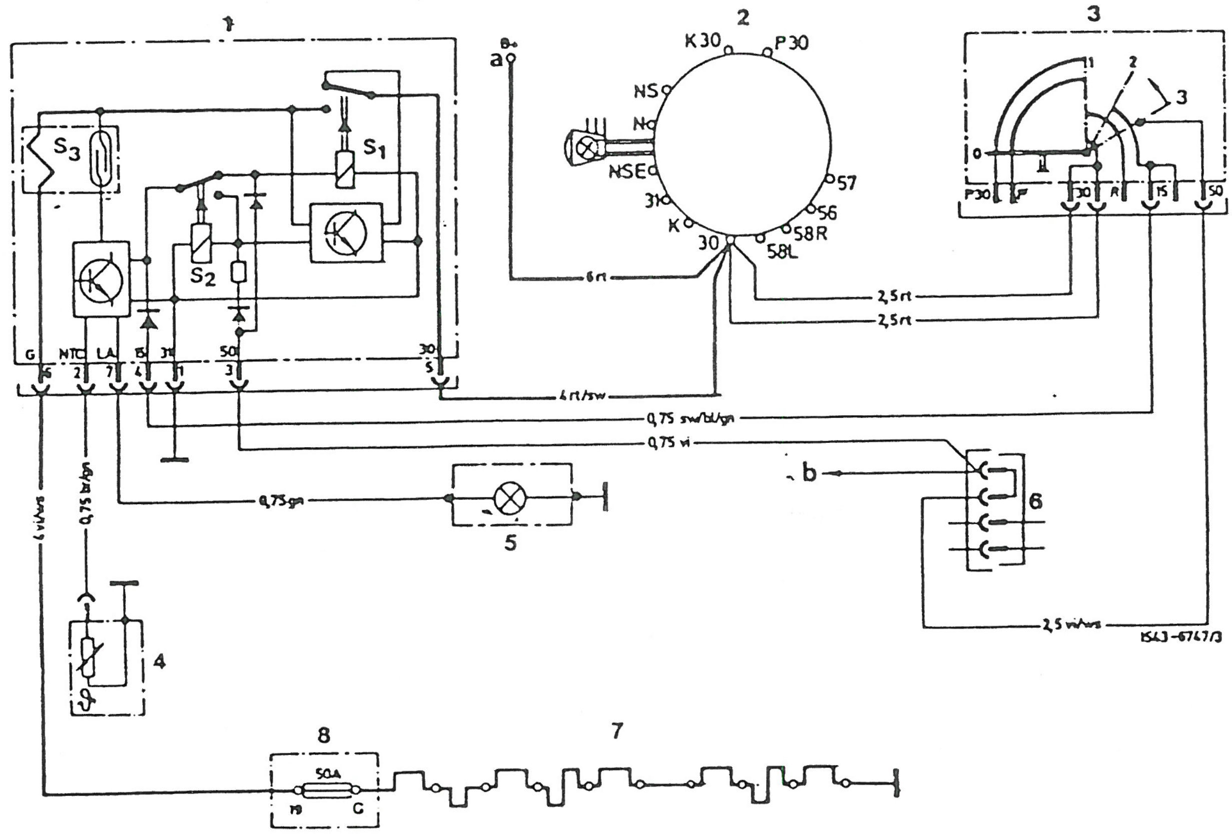
ENGINE: 615, 616, 617

MODEL: W123.1

IDENTIFICATION: GLOW PLUGS CONNECTED IN SERIES AND BUS BARS FITTED.

REFER: SI NO. 07.1/23

SUBJECT: PREGLOW SYSTEM
MODELS 240D (123.123) AND 300D (123.130)



WIRING DIAGRAM FOR PREGLOW SYSTEM

1 Preglow time relay
2 Rotary light switch
3 Preglow-starter switch
4 Temperature sensor
S1 Main preglow relay
S2 Control relay
S3 Magnetic glow indicator switch

5 Preglow indicator light
6 Plug (starter lock-out/ back-up light switch)
7 Glow plugs and pre-resistance

8 Fuse (50 Amp.)
a Battery+
b Terminal 50, starter

QUICK START PREGLOW SYSTEM

Aug. 1980

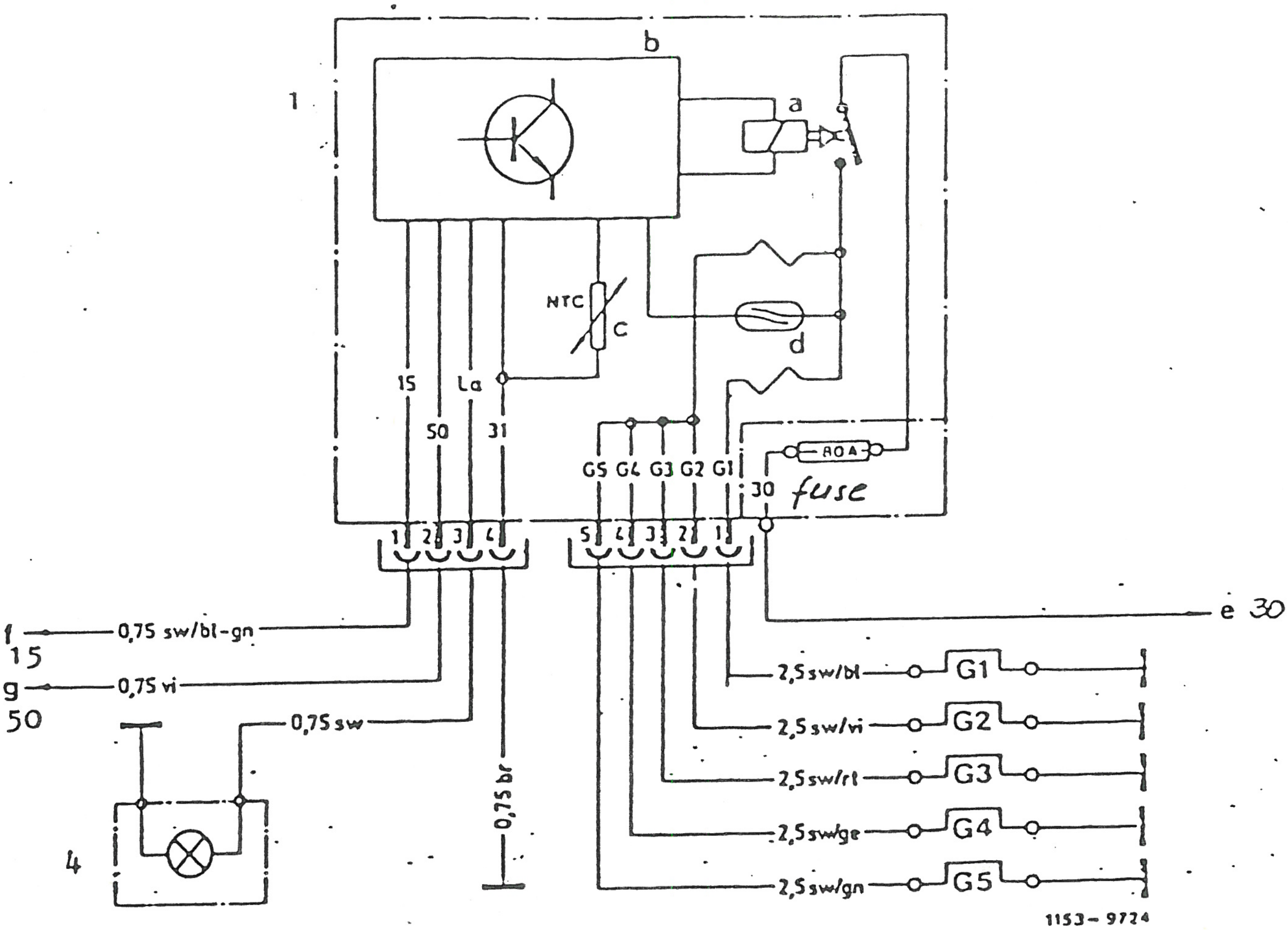
ENGINE: 615, 616, 617.91

MODEL: W123.1 AND 460.3 G series

safety circuit 25 +10 −5

IDENTIFICATION: GLOW PLUGS CONNECTED IN PARALLEL NO BUS BARS.

PREGLOW TIME RELAY



1	PREGLOW TIME RELAY
4	INDICATOR GLOBE
A	MAIN RELAY
B	ELECTRONIC UNIT
C	NTC - RESISTOR
D	REED - RELAY
E	STARTER TERMINAL 30
F	FUSE BOX TERMINAL 15
G	STARTER MOTOR TERMINAL 50
G1-G5	GLOW PLUGS PENCIL TYPE. — 30 Amps, 20 seconds after 14 amps

Date 22. Apr. 1980 Distribution I Supersedes Group 07.1/23

A. Inspecting Preglow System
   Diesel Engines with Key Starting System
B. Complaints about Glow Plugs
   Diesel Engines with Coil Element Glow Plugs

This Service Information is intended to facilitate troubleshooting on the preglow system and the glow plugs and to permit a quick and correct diagnosis.
Vehicles with pencil element glow plugs are not dealt with in this information.

General Information on Preglow System

The glow plugs are connected in series. The current flows from the glow plugs of cylinders (5-) 4-3-2-1 to engine ground. Each glow plug is designed for a voltage of 0.9 V and a maximum power of 63 A. For this reason they are connected to resistance bus bars which absorb the residual voltage. During the preglowing process the resistance bus bars become red-hot.

Preglowing current intensity is determined by the total resistance of the preglow system (glow plugs + resistance bus bars).

From this it follows that the preglow time relay can by no means be the cause for a glow plug to have burnt through or a fuse to have blown due to the flow of an excessive amperage current. In such instances the total resistance in the preglow system is reduced (e.g. one or more glow plugs are shorted to ground because of carbon fouling or due to contacting the prechamber).

A ground short on a glow plug will produce various effects on the preglow system. If, for example, a ground short occurs on the glow plugs of 4th or 5th cylinder, the fuse will blow immediately. If, however, a ground short occurs on the glow plug of the 3rd cylinder, this will cause the 4th cylinder glow plug to burn through (maybe only after repeated preglowing). In the case a glow plug has burnt through, you should therefore always inspect the glow plug in front of it for a ground short and renew it, if necessary.

A. Inspecting Preglow System
Diesel Engines with Key Starting System

For the inspection it must be taken into account that the preglow system cuts out automatically after 90 (+20) seconds. If the inspection extends over a longer period, switch on the preglow system again.

1. Preglow System will not Operate

The circuit of the preglowing system is interrupted (on model 123, check separate fuse in engine compartment!). This fuse blows, if there is a ground short on the glow plugs of cylinders 4 or 5.

In order to exactly determine the cause of the failure (whether it is the plugs or other component parts), connect voltmeter (measuring range 0 - 30 volts) to the current inlet end of the glow plugs of 4th or 5th cylinder and to vehicle ground (figure 2).

Reading approx. 12 V = disconnected at the glow plugs incl. connections (but not on preglowing time relay)

Reading 0 V = preglow time relay or triggering unit of relay defective

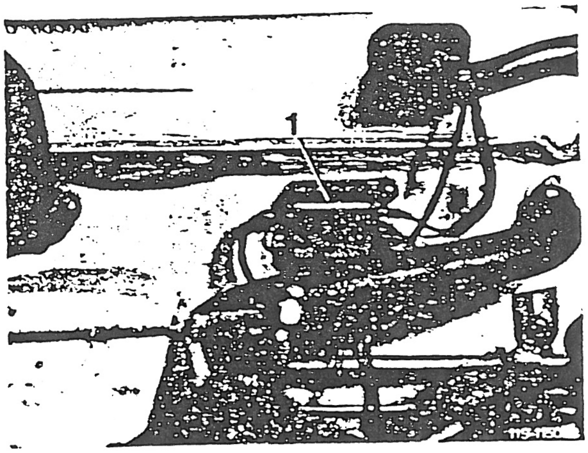


Figure 1

Model 123
Fuse in engine compartment

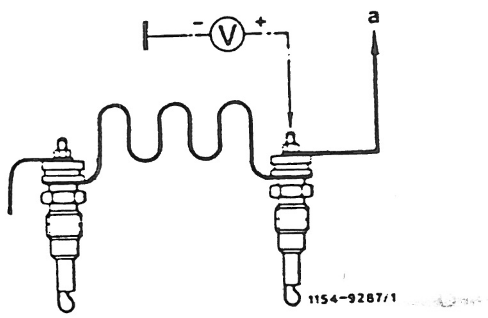


Figure 2

Voltmeter connection

a to fuse

a) Continuity Check on Glow Plugs

Connect negative cable of voltmeter to vehicle ground and test voltage with positive cable at inlet and outlet of each glow plug (for this purpose, disconnect ground of glow plug of 1st cylinder). If approx. 12 V are recorded at the inlet of the glow plug and 0 V at the outlet, the glow plug circuit is broken and the plug needs to be replaced.

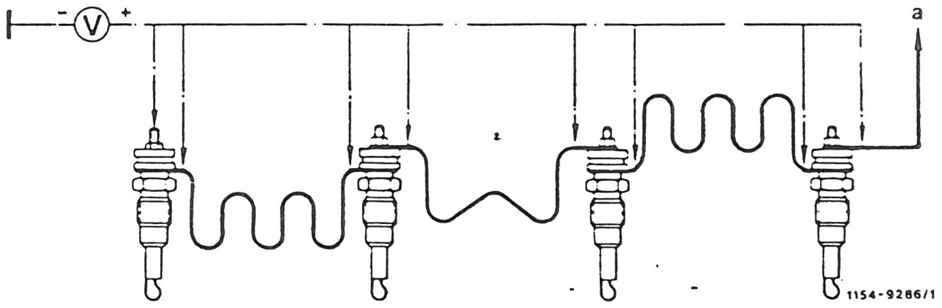


Figure 3

Voltmeter connection

a to fuse

Caution!

Never short-circuit glow plug or resistance bus bar connections to ground (e.g. with screwdriver on engine block) as this may ruin the preglow time relay!

b) Checking Preglow Time Relay and Connections

Pull connector from preglow time relay. Connect voltmeter negative cable to vehicle ground. Using the positive cable, consecutively check the voltage at sockets 5, 4 and 3, whereby the starter must be operated at socket 3 (figure 4). Then connect negative cable of voltmeter to socket 1 and positive cable to socket 5 and measure voltage (figure 5).

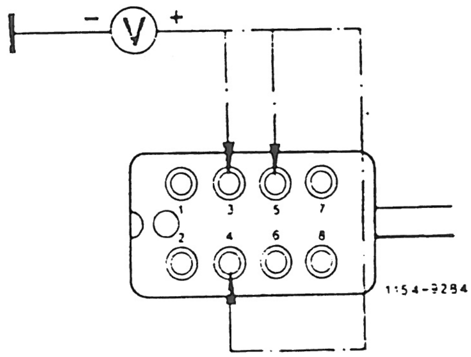


Figure 4

Voltmeter connection

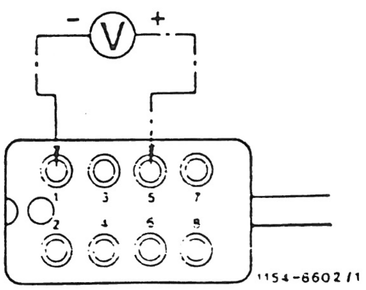


Figure 5

Voltmeter connection

Nominal Data

Socket 5 = approx. 12 V (terminal 30, continuous voltage)
Socket 4 = approx. 12 V (terminal 15, preglowing system switched on)
Socket 3 = approx. 12 V (terminal 50, while starting)

Socket 1 = approx. 12 V (terminal 31, negative line)

Should a 0 V reading be obtained on one of the sockets, check the respective line for continuity and eliminate circuit breakage, if necessary.

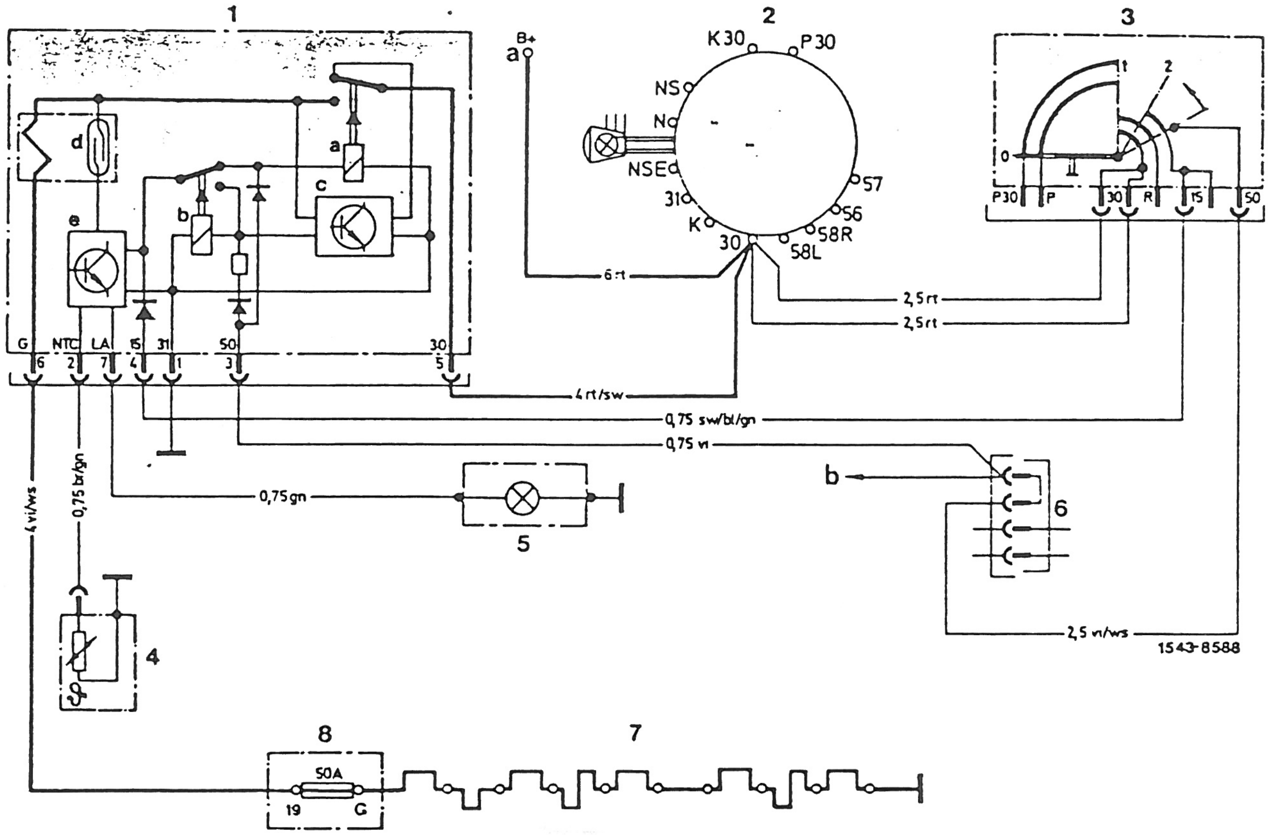


Figure 6 - Wiring diagram of preglowing system

1 Preglow time relay
2 Lighting switch
3 Steering lock starting switch
4 Temperature sensor
5 Ready-to-start indicator
6 Line connector (engine cable harness)
7 Glow plugs and resistance bus bars
8 Fuse

a to battery
b to starter

2. Engine Starts Hard or Not At All Despite Ready-to-start Signal

The preglow system is glowing too slowly because insufficient current flow due to contact resistance in the glow plugs or at the connections or because of excessive current flow due to a short-circuit on one or more glow plugs.

These faults can be determined by measuring the voltage drop of each glow plug (figures 7 - 9). For this purpose, measure voltage at glow plug inlet and outlet with the test prods of the voltmeter (measuring range 0 - 3 volts).

Nominal data (after an approximate 15 sec preglow interval at a minimum battery electrolyte specific gravity of 1.22 g/cm³)

In the case of deviating data, replace the respective glow plugs or eliminate short circuit.

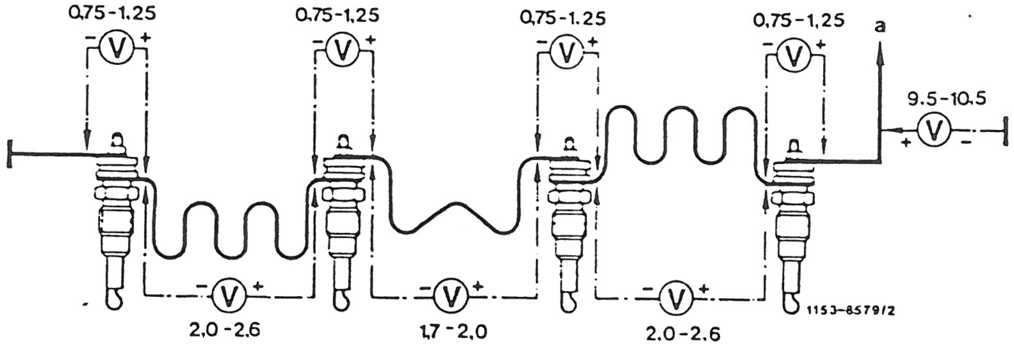


Figure 7

Engines 615, 616

a to fuse

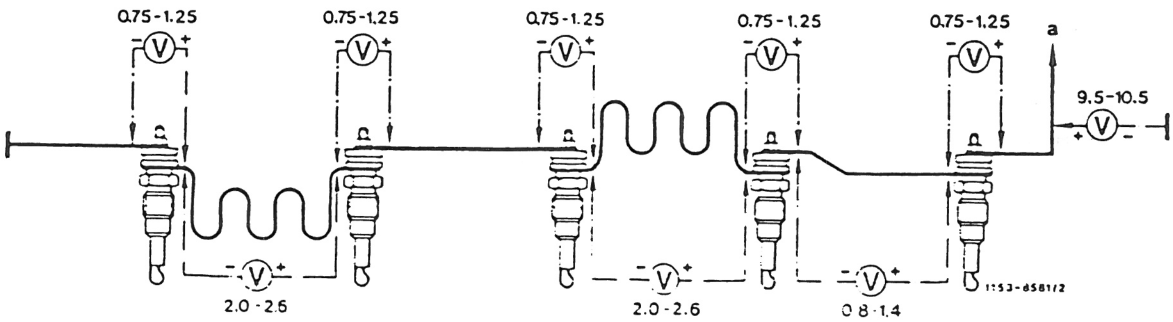


Figure 8

Engine 617

a to fuse

Note: Measure as close as possible to the glow plug, since otherwise faulty measurements (higher drop of voltage) may be obtained by including the resistance bus bars into the measurement.

Beware of short-circuiting during measurements.

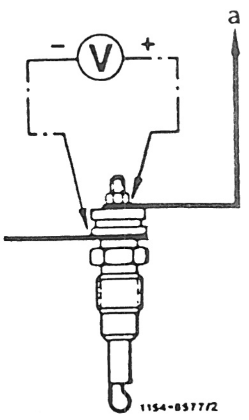


Figure 9

Measuring voltage drop with voltmeter

If the there is a short circuit on 3rd cylinder glow plug, the 4th cylinder glow plug will burn through (possibly only after several preglow intervals). In the case of a burnt through plug you should therefore always inspect and renew, if necessary, the glow plug arranged before the one that has been burnt through.

Note: In the majority of the cases the cause of poor starting is not the preglow system but, for example, the vacuum cell or the shut-down lever which stick in stop position, condition of batteries or starter, poor compression or unsuitable engine oil!

3. Ready-to-start Indicator (Preglow Indicator Lamp)

a) Function

The preglow indicator lamp is switched on and off by the preglowing time relay which is controlled by a temperature sensor in the coolant circuit.

After the respective preglowing time has elapsed (figure 10) the preglow time relay cuts out the indicator lamp on the instrument cluster. The preglow system, however, remains in operation until the starting process has been finished. If the engine is not started, the preglow system is switched off by a safety circuit after 90 +20 seconds.

Note: The preglow system may be working properly although the indicator lamp on the instrument cluster will not come on or no longer go out.

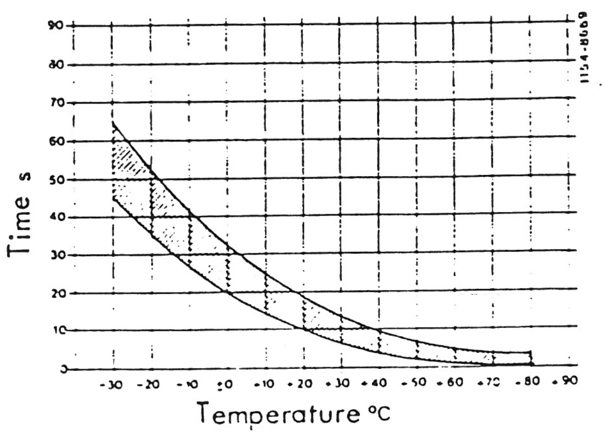


Figure 10

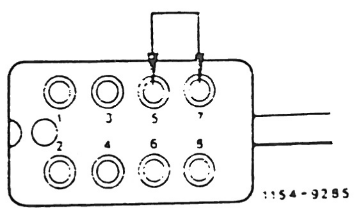


Figure 11

b) Inspection

Should the preglow indicator lamp fail to come on, pull connector from temperature sensor - indicator lamp must come on then. In this instance, renew temperature sensor. Should the indicator lamp fail to come on, remove connector from preglow time relay and bridge sockets 5 (terminal 30) and now 7 (fig. 11). If the preglow indicator lamp comes on, the preglow time relay is defective and must be renewed. Should the indicator lamp fail to come on, check bulb of preglow indicator lamp and renew, if required.

Should the preglow indicator lamp fail to go out after the system is ready to start, ground connector of temperature sensor. If the indicator lamp goes out then, no current flows through the temperature sensor and the sensor must be renewed. If the indicator lamp continues burning, the preglow time relay is defective or the line to the relay is broken. Renew preglow time relay or eliminate broken line.

Note: The temperature sensor can be checked with an ohmmeter.

Resistance corresponds to coolant temperature:

0 °C/32 °F = approx. 8 500 Ω
+25 °C/77 °F = approx. 2 500 Ω
+80 °C/176 °F= approx. 300 Ω

At a reading of 0 Ω the temperature sensor has a short, at a reading of ∞ Ω the temperature sensor circuit is broken and the sensor must be renewed.

Time Allowed

Section 1 - Inspecting preglow system, will not preglow

15-340/01	Basic work:	0.6 hours
341/01	Combined work:	0.3 hours

Section 2 - Inspecting preglow system - is preglowing too slowly or too quickly (engine starts hard or not at all)

15-344/01	Basic work:	0.5 hours
345/01	Combined work:	0.3 hours

Section 3 - Inspecting preglow system - no ready-to-start signal

15-348/01	Basic work:	0.4 hours
349/01	Combined work:	0.3 hours

For all testing modes not listed, see repair instructions for engines 615, 616 and 617.

B. Complaints about Glow Plugs
Diesel Engines with Coil Element Glow Plugs

1. Coil element cracked
(hair crack - see figure 12)

Cause:

Premature start of delivery or faulty nozzles (dripping, sticking)

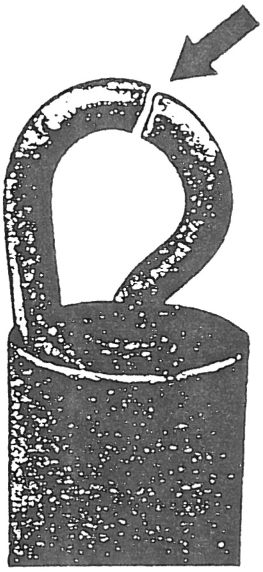

107-16708

Figure 12

2. Coil element burnt or charred
(coil black or brown - figures 13 and 14)

Cause:

Overheating during operation due to faulty nozzles (dripping, sticking), premature start of delivery or oil in the combustion chamber (e.g. due to leaking vacuum pump or defective valve stem gasket).

Note: In the case of a burnt coil element, never fail to check the glow plug positioned before the burnt one, too (in this respect, also see "A", section 2). During this inspection, also check for deposits in the glow plug bore. If carbon fouled, clean glow plug bore with reamer 617 589 00 53 00.

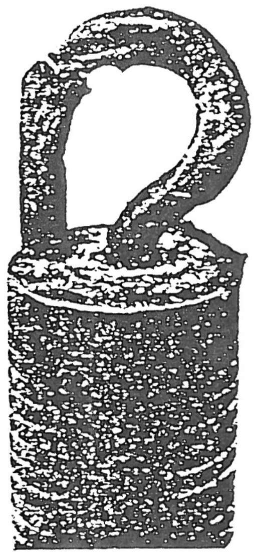

107-16706

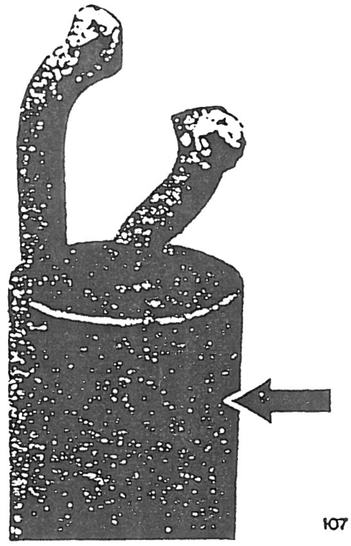
Figure 13

3. Coil element burnt (coil grey - figures 13 and 14)

Cause:

a) Short circuit on glow plug stem (outer terminal - figure 14, arrow) due to carbon fouled glow plug bore (remedied by reaming the glow plug bore in the cylinder head). Short-circuited by bent bus bar which contacts the throttle linkage (e.g. at full load).

b) Preglowing time relay will not cut out after starting process (check preglowing time relay).



107-16707

Figure 14

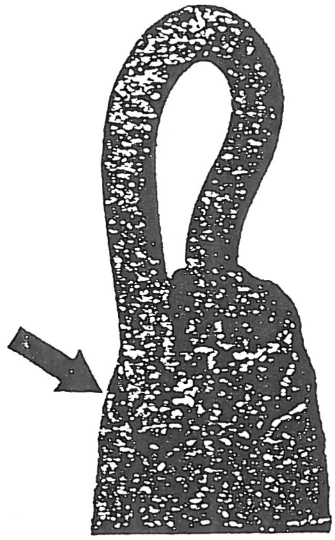
4. Glow plug stem burnt (arrow, figure 15)

Cause:

a) Water in combustion chamber because of defective cylinder head gasket or crack in cylinder head.

b) Water in fuel, if all glow plugs show the same damage.

c) Oil in combustion chamber due to leaking vacuum pump, faulty valve stem gasket or excessive engine oil level (e.g. heavy interior leaks of injection pump attached to engine oil circuit).



107-16709

Figure 15

5. Short-circuit on glow plug stem and housing

Cause:

Oil carbon deposits accumulated due to frequent short distance operation, premature start of delivery or metal particles (e.g. chips).

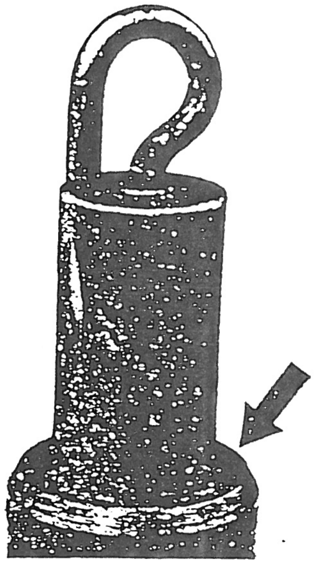

107–16710

Figure 16

Special Tools

Name	Part No.
Reamer, 3/8", square, for glow plug bore	617 589 00 53 00

Available from: Plant 10 (ET-VEX Esslingen-Mettingen)

Daimler-Benz Aktiengesellschaft
s/ppa. Buesser s/i.V. Görres

Pencil Element Glow Plugs

These plugs are smaller than the previous ones and are connected in parallel. Preglowing is also possible if one glow plug is defective. Quick heating of the pencil element glow plug is reached by a two-component heating element which consists of a heating and a regulating filament. When switching on the preglow system, a current of approx. 30 A flows per glow plug. The regulating filament gradually increases its resistance as it heats up and current is thus limited to approx. 14 A after 20 seconds.

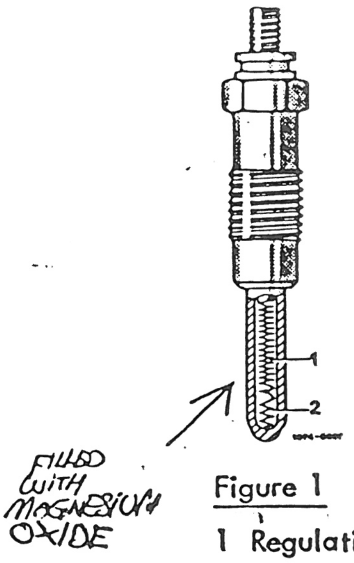


Figure 1

1 Regulating filament
2 Heating filament

Preglow Time Relay

A power relay, electronic element, temperature sensor as well as a reed relay are installed in the modified preglow time relay which is accommodated on the left wheel arch in the engine compartment.
The preglow time relay controls the following functions:

- Control of glow current
- "Ready-to-start" indicator and safety cutoff
- Failure indicator

Control of Glow Current

During preglowing (key in position "2") the preglow time relay is energized via terminal 15 (jack 1 on 4-pole coupling). The power relay (a) closes the circuit of terminal 30 (battery +, connection e) via the 80-A fuse to the pencil element glow plugs. During starting (position 3) the relay (a) - controlled by terminal 50 - remains closed until the starting process is completed.

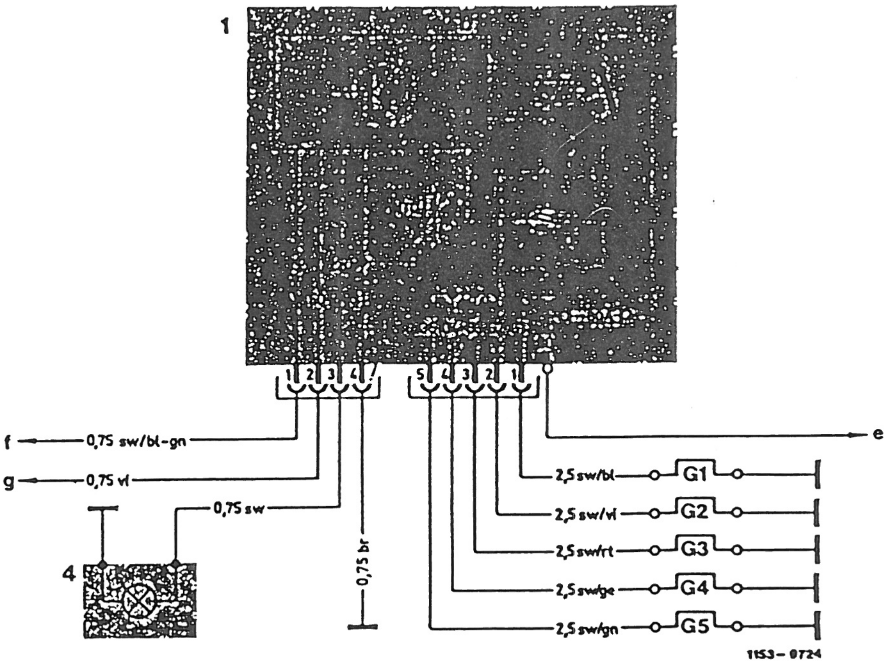


Figure 2

1 Preglow time relay
a Power relay
b Electronic element
c Temperature sensor (NTC resistor)
d Reed relay

4 Preglow indicator lamp
e to terminal 30
f to fuse box terminal 15
g to plug-in connection of starter lockout and back-up lamp switch terminal 50

G1 - 5 Pencil element glow plugs

"Ready-to-start" Indicator Lamp and Safety Cutoff

The preglow indicator lamp in the instrument cluster indicates as up to now that the engine is ready to start. If no defect exists, the preglow control lamp always lights up if the preglow system is switched on (possible failures are described in section "Checking the preglow system").

Safety Cutoff

The safety cutoff time after which the glowing process is interrupted if no starting process follows is no longer specified. It consists of the time to the point when the engine is ready to start (the preglow control lamp extinguishes) plus 25^{+10}_{-5} seconds.

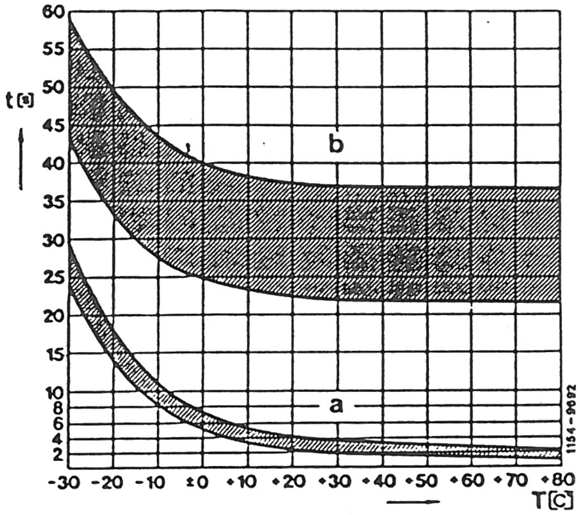


Figure 3

a Preglow time
b Safety cutoff time

Failure Indicator of Reed Relay

The reed relay consists of a contact set in a glass vessel filled with inert gas. Energizing, i. e. the closing of the contacts, is accomplished by producing an outer magnetic field. Two oppositely directed coils with a different number of windings are arranged around the reed contact. The glow current of the pencil element glow plug of the 1st cylinder flows through the coil with the greatest number of windings and the glow current of the pencil element plugs of cylinders 2 to 4/5 through the coil with the smallest number of windings.
When the preglow system is in functional order, the two magnetic fields created by the preglow current will be cancelled during the preglow procedure so that no residual magnetic field exists for controlling the reed contact.

If the pencil element glow plug of the 1st cylinder, or one or more glow plugs of the cylinders 2 to 4 or 5 are defective, both magnetic fields become unbalanced so that the reed contact will be closed by the residual magnetic field which now becomes effective. The electronic element in the preglow relay becomes energized via the closed reed contact and the preglow indicator lamp is extinguished.

Checking the Preglow System

Indicator lamp in instrument cluster	Possible faults
Indicator lamp does not light up when switching on the preglow system; engine starts.	Glow lamp or line to the indicator lamp is defective.
Indicator lamp does not light up, engine does not start.	Main circuit is interrupted (fuse or preglow time relay is defective)
Indicator lamp does not light up, poor engine starting	Circuit of pencil element glow plug in cylinder 1 interrupted Circuit of one or more pencil element glow plugs of cylinders 2 to 4/5 interrupted
Indicator lamp lights up, poor engine starting, although ready-to-start condition has been reached	Circuit of pencil element glow plug of cylinders 2 to 4/5 interrupted. It is possible that the indicator lamp (due to unfavourable tolerances) only indicates a failure when 2 pencil element glow plugs in cylinders 2 to 4/5 are defective. In order to make sure that the failure indicator in the preglow time relay is not defective, 2 pencil element glow plugs of cylinders 2 to 4/5 should in this case be disconnected and the preglow procedure repeated. If the indicator lamp now indicates a failure (does not light up) the preglow time relay is in proper order.

An ohmmeter can be used to detect on which of the pencil element glow plugs an interruption has occurred:

Pull off coupling of the engine cable harness from preglow time relay.

Connect one plug of the ohmmeter to ground (engine block).

With the other plug of the ohmmeter test consecutively the resistance of
jack 1 on coupling - pencil element glow plug, cylinder 1
jack 2 on coupling - pencil element glow plug, cylinder 2
jack 3 on coupling - pencil element glow plug, cylinder 3
jack 4 on coupling - pencil element glow plug, cylinder 4
jack 5 (on 5th cylinder) - pencil element glow plug, cylinder 5

If the result is resistance ∞, there is an interruption either in the respective pencil element glow plug, in the line or in the connection.

If a low resistance (e. g. at 20 °C / 68 °F $< 1\ \Omega$) the line and the pencil element glow plug are in proper order.

Please take the part numbers from the spare parts microfiche.

Daimler-Benz Aktiengesellschaft
s/i.V. Behrens s/i.V. Görres

TRAINING

Mercedes-Benz service

Date | Subject | Group

Diesel All

- Bolt on Injector pump drive is "LH" Thread 40 - 50 Nm

/ For safty reason bolt will shear of behind head if turning wrong way
When removing Pump it is then possible to remove broken Bolt "Stud"

- On Prechamber is no shim
if maschining Cyl Head install shims accordingly to clear piston

Injectors

0.05m — 3 Bar

Presser 115 - 125 bar New
100 Bar used Min.
Crowsfoot ~~st~~ tool
000 589 7703 00

checking of Pintel
dip pintel in disel after cleaning should fall throu by ~~its~~ its own weight

Technical data

Engine

		190D 2.5	300D
Model		201.126	124.130
Engine		602.911	603.912
Operation		4-stroke diesel engine MB-pre-chamber system	
Number of cylinders		5	6
Cylinder arrangement		upright in line, 15° inclination to the right	
Bore/stroke	mm	87.0/84.0	
Total eff. piston displacement	cc	2497	2996
Compression	ε	22	
Firing order		1-2-4-5-3	1-5-3-6-2-4
Max. speed	1/min	5150	
Nominal output acc.to DIN kW (HP) at 1/min		66(90)/4600	80(109)/4600
Nominal torque max. acc. to DIN Nm at 1/min		154/2800	185/2800
Crankshaft bearings (multi-component friction bearings)		6	7
Valve arrangement		overhead	
Camshaft arrangement		1 overhead camshaft (ohc)	
Oil cooling		-	
Cooling		overpressure liquid cooling, coolant circulation by pump, thermostat with bypass disc	
Fan		plastic fan with viscofan clutch	
Lubrication		forced-feed lubrication via gear-type pump	
Oil filter		combined main flow and bypass filter	
Air cleaner		dry air cleaner with paper cartridge	

1) The specified output is effectively available at clutch for driving, since all the auxiliary requirements are already deducted.

Diesel injection system

General information

The injection system differs from engines 616 and 617 with regard to the following items:

- Lubrication of injection pump
- Relief throttle (orifice) in pressure valve holder
- Reference impulse verification (RIV), as a result, start of delivery can be dynamically measured.
- Adjustment of start of delivery via adjusting device on injection pump flange
- Self-bleeding injection system:
  Fuel pump with increased delivery, eliminating hand priming pump.
  Overflow valve with throttle (orifice).
- Injection nozzle as flat surface pintle nozzle
- Injection advance mechanism mounted directly on injection pump shaft. Fastened by a central bolt with "lefthand threads".
- Fuel preheating
- Electronic idle speed control (ELR)

Lubrication of injection pump

The injection pump is connected to the engine oil circuit by an oil bore (arrow).

The oil returns via an annular gap (x) between the bearing and housing into the crankcase.

An O-ring (10) on flange (1a) seals the drive shaft coupling area between injection pump flange and crankcase.

Fig. 07.1/1

Checking and adjusting values

Timing with 2 mm valve lift

Camshaft code number[1]	Intake valve opens after TDC	Intake valve closes after BDC	Exhaust valve opens before BDC	Exhaust valve closes before TDC
	with new timing chain			
07	11°	17°	28°	15°
	with used timing chain (approx. 20 000 km)			
	12°	18°	27°	14°

1) The camshaft code number is stamped into the flange adjacent to TDC notch.

Survey engine injection system

Engine	Injection pump	Bosch combination number	Fuel pump	Injection nozzle	Nozzle holder
602	PES 5 M 55 C 320 RS 153	0400 075 982	FP/KG 24 M 150		KCA 30 S 44
603	PES 6 M 55 C 320 RS 156	0400 076 994		DN O SD 265	

Testing and adjusting data

Engine	Idle speed rpm governed	not governed	RI nominal value with digital tester
602	680 ± 20	620 ± 40	15 ± 1° after TDC
603	630 ± 20	570 ± 40	

RI = governor impulse testing or adjusting value

Start of delivery - adjusting device

An adjusting device is attached to the injection pump flange to adjust the start of delivery with the engine running (arrow).

Fig. 07.1/3

Fuel pump

The fuel system is self-bleeding after the fuel tank has been run dry, due to a higher capacity fuel pump. The hand priming pump has been eliminated.

Fig. 07.1/4

D Suction side
E Pressure side

Overflow valve with orifice

The overflow valve has an orifice (arrow) for bleeding the injection pump.

The overflow valve prevents unfiltered fuel from flowing back through the return line into the injection pump.

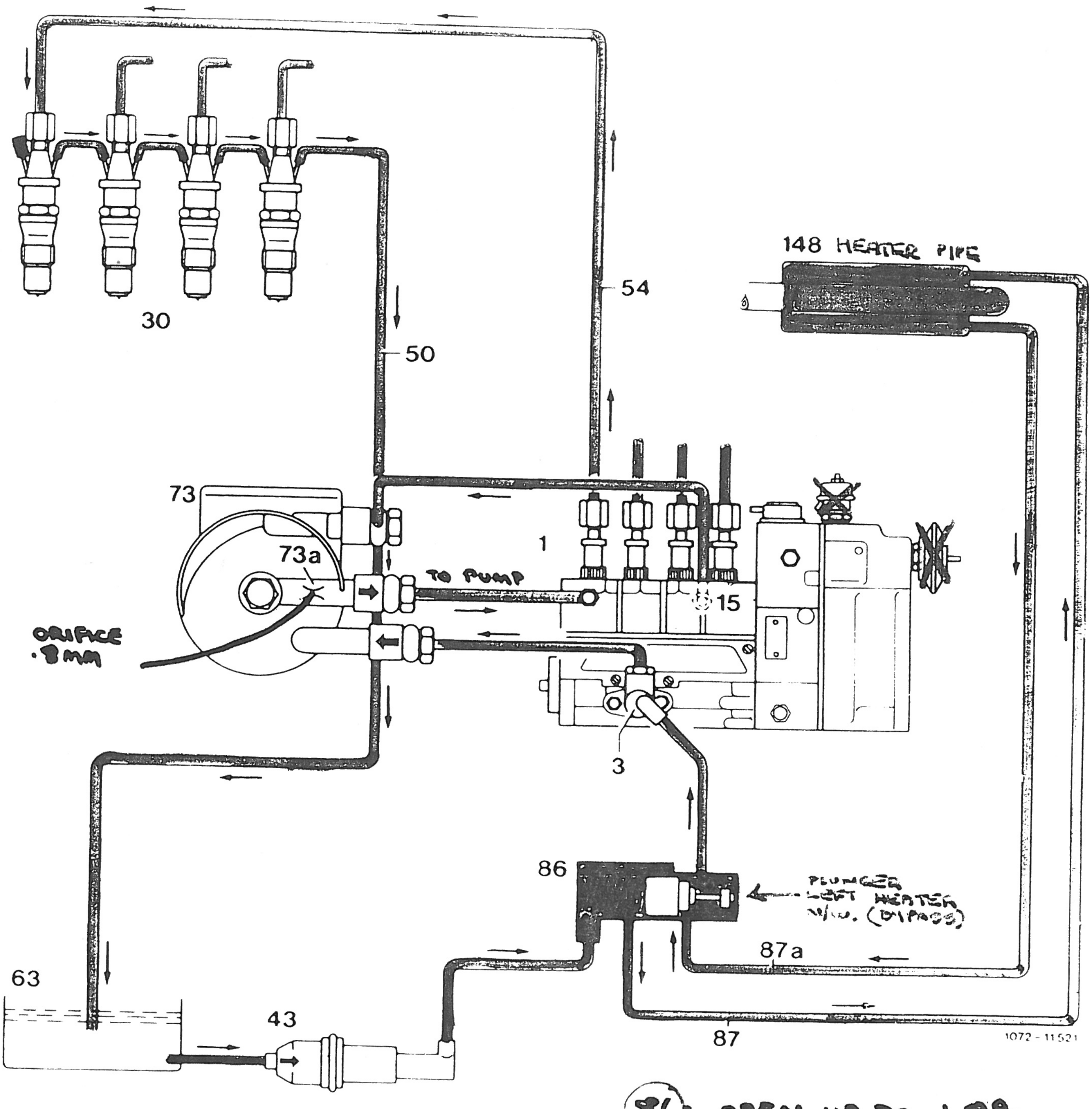
Fig. 07.1/5

Injection timing advance mechanism

The injection timing advance mechanism is mounted on the injection pump shaft and fastened by a central screw with lefthand threads.

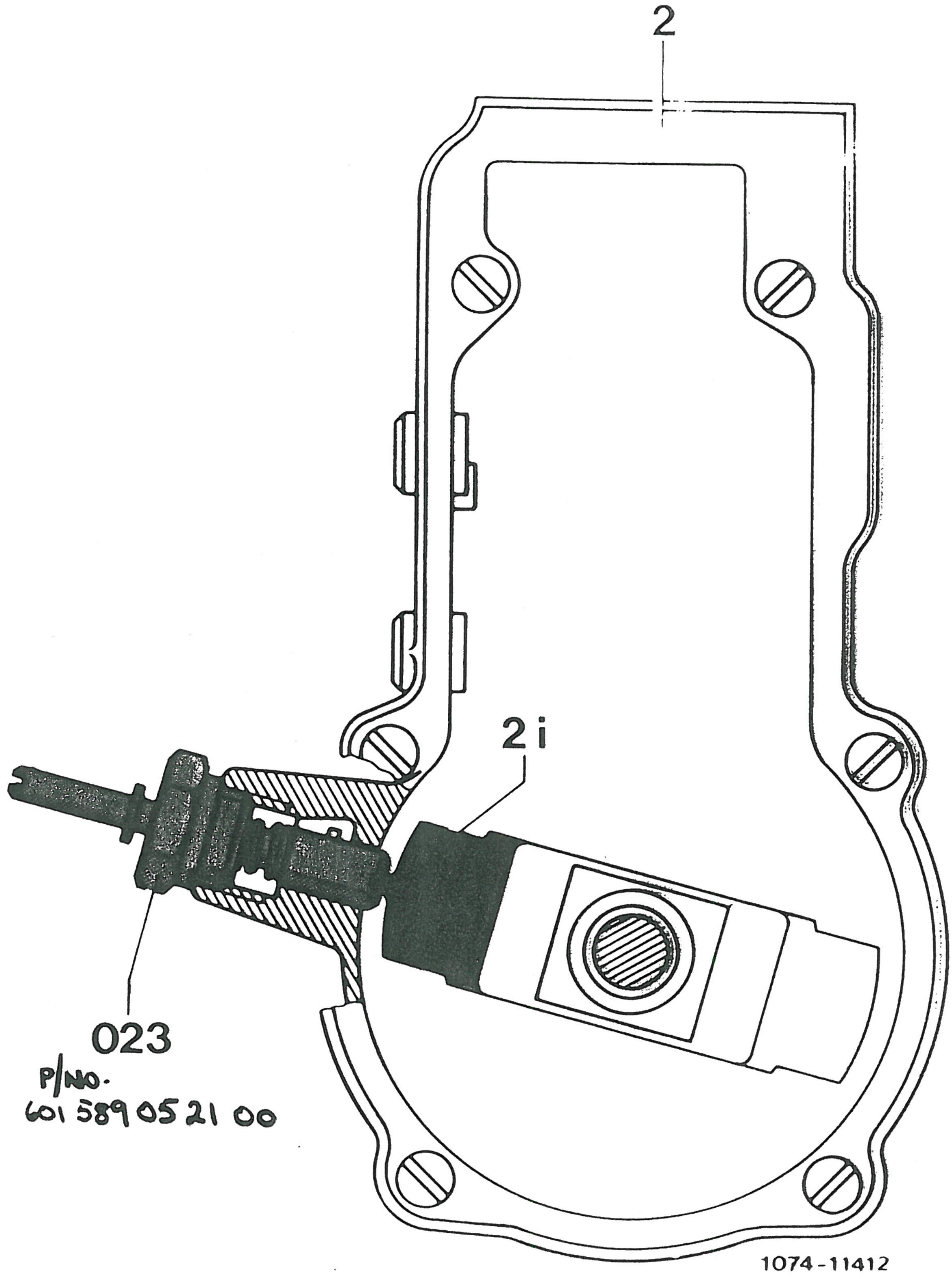
Fig. 07.1/6

15. OVERFLOW VALVE (BLEEDING)

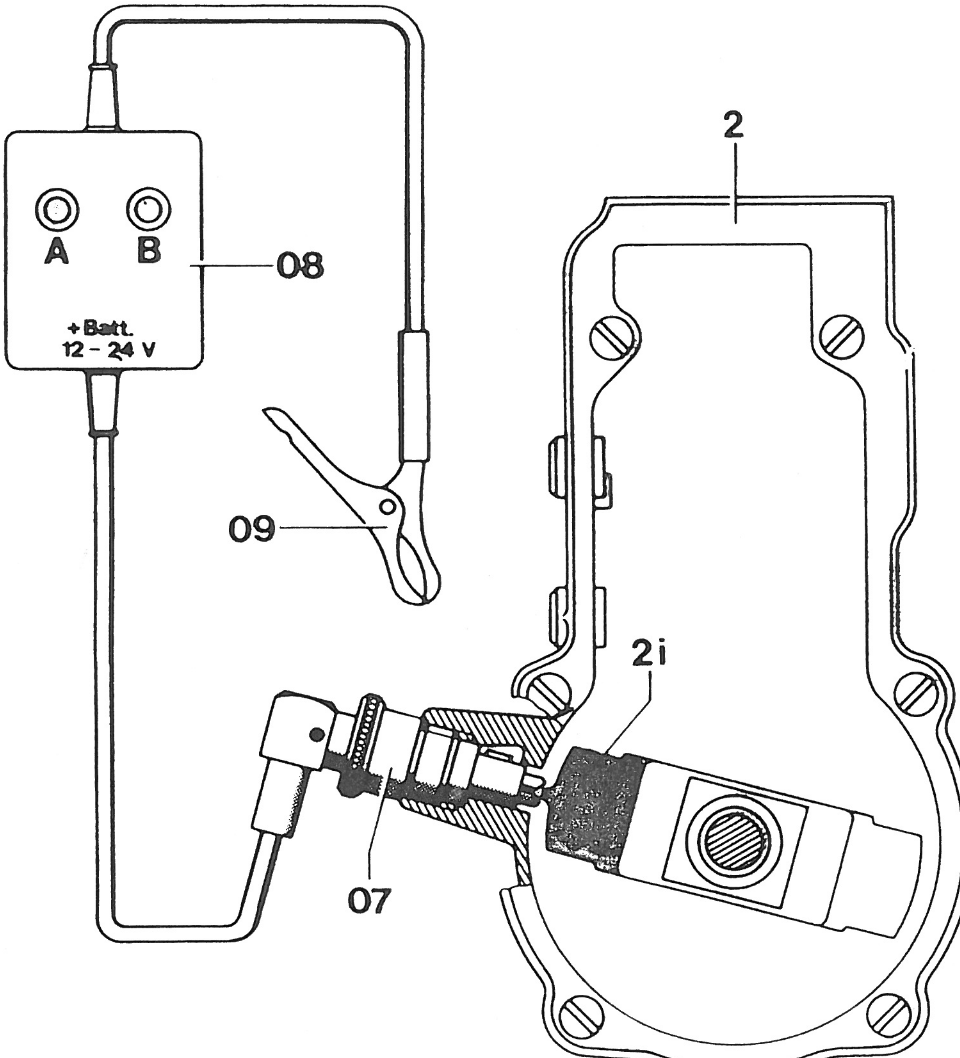


(86). OPEN UP TO +8°C

For Installing Pump



"A" - FIRST
"A-B" — TOGETHER = 15° ATDC



P/NO. 617 589 08 21 00

MOST SET 14° - O.K T/C STRETCH

Electronic idle speed adjustment

...transmission and air conditioner, an electronic idle speed governor is installed in addition to mechanical governor.

...independent of engine load.

The idle speed nominal value is increased by temperature sensor (167) according to a specified characteristic at coolant temperatures of < 60 °C.

Operation

The rpm sensor (132) picks up the engine speed (144 impulses/rev.) for transmission to control unit (141) in the shape of an AC voltage

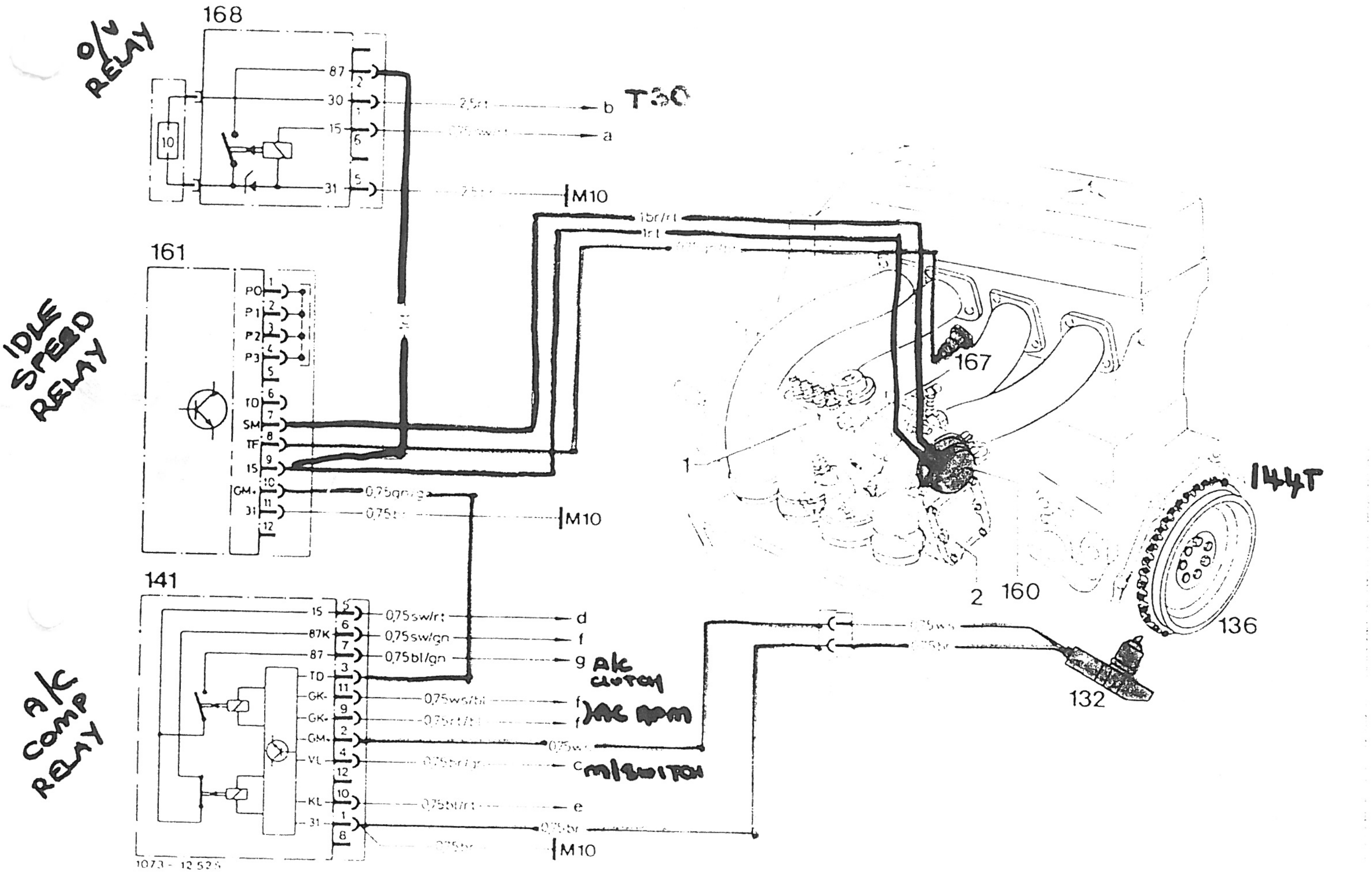
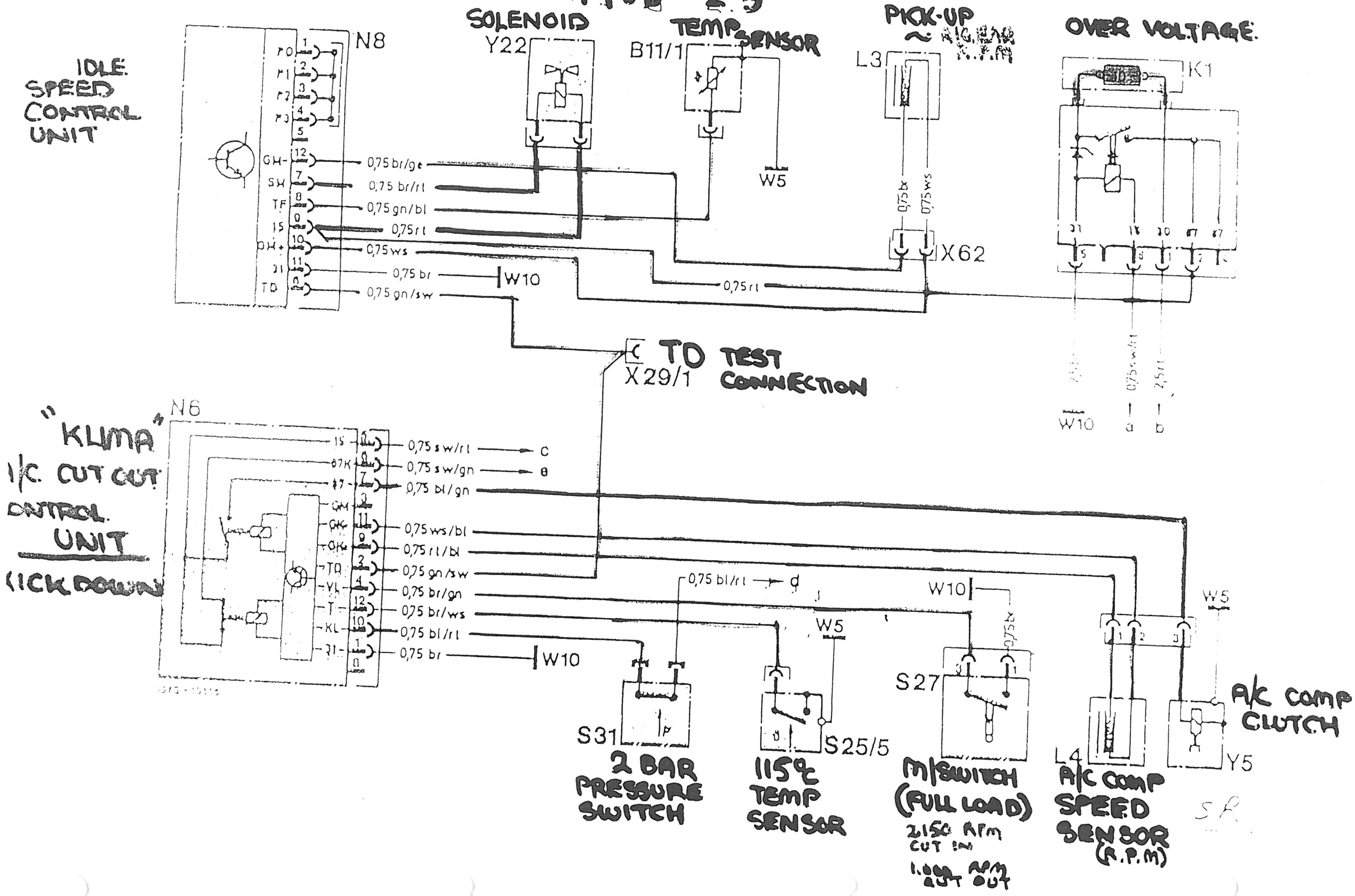


Fig. 07.1/5 Function diagram electronic idle speed adjustment

1 Injection pump
2 Governor
132 Rpm sensor starter ring gear
136 Starter ring gear
141 Control unit refrigerant compressor
160 Servo magnet injection pump
161 Control unit idle speed adjustment
167 Temperature sensor coolant
168 Excess voltage protection
M10 Ground battery

300D - 190D 2.5



IDLE SPEED CONTROL UNIT
N8
r0
r1
r2
r3
GH-
SH
TF
15
DH+
31
TD
0,75 br/ge
0,75 br/rt
0,75 gn/bl
0,75 rt
0,75 ws
0,75 br
0,75 gn/sw
W10
SOLENOID
Y22
TEMP SENSOR
B11/1
W5
PICK-UP
L3
0,75 br
0,75 ws
X62
0,75 rt
OVER VOLTAGE
K1
W10
a
b
0,75 sw/rt
2,5 rt
TD TEST CONNECTION
X29/1
"KLIMA" A/C CUT OUT CONTROL UNIT (KICKDOWN)
N6
0,75 sw/rt
0,75 sw/gn
0,75 bl/gn
0,75 ws/bl
0,75 rt/bl
0,75 gn/sw
0,75 br/gn
0,75 br/ws
0,75 bl/rt
0,75 br
c
e
d
W10
W5
S31
2 BAR PRESSURE SWITCH
S25/5
115°C TEMP SENSOR
S27
M/SWITCH (FULL LOAD)
2150 RPM CUT IN
L4
A/C COMP SPEED SENSOR (R.P.M)
Y5
A/C COMP CLUTCH

Testing electronic idle speed control

In the event of complaints such as: Idle speed too high > 740/min
too low
Engine not running smoothly when cold

Test conditions: Connect digital tester. Engine coolant temperature > 60 °C. Battery voltage min. 11.5 V. Selector lever for automatic transmission in position "P". Air-conditioning system switched off. Bowden wire should rest free of tension against guide lever.

Tested: Electronic idle speed control and basic adjustment of manual governor.

Test and adjustment data

Engine	Idle speed/min with control	without control plug on servo magnet pulled off
602	680±20	620±40
603	630±20	670±40

Special tools

TDC transmitter Resistance 2.5 kΩ

Conventional tools

Multimeter	e.g. Sun, DMM-5
Digital tester	e.g. Bosch MOT 002.01 SUN DIT 9000

Quick test

Engine at idle. 2-pin connector (arrow) on servo-magnet (Y22) pull off for min. 3 seconds and plug on again.
Engine speed will increase for a short period.

Yes

No.

Fig. 07.1/20

For a short period, connect battery voltage (approx. = 12 V) to servo magnet (Y22).
Note: If battery voltage is connected longer than 3 seconds, servo magnet will suffer damage. Engine speed increases.

Yes

No

Test components

Fig. 07.1/21

Renew servo magnet (Y22)

Engine at idle. Pull off 2-pin connector on servo magnet (Y22). Test idle speed:

Nominal values:	Engine	Idle speed/min
	602	620±40
	603	570±40

Yes

No

End of test.

Fig. 07.1/22

Testing rpm sensor starter ring gear (L 3)

Engine stopped. Separate coupling (X62) and test resistance with multimeter.

Readout: 1.9 ± 0.2 kΩ

Yes

No

Fig. 07.1/25

Renew rpm sensor starter ring gear.

Engine at idle (connection as above), With multimeter in button "V~".

Readout: > 4 V~
Voltage increases with increasing speed.

Yes

No

Renew rpm sensor starter ring gear.

End of test.

Testing rpm sensor starter ring gear (L 3)

Engine stopped. Separate coupling (X62) and test resistance with multimeter.

Readout: 1.9 ± 0.2 kΩ

Yes

No

Fig. 07.1/25

Renew rpm sensor starter ring gear.

Engine at idle (connection as above), With multimeter in button "V~".

Readout: > 4 V~
Voltage increases with increasing speed.

Yes

No

Renew rpm sensor starter ring gear.

End of test.

Testing electric activation of servo magnet

Run engine at idle. Pull 2-pin connector (arrow) from servo magnet (Y22) and measure voltage with multimeter in button "V = ".

Readout: approx. = 12 Volts

Yes

No

Test activation according to wiring diagram, renew control unit (N 8) if required.

Fig. 07.1/26

End of test.

Testing temperature sensor (B11/1) for coolant

Engine at idle.

Pull plug from temperature sensor. With test resistor (arrow) on plug for temperature sensor coolant and ground, simulate coolant temperature of +20 °C.

Engine speed increases:

Yes

No

Fig. 07.1/27

Test activation according to wiring diagram.

End of test.

Fig. 07.1/28

Engine stopped.

Test resistance against ground.

From nominal value refer to diagram.

Example:
+20 °C 2.2-2.8 kΩ
+80 °C 290-370Ω

Yes

No

Renew temperature sensor.

End of test.

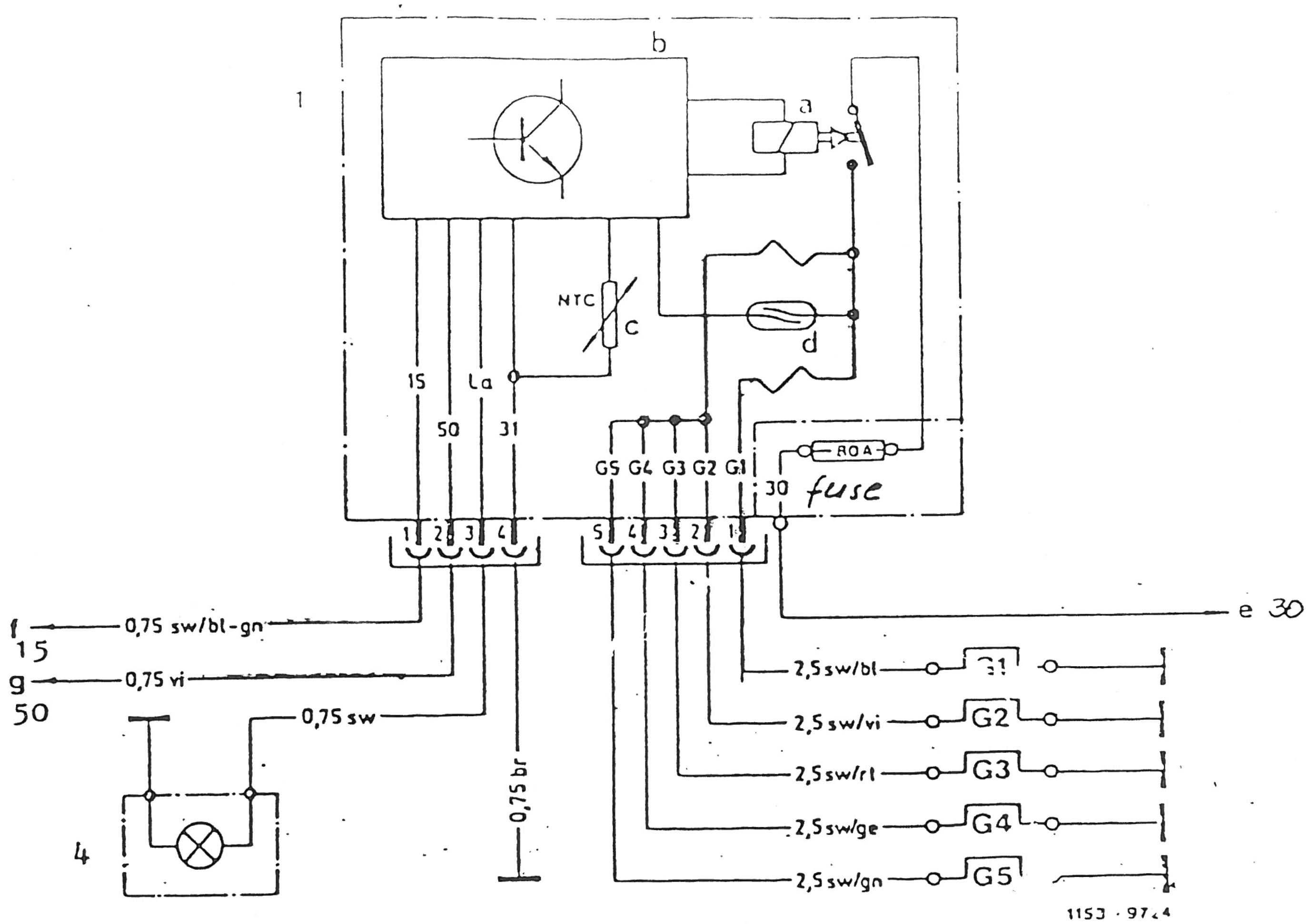
Fig. 07.1/29

QUICK START PREGLOW SYSTEM

ENGINE: 615, 616, 617.91, 602, 603

MODEL: W123.1, W201.1, W124.1 (460.3)

IDENTIFICATION: GLOW PLUGS CONNECTED IN PARALLEL NO BUS BARS.



1	PREGLOW TIME RELAY
4	INDICATOR GLOBE
A	MAIN RELAY
B	ELECTRONIC UNIT
C	NTC - RESISTOR
D	REED - RELAY
E	STARTER TERMINAL 30
F	FUSE BOX TERMINAL 15
G	STARTER MOTOR TERMINAL 50
G1-G5	GLOW PLUGS PENCIL TYPE. (< 1 Ω) + 20°C APPROX

Trailer operation

Trailer coupling

The trailer coupling available ex factory is provided with a removable ball neck.

Fig. 31/1

a Mortise lock

A new feature of this trailer coupling is that the removed ball neck is preloaded and will automatically lock itself during assembly.

As a protection against unauthorized unlocking, the ball neck can be protected with a mortise lock.

With ball neck removed, the holder of the trailer coupling is protected with a cover against contamination.

Fig. 31/2

The electrical connection of the trailer coupling on vehicle has been modified as compared with model 123, since model 124 is provided with a lamp bulb failure indicator for this vehicle only. ALSO W126
The electrical connection of the trailer coupling must be made according to wiring diagram also during subsequent installation, since otherwise the lamp bulb failure indicator may be destroyed.

Repair note

The control unit trailer flasher is located behind the lefthand trunk cover.

Fig. 31/3

N28 Control unit trailer flasher

Line connector 1- or 2-pole, terminal 30 on fuse/relay box

Fig. 54/10

Layout: Relay comfort circuit terminal 30, ABS

Connections in fuse/relay box on fuse carrier

Initial fuse	Terminal	Connection
2	15 R	Belt tensioner/airbag
7	15	Relay excess voltage protection terminal 15
E/F	15 R/30	Relay comfort circuit terminal 87

Identification of relays on relay holder

Fig. 54/11

Code letter A	Relay for window lift/seat adjustment (main relay)
Code letter B	Relay for auxiliary fan ballast resistor
Code letter C	Relay for auxiliary fan
Code letter D	Relay for headlamp cleaner
Code letter E	vacant
Code letter F	vacant
Code letter G	vacant
Code letter H	Combination relay (turnsignal, heated rear window, wiper)
Code letter I	Relay for diode (window opener, seat adjustment)
Code letter K	Relay for lamp monitoring unit

Instrument cluster

The indicators and indicator lights are functionally the same as on model 201 model year 1985.

The glow bulb failure indicator has been newly added.

Fig. 54/15

1 Glow bulb failure indicator

Glow bulb failure indicator

Fig. 54/16

The following bulb functions of the external lamps are monitored by the lamp monitoring unit in relay box and are indicated by the indicator lamp lighting up on instrument cluster.

Low beam, high beam, fog lamp, parking lamp, tail lamp, license plate lamp, stop lamp, turnsignal (flasher) lamp, fog tail lamp, backup lamp.
If a bulb in one of these circuits fails, the indicator lamp indicates the fault as long as this particular lamp remains switched on.

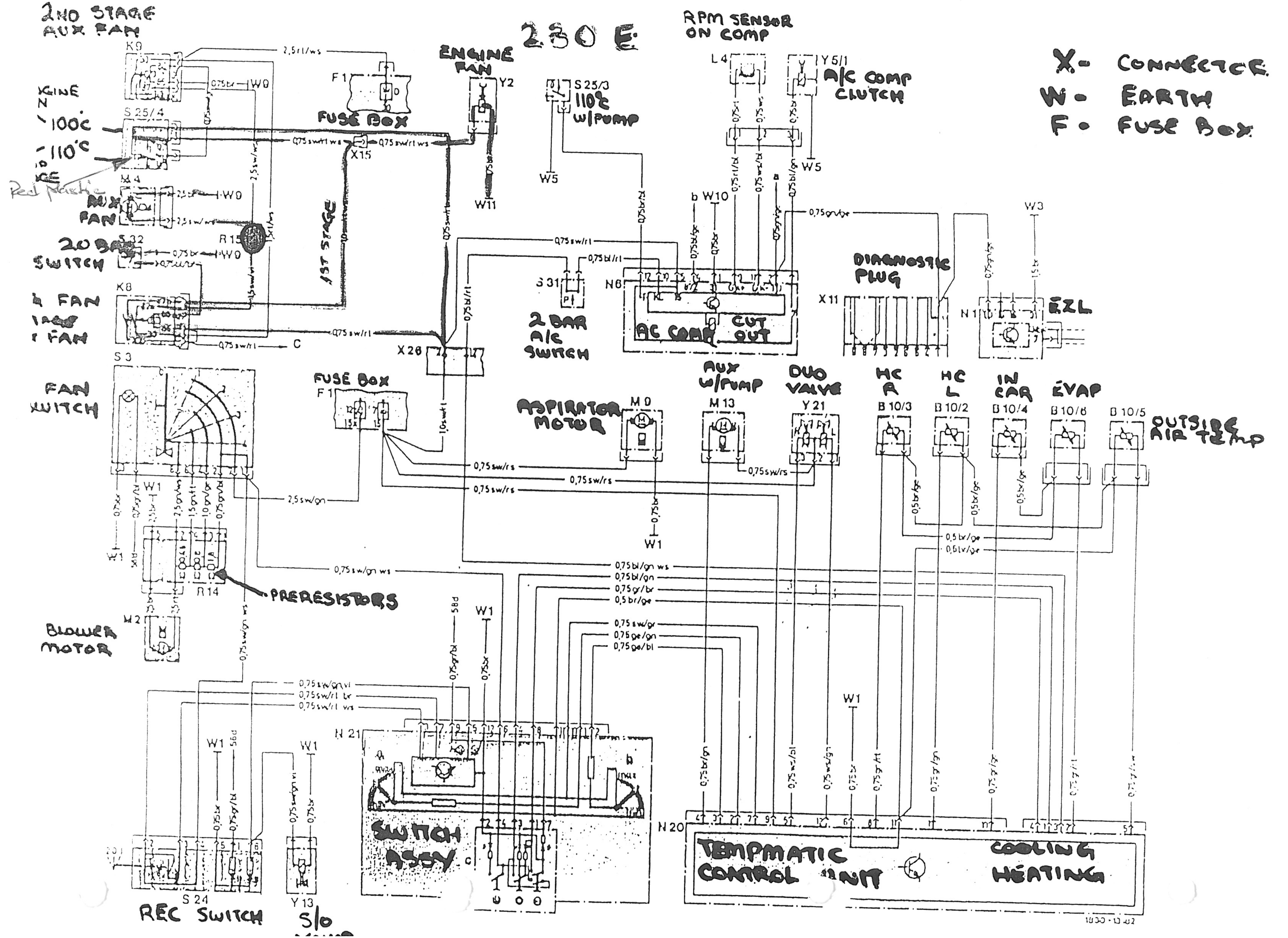
The stop lamp and the turnsignal (flasher) lamp have a trouble memory, i.e. in the event of a bulb failure in one of these circuits the glow bulb failure indicator remains energized until the key in the steering lock is turned back to "I" or "0".

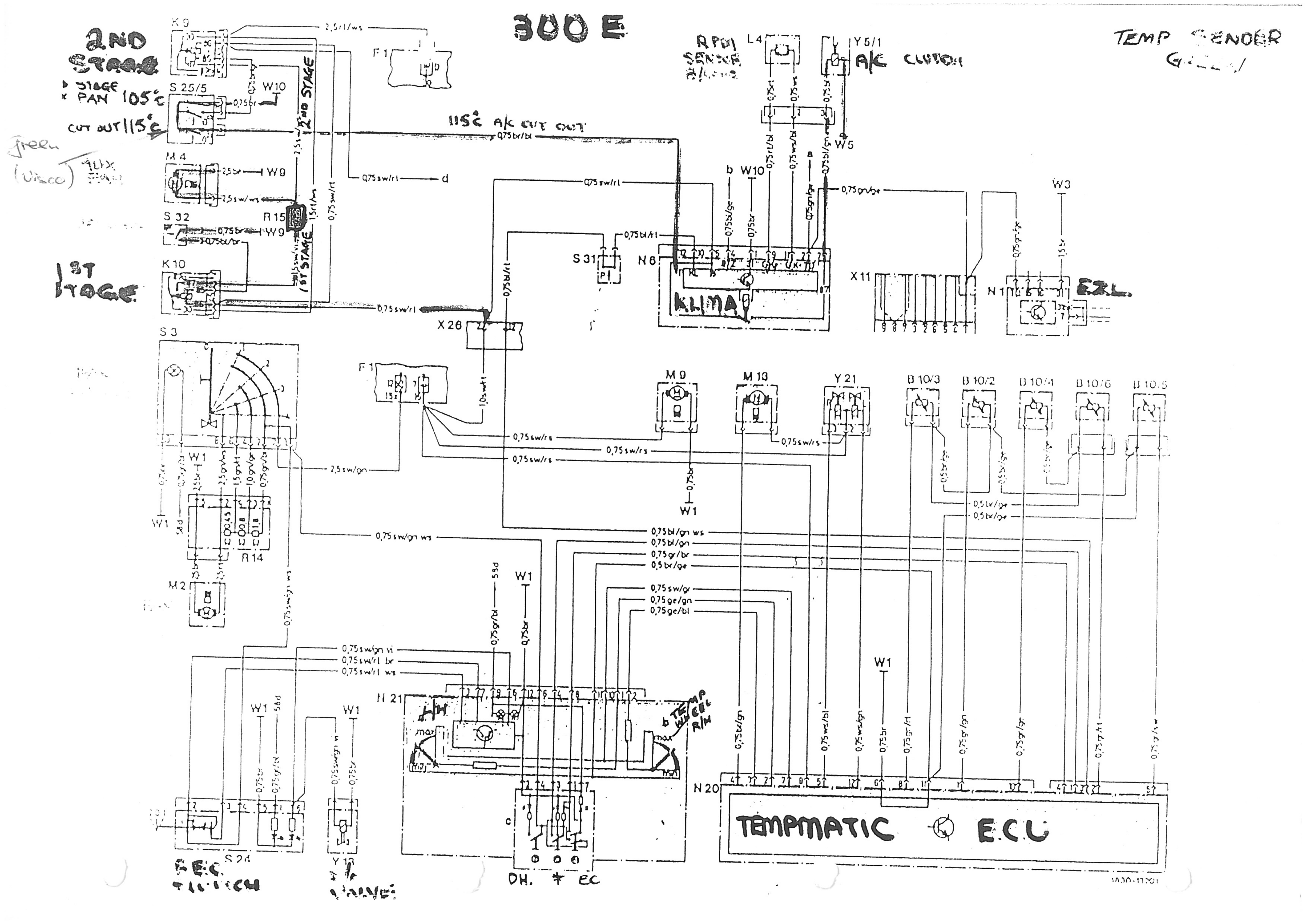
To recognize the fault, turn key from position "0" to position "2" (ignition ON) and switch on turnsignal or stop lamp.

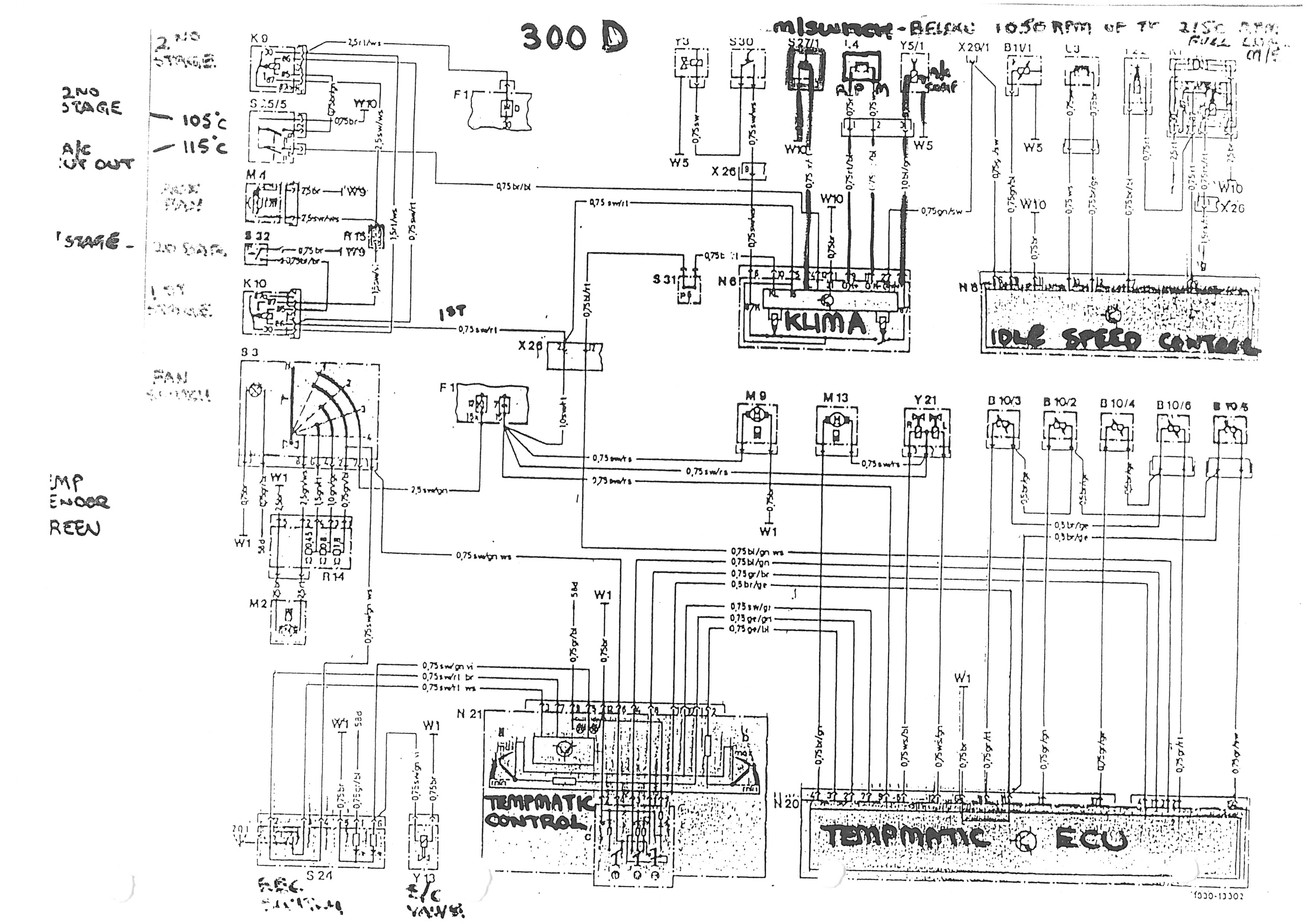
Since switching on of the illumination will simultaneously activate several lamps, a visual checkup is required to show where the fault is located.

Note: The indicator lamp lights up for self-inspection in key position "2" at reduced brightness and will go out when the engine is running.

During subsequent installation of auxiliary lights such as additional headlamps, additional stop lamps, trailer coupling etc. the lamps must be connected to fuse in front of lamp indicator unit, since otherwise the lamp bulb failure indicator is interrupted or the lamp checkup unit is damaged.


280 E
X- CONNECTOR
W- EARTH
F- FUSE BOX
2ND STAGE AUX FAN
K9
ENGINE FAN
Y2
RPM SENSOR ON COMP
L4
Y5/1
A/C COMP CLUTCH
S25/3
110°C W/PUMP
FUSE BOX
F1
S25/4
100°C
110°C
Red Plastic
X15
AUX FAN
20 BAR SWITCH
S32
R15
1ST STAGE
K8
X26
S31
2 BAR A/C SWITCH
N6
AC COMP CUT OUT
DIAGNOSTIC PLUG
X11
EZL
N1
S3
FAN SWITCH
ASPIRATOR MOTOR
M9
AUX W/PUMP
M13
DUO VALVE
Y21
HC R
B10/3
HC L
B10/2
IN CAR
B10/4
EVAP
B10/6
OUTSIDE AIR TEMP
B10/5
R14
PRERESISTORS
BLOWER MOTOR
M2
N21
SWITCH ASSY
N20
TEMPMATIC CONTROL UNIT
COOLING HEATING
S24
REC SWITCH
Y13
S/O


300 E
2ND STAGE
STAGE
FAN 105°C
CUT OUT 115°C
1ST STAGE
2ND STAGE
115°C A/C CUT OUT
TEMP SENDER
A/C CLUTCH
KLIMA
E.Z.L.
TEMPMATIC E.C.L.
DH. * EC
K 9
S 25/5
M 4
S 32
R 15
K 10
S 3
R 14
M 2
F 1
X 26
S 31
N 6
L 4
Y 6/1
W 5
W 10
W 3
X 11
N 1
M 9
M 13
Y 21
B 10/3
B 10/2
B 10/4
B 10/6
B 10/5
N 21
N 20
S 24
Y 13
W 1
1030-11301


300 D
MISWITCH - BELOW 1050 RPM
2ND STAGE
105°C
A/C CUT OUT
115°C
1 STAGE
1ST
TEMPMATIC CONTROL
TEMPMATIC ECU
KLIMA
IDLE SPEED CONTROL
K 9
S 25/5
M 4
S 32
K 10
S 3
F 1
X 26
M 2
R 14
N 21
N 20
S 24
Y 13
M 9
M 13
Y 21
B 10/3
B 10/2
B 10/4
B 10/6
B 10/5
N 6
N 8
S 31
Y 3
S 30
S 27/1
L 4
Y 5/1
X 20/1
B 11/1
L 3
W 1
W 5
W 9
W 10
1030-13302