Mercedes-Benz

Service

Service Manual Supplement
Engine 102.983

Mercedes-Benz of North America, Inc.

S-2347-SUP

Published by Mercedes-Benz of North America, Inc.
Printed in U.S.A.

Order No. S-2347-SUP

Introduction

This supplementary manual is the product of existing technical publications. It is intended to supplement Service Manual Engine 102 and covers those areas where the 16-valve engine differs from the standard 8-valve engine. In Group 07.3, additional information covers fuel system changes for 1987.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by **trained Mercedes-Benz personnel** at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied **only** to its authorized dealers. The information outlined herein is intended for use by **trained Mercedes-Benz service and dealership personnel.** This manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

⚠ Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such a manner that the service may be performed safely and accurately.

However, it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

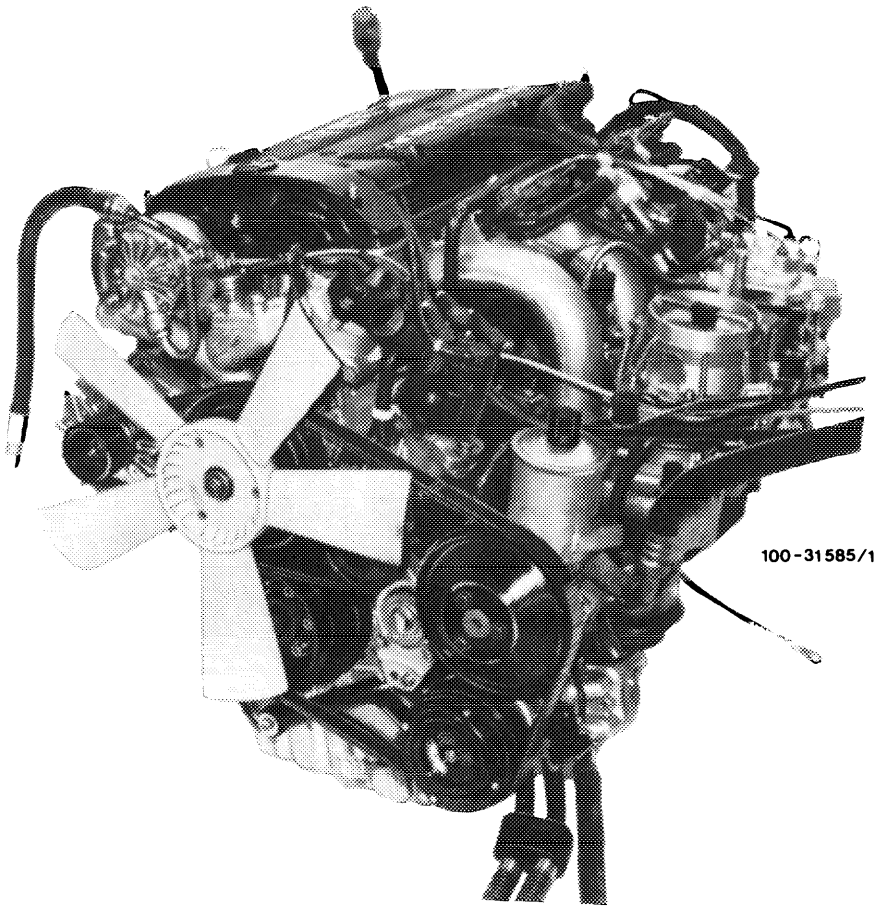
Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

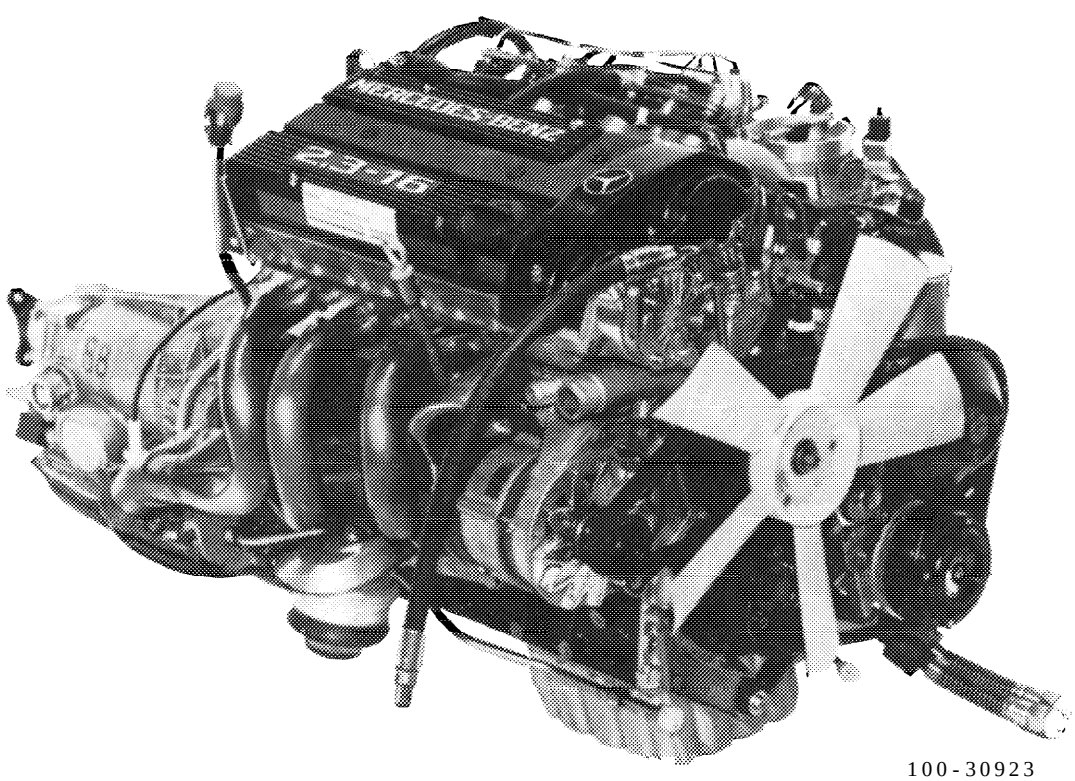
MERCEDES-BENZ OF NORTH AMERICA, INC.
Service and Parts Literature

Table of contents

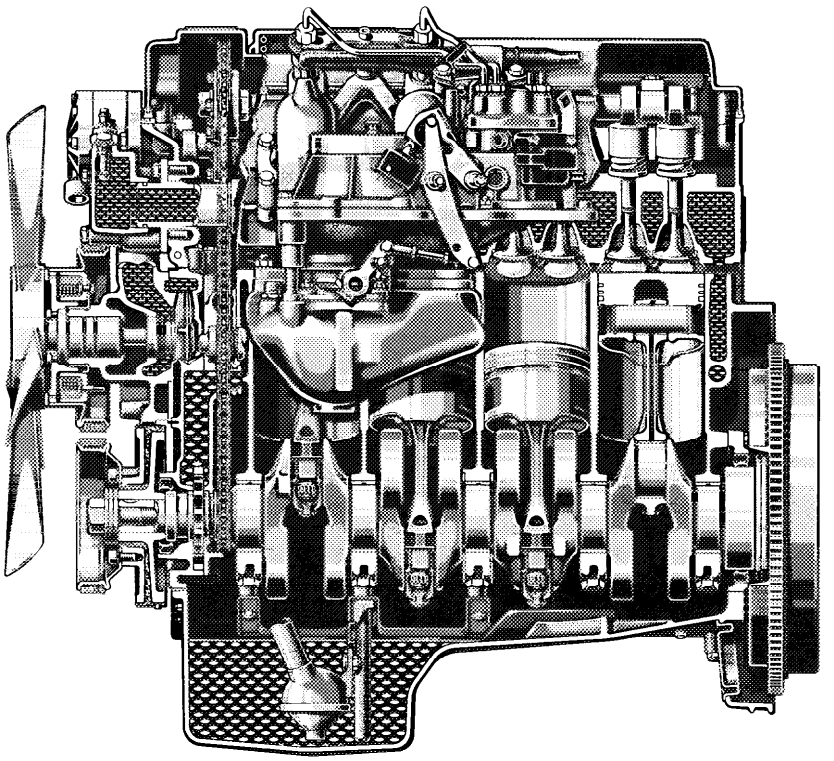
Engine 102.983

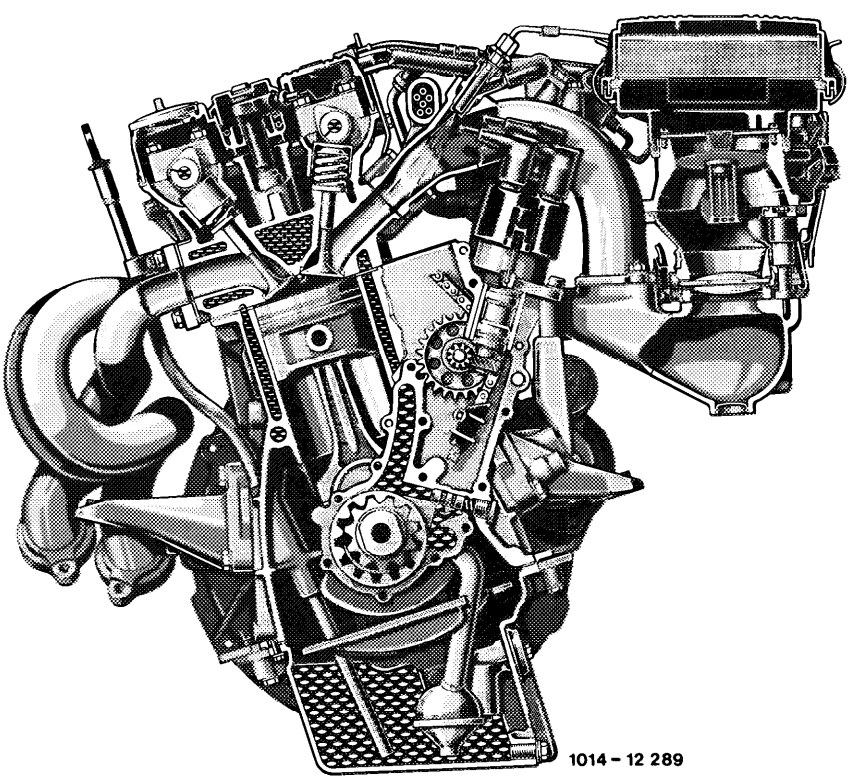
Views of engine 102.983





Longitudinal and cross sectional views of engine 102.983





1014 – 12 289

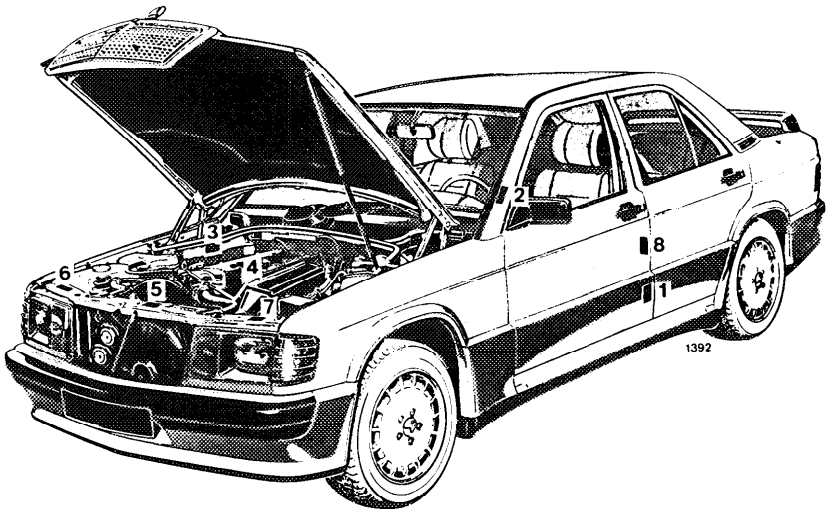
This manual applies to the following passenger cars, model years 1986 – 1987.

Gasoline engines

Model Year	Model	Sales Designation	Engine
1986 – 1987	201.034	190 E 2.3-16	102.983

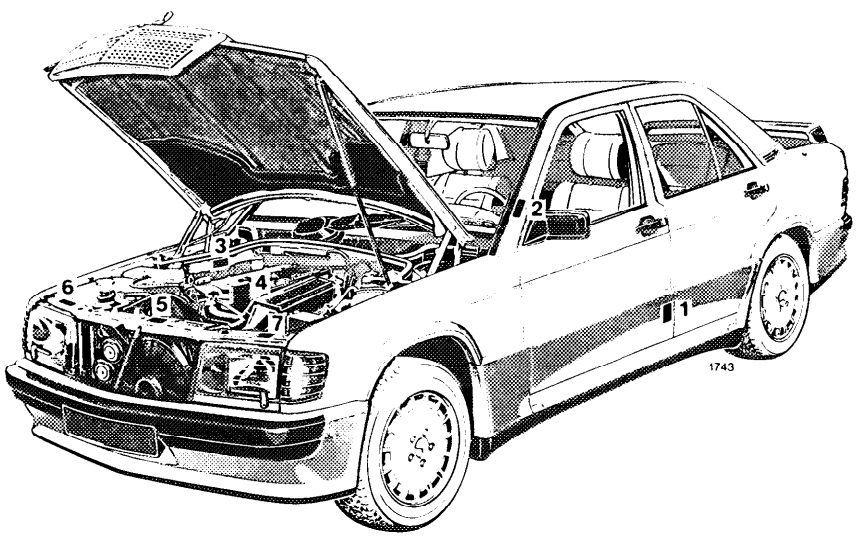
Model 201.034

When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information
(model year 1986)

Model year 1986



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identrficatlon No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model year 1987

Gasoline engine

Model	201.034
Sales designation	190 E 2.3-16 (Model Years 1986 - 87)
Engine	102.983
Operation	4-stroke spark ignition, mechanically/electronically controlled continuous fuel injection system with airflow sensor (CIS-E)
Number of cylinders	4
Cylinder arrangement	In-line 15 ° inclination
Bore/stroke mm	95.5/80.25
Total effective piston displacement cc	2299
Compression ratio	9.7 : 1
Firing order	I-3-4-2
Maximum speed rpm	6800 ± 50
Engine output (SAE) kW/rpm net bhp/rpm	 125/5800 167/5800
Maximum torque Nm/rpm net lb-ft./rpm	 220/4750 162/4750
Crankshaft bearings	5 (multi-component, anti-friction bearings)
Valve arrangement	Overhead, 4 per cylinder
Camshaft arrangement	2 overhead camshafts
Oil cooling	Oil-to-air-cooler
Cooling	Coolant circulation pump, thermostat with bypass line, fan with visco clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump
Oil filter	Full flow filter
Air cleaner	Dry air filter with paper cartridge

Filling capacities

Model	201.034
Sales designation	190 E 2.3-16 (Model Years 1986 - 87)
Engine	102.983
Fuel tank/reserve approx. l	7018.5
During initial oil filling approx. l	5.5
During oil and filter change approx. l	5.0
Marks on dipstick max./min. approx. l	4.8/2.8
Cooling system with heater approx. l	8.0

Electrical system

Model	201.034
Sales designation	190 E 2.3-16
Engine	102.983
Battery Voltage Capacity	 12 v 62 Ah
Starter Bosch	12 v 1.5 kW
Alternator	14 V 70 A

Crankcase, cylinder head, crankcase ventilation

Crankcase

The crankcase corresponds with that of the engine 102.985, except for the following modifications.

The mounting bore for the TDC position indicator of the ignition system (arrow) is located above the starter mounting flange.

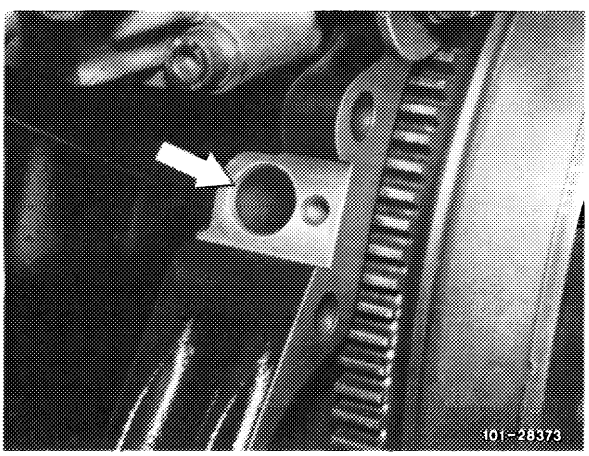


Fig. 01/1

The oil deflector plate fastened to crankshaft bearing caps 1 – 3 prevents splashing of oil at high engine speeds.

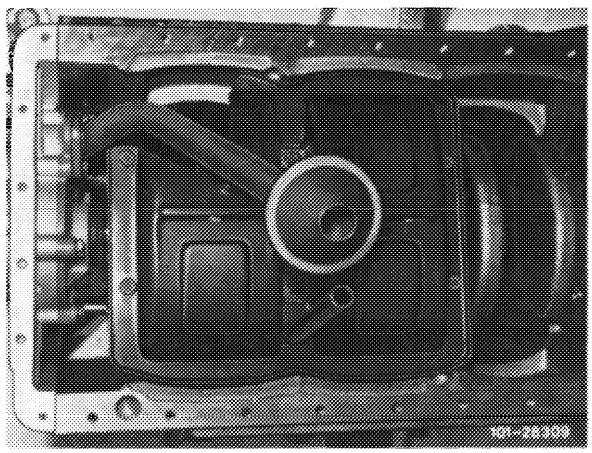


Fig. 01/2

Oil pan

The oil pan was reinforced by additional ribs on the bottom.

The low oil level switch was moved higher on the oil pan due to the lower oil quantity circulated through the engine.

Repair note

The oil pan can be removed without removing the engine.

Cylinder head

Cross flow cylinder head with roof-shaped combustion chambers.

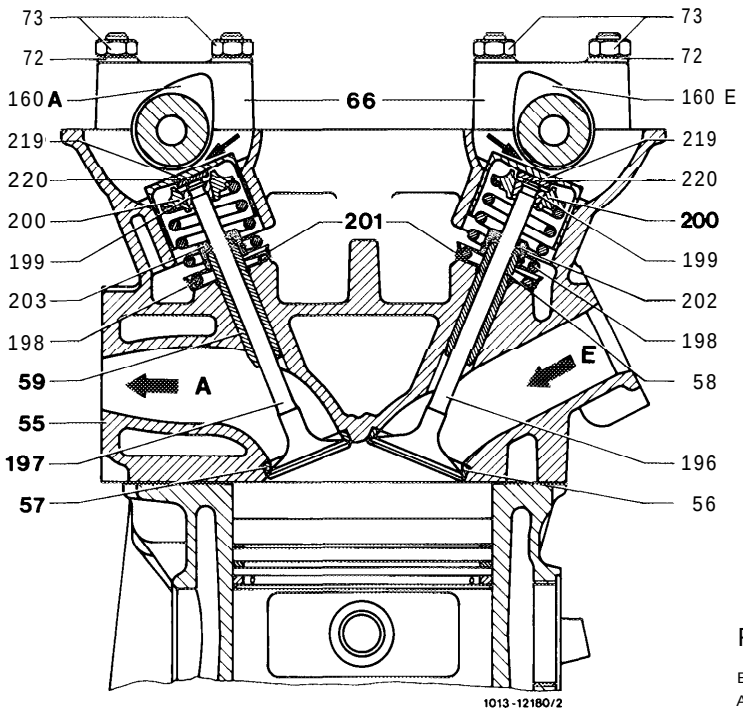


Fig. 01/3

E = Intake
A = Exhaust

Camshaft bearings

Intake and exhaust camshafts are mounted directly in the cylinder head. The four split bearing bores for each camshaft are half in the cylinder head and in mounted bearing caps.

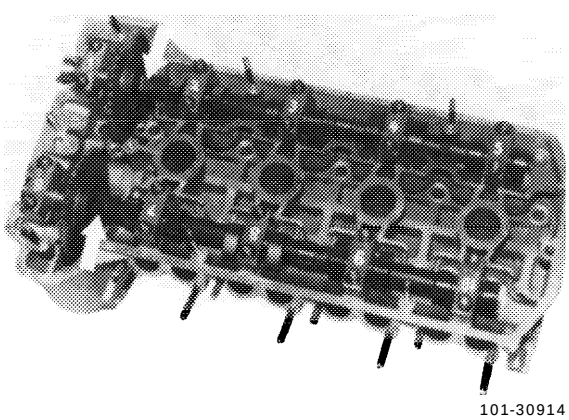


Fig. 01/4

The shaft ends of the camshaft sprockets are mounted in the two bearings (1 and 6).

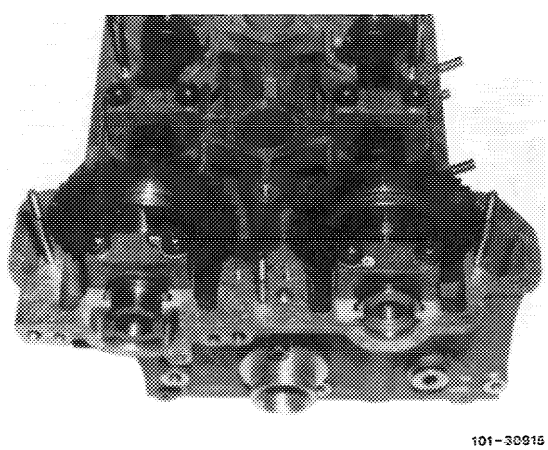


Fig. 01/5

All bearing caps are identical. They are line bored together with the cylinder head and are identified with the numbers 1 to 10. During assembly jobs, the original installation position must be maintained.

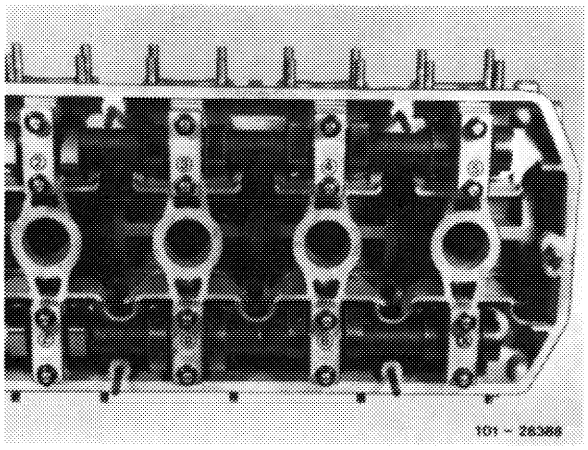


Fig. 01/6

Installation position of bearing caps

Bearing cap 1 = bearing of exhaust camshaft sprocket (Fig. 01/5).

Bearing caps 2 - 5 = bearings of exhaust camshaft (Fig. 01/6).

Bearing cap 6 = bearing of intake camshaft sprocket (Fig. 01/5).

Bearing caps 7 - 10 = bearings of intake camshaft (Fig. 01/6).

The bearing caps are fastened to the cylinder head with M 8 studs, wave washers and nuts.

Tightening torque of nuts 21 Nm.

Repair notes

In case of seizing or excessive scoring on camshaft bearings, replace cylinder head and camshaft.

Replace only one bearing cap per camshaft since during simultaneous replacement of several bearing caps the camshaft may bind.

The bearing caps are correctly installed, if the stamped in code numbers are closest to the inner studs (Figs. 01/5 and 01/6).

Valve guides

The valve guides are located at an angle of 45° in relation to each other (Fig. 01/8) and arefitted in the cylinder head with an interference fit of 0.012 - 0.041 mm.

The OD (13 mm) is 1 mm smaller than on the other engines 102. They are also shorter.

Repair note

The finished valve guides are available in four repair sizes.

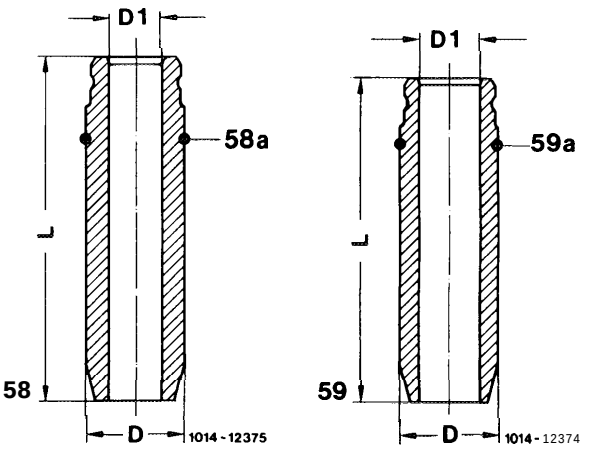


Fig. 01/7

58 Intake valve guide (copper colored)
D = 13.023 - 13.041 mm
D1 = 7.000 - 7.015 mm
L = 45.5 mm
58a Retaining ring

59 Exhaust valve guide (brass colored)
D = 13.023 - 13.041 mm
D1 = 8.000 - 8.015 mm
L = 42.9 mm
59a Retaining ring

Valve seat rings

The valve seat rings are press fitted in the cylinder head with an interference of 0.075 – 0.120 mm.

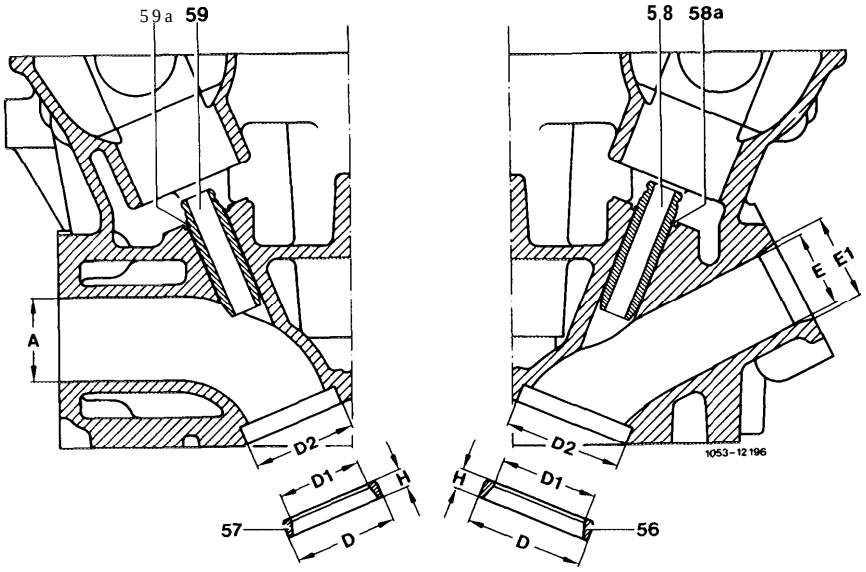


Fig. 01/8

56 Intake valve seat ring
D = 39.100-39.120 mm
D1 - 3 3 m m
D2 = 39.000 – 39.025 mm
H = 5.8 mm

57 Exhaust valve seat ring
D = 34.100 – 34.120 mm
D1 - 2 8 m m
D2 = 34.000 – 34.025 mm
H = 5.4 mm

Repair note

One repair size valve seat ring with a larger OD is available for intake and exhaust respectively.

Spark plug location

The spark plug with threads M 14 x 1.25 and tapered sealing seat is centrally located in the combustion chamber.

Repair note

Before unscrewing spark plugs clean out recesses with compressed air. This will help prevent dirt from entering the combustion chambers when removing the spark plugs.

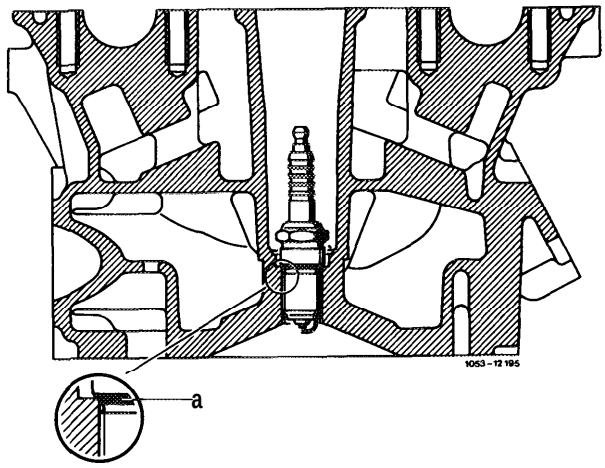


Fig. 01/9

a Tapered sealing seat

Core plugs

The core holes in cylinder head are closed with 18.2 mm dia. sheet metal plugs (59), the front and lateral oil ducts with 5.2 mm dia. sheet metal plugs (57) and the bottom oil duct with a 5 mm dia. dowel pin (58).

Repair note

Leaking plugs can be replaced similar to the other engines 102. Refer to special tools section.

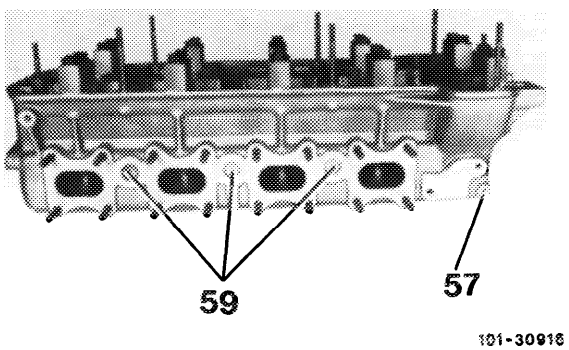


Fig. 01/10 Cylinder head right side

57 Sheet metal plug 5.2 mm dia
59 Sheet metal plug 18 2 mm dia

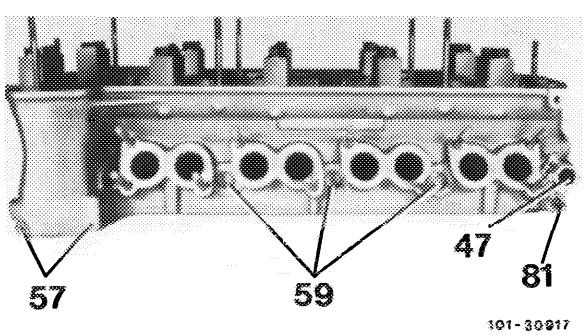


Fig. 01/11 Cylinder head left side

47 Threaded pipe connector for coolant to heater core
57 Sheet metal plug 5.2 mm dia.
59 Sheet metal plug 18 2 mm dia.
81 Threaded pipe connector for crankcase ventilation coolant heating

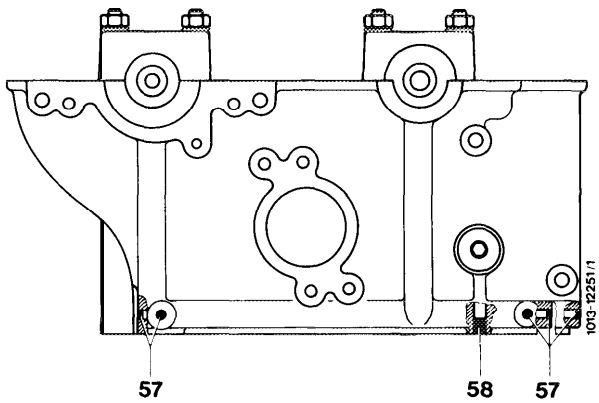


Fig. 01/12 Cylinder head front

57 Sheet metal plug 5.2 mm dia
58 Dowel pin, 5 mm dia.

Connections

A coolant return pipe (23) is inserted at the front of the cylinder head, leading through the timing chain housing to a coolant chamber.

Sealing

- In the coolant passage with O-ring (24)
- At the mounting flange with gasket (26)

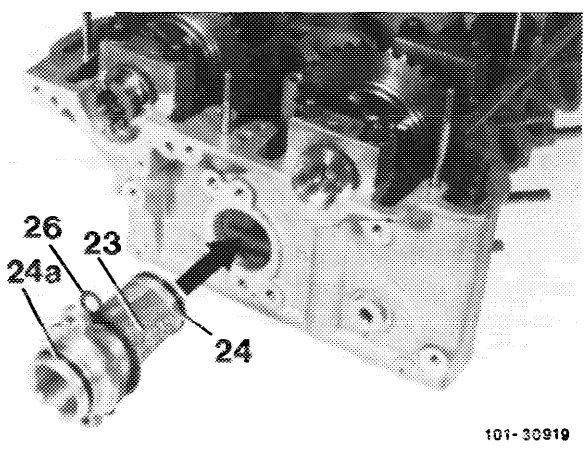


Fig. 01/13

A threaded connection for coolant to the heater core (47) and one for the crankcase ventilation heating (81) are screwed into the cylinder head left rear corner (Fig. 01/11).

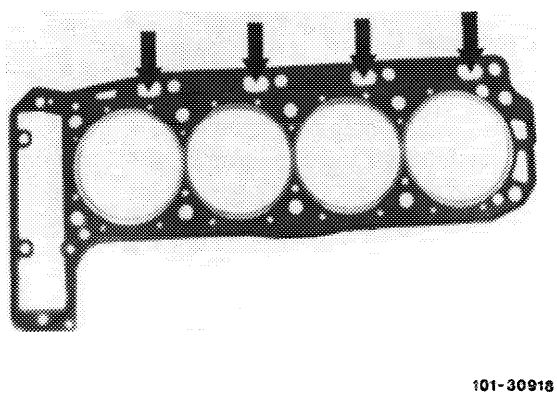
Cylinder head gasket

The cylinder head gasket does not require retorquing. There is only one gasket version for this engine, independent of cylinder dia. (standard, repair sizes + 0.5 mm dia. and + 1 .O mm dia.).

The gasket has an adhesive strip on the sealing surface. It is identified by the stamped in part number and by the relief holes (arrows).

Caution:

Do not interchange this cylinder head gasket with those of other 102 engines.



101-30918

Fig. 01/14

Valve cover

The valve cover is made of a magnesium alloy and is laminated with black plastic on the outside.

The ignition cable channel cover is plastic (113). It is fastened with three plastic screws (114) and sealed with a rubber gasket. To prevent excessive tightening which could damage the cover, each screw has a special washer.

The oil filler cap is plastic (90).

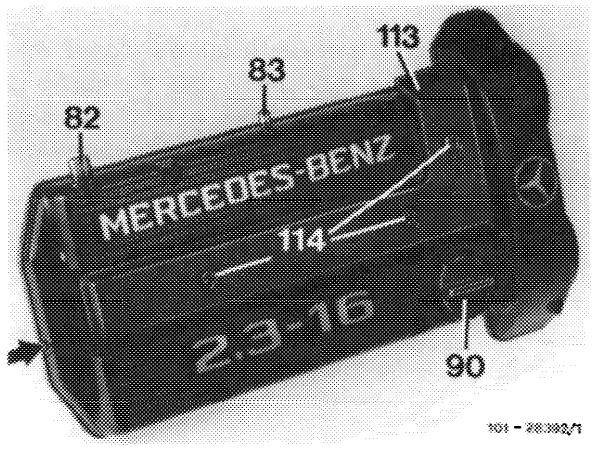


Fig 01/15

82 Hose connection for engine ventilation
83 Hose connection for engine ventilation with bypass bore 1.6 mm dia.
90 Oil filler cap
113 Ignition cable channel cover
114 Plastic screws (Tightening torque 1.5 – 2 Nm)

Inside/underside

The oil separator plate (85) for the engine ventilation is fastened with 8 screws and sealed with silicone adhesive.

Valve cover gasket (93) made of rubber (U section).

Rubber seal rings (112) for sealing spark plug recesses.

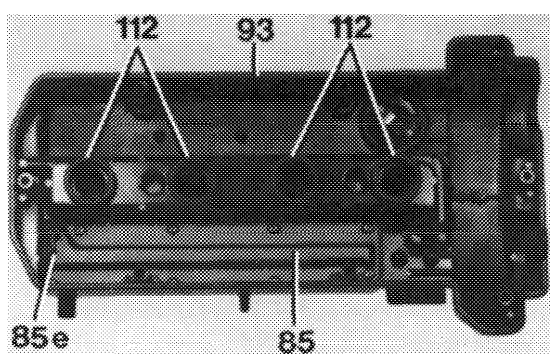


Fig. 01/16

85 Oil separator plate
85a Oil drain tube
93 Valve cover gasket
112 Rubber seal rings

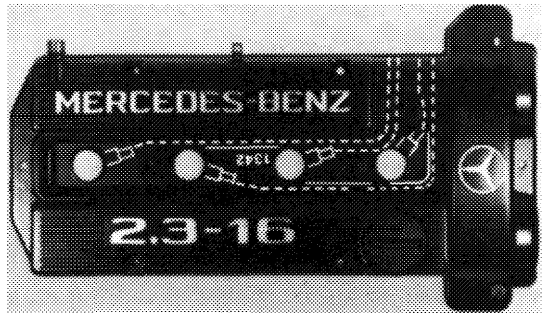
To make sure that the spark plug recesses and the ignition cable channels are not filled with water, e. g. during an engine wash, the valve cover has a drain hole at the rear (arrow, Fig. 01/15).

Assembly notes

The valve cover M6 cap nuts should be tightened crosswise and in several steps.

Tightening torque 9 Nm.

The ignition cable channel has guide ribs and symbols for correct installation of ignition cables.



101 - 28390

Fig. 01/17

Positive crankcase ventilation (PCV)

Operation

The engine blow-by gases flow from cylinder crankcase to oil separator (90) in the valve cover. The oil separated here flows back to the cylinder head through a drain pipe.

From the oil separator the engine blow-by gases flow into the combustion chambers depending on load condition (intake manifold vacuum) as follows:

Idle/decel
(high intake manifold vacuum)

Through bypass bore 1.6 mm dia. in hose connection (83) on the valve cover to idle speed air distributor (108) and through the insulating sleeve of the injection valves to combustion chambers.

Simultaneously, additional clean air is drawn in from air cleaner (111) via hose line (103a – 103c) and fed to the combustion chambers via the oil separator together with the blow-by gases.

Partial and full load operation
(low intake manifold vacuum)

Mainly via hose line (103a – 103c) to air cleanerclean side and with intake air to the combustion chambers.

To make sure that the vent line (103a – 103c) does not freeze at low outside temperatures, it is heated with coolant. The coolant line (106) is integrated in the vent line and is connected to the cylinder head via the supply line (104). The coolant is returned to the coolant pump (1) via return line (109).

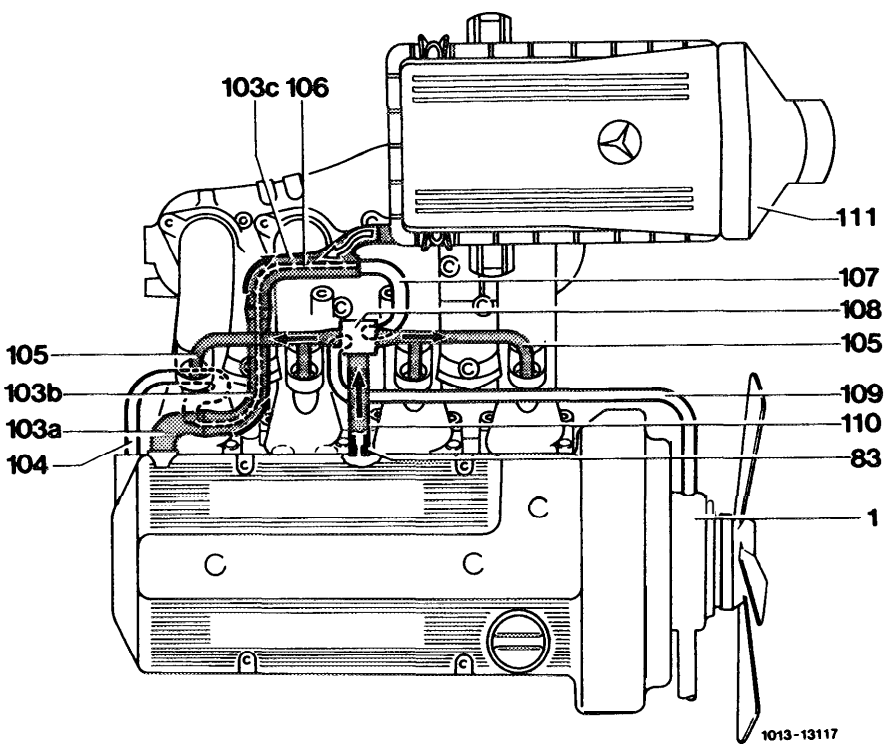


Fig. 01/18

1	Coolant pump
83	Hose connection with 1.6 mm throttle
103a – 103c	Vent lines
104	Coolant supply line for crankcase vent line
105	Idle speed air line
106	Heating water line (copper tubing)
107	Coolant connection line
108	Idle speed air distributor
109	Coolant return line
110	Crankcase vent line
111	Air filter

Removal and installation of cylinder head

Note: Only repair instructions not described in microfiche Engine 102, Mechanical I, will be discussed in the following pages.

Tightening torques	Nm
Chain tensioner in crankcase	40
Camshaft sprockets	12
Camshaft bearing caps	
Exhaust manifold to cylinder head	
Thermostat housing to cylinder head	21
Coolant connecting pipe (cylinder head – thermostat housing) to cylinder head	
Support (exhaust manifold – transmission) to exhaust manifold	
Exhaust system to exhaust manifold	27
Valve cover	9

Removal

Air filter housing

Disconnect plug from intake air temperature sensor (124) and crankcase ventilation hose (103c) on air cleaner (121).

Remove nuts (122), lift housing at the rear until it is released from studs, slide back slightly (direction of arrow) and lift from air flow sensor.

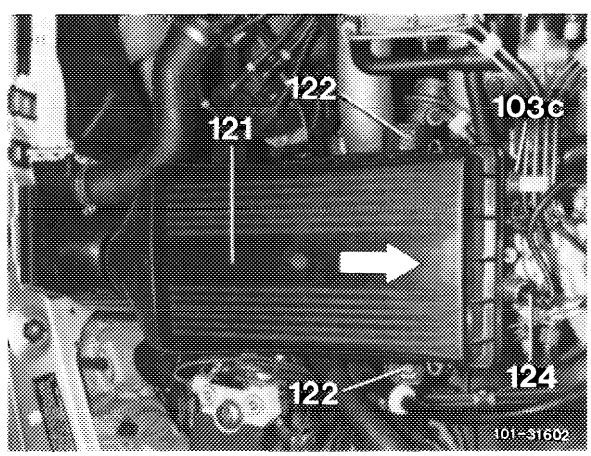


Fig. 01/19

Oil dipstick guide tube

Remove screw (46) and rotate clamp (47) away from bracket (45). Pull out oil dipstick (42).

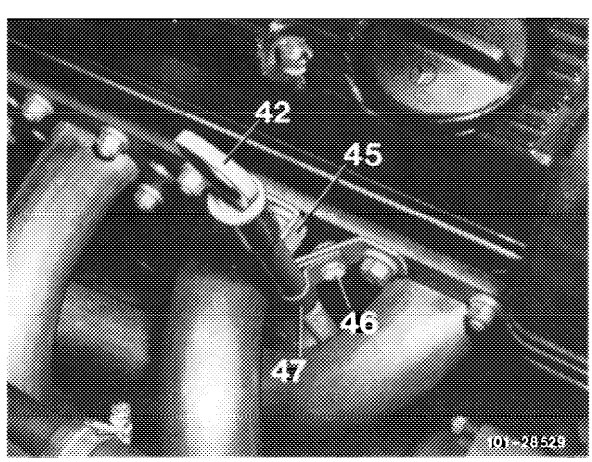


Fig. 01/20

Poly-V-belt drive

Loosen screw (25) by ¼ – ½ turn, slacken poly-V-belt (27) by turning tensioning nut (24) counterclockwise. Remove poly-V-belt (27).

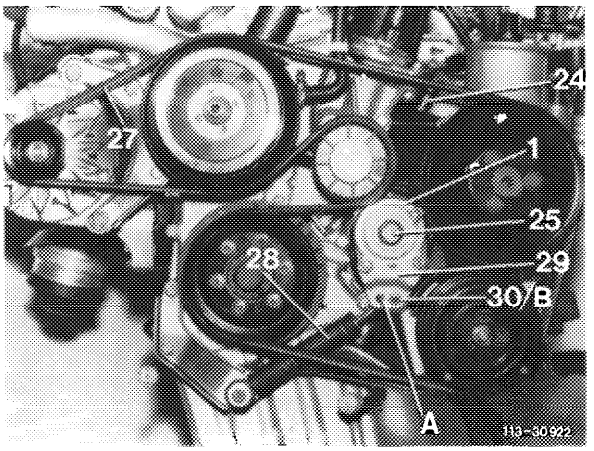


Fig. 01/21

Exhaust manifold

Remove screw (119) from support bracket (118) and loosen screws (120) on transmission.

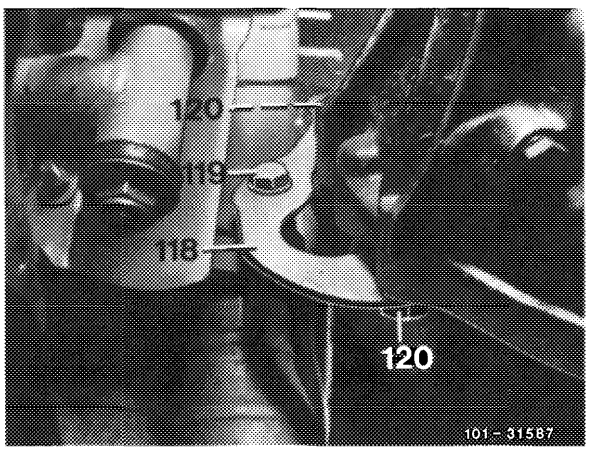


Fig. 01/22

Valve cover

Remove screws (114) of ignition cable channel cover (113), remove cover, pull off spark plug connectors and put ignition cables aside.

Loosen hose clamp (128) and pull hose (103) from valve cover (81).

Pull hose (110) from valve cover, remove nuts (96) and remove valve cover.

Caution!
If the valve cover is stuck, do not strike with a hammer to loosen it, the valve cover may crack

Try to loosen the valve cover by pushing at one side with your hands; if necessary, carefully tap corners with a rubber mallet.

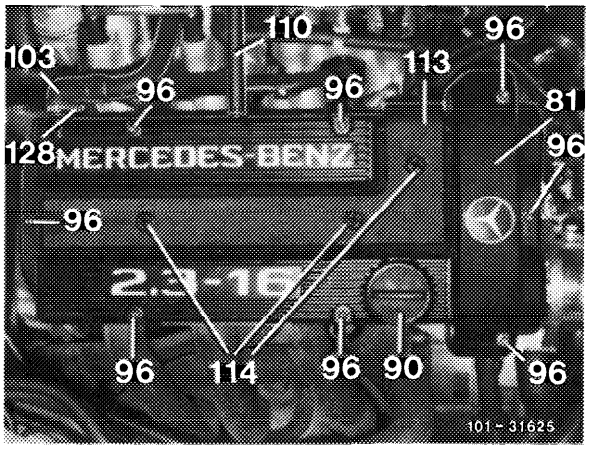


Fig. 01/24

Camshaft sprockets

Set engine to ignition TDC of 1st cylinder.

For this purpose, turn crankshaft until the bores in the camshaft sprockets (2 mm dia., arrows) are aligned opposite each other.

Mark camshaft sprockets (4A and 4E) and timing chain (21) in relation to each other.

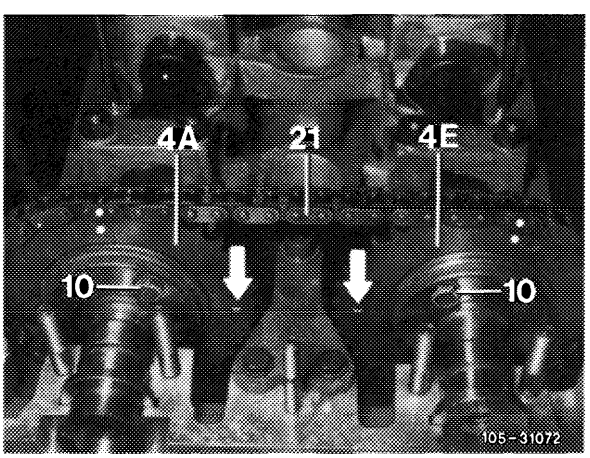


Fig. 01/25

Remove alternator air duct. Disconnect wires to alternator at terminal block. Pull harness through component compartment wall and put aside with air duct.

Remove screw (722), loosen screw (723) and rotate alternator (724) away from engine.

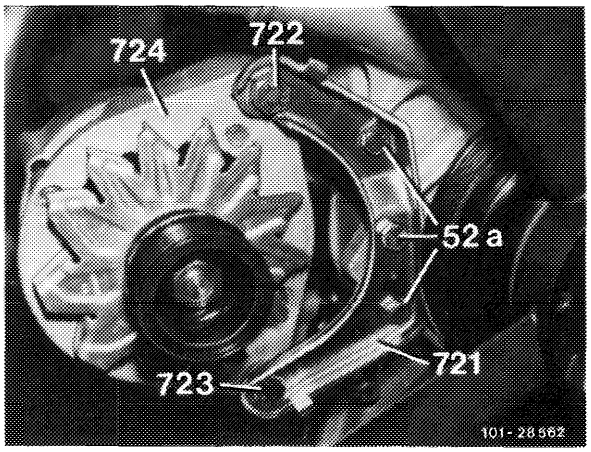
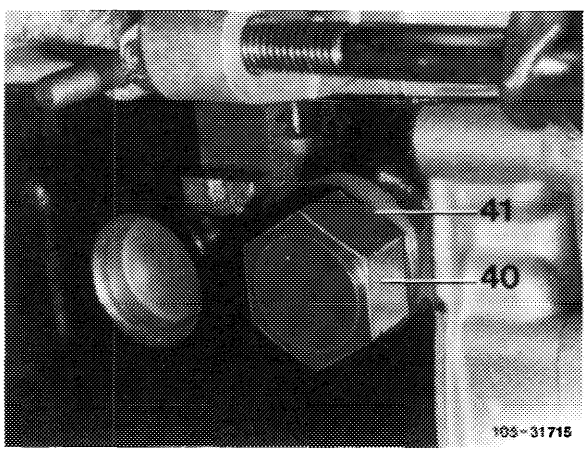


Fig. 01/26

Unscrew chain tensioner (40) at hex. head (32 mm).



Pig. 01/27

Remove screws (241) and flange (239).

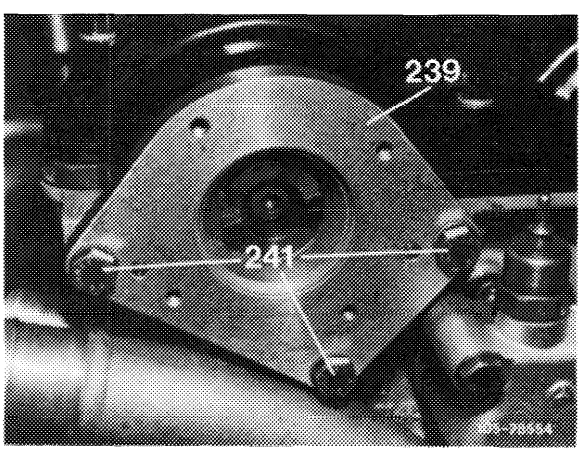


Fig. 01/28

Remove nuts (65) and remove bracket (27) together with slide rail (31).

Mote: If installed, remove the sheetmetal bracket which is attached at the two front cylinder head bolts and two eyes at timing chain housing cover.

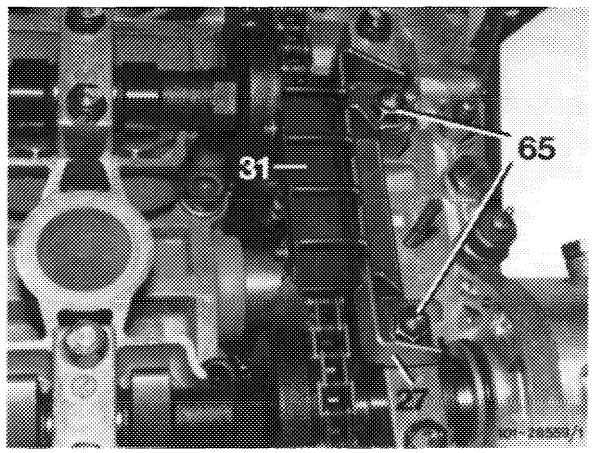


Fig. 01/29

Remove screws (10) (four, each sprocket), knock back camshaft (1A and 1 E) with a plastic hammer, remove nuts (65), remove bearing caps (61/1 and 61/6) and then remove camshaft sprockets (4A and 4E).

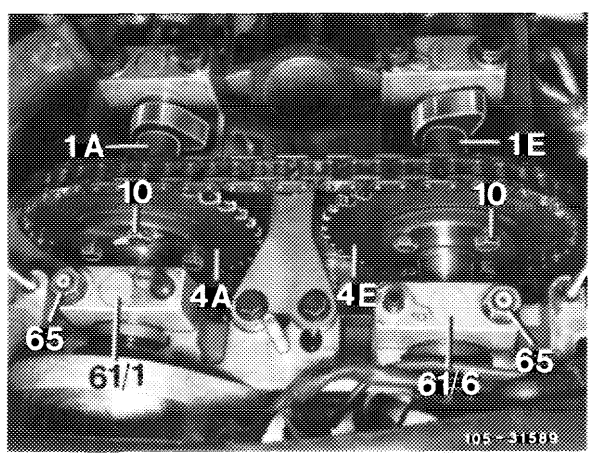


Fig. 01/30

Coolant return pipe between cylinder head and thermostat housing

Loosen hose clamp (38), remove screws (39), remove thermostat housing (29) and put aside.

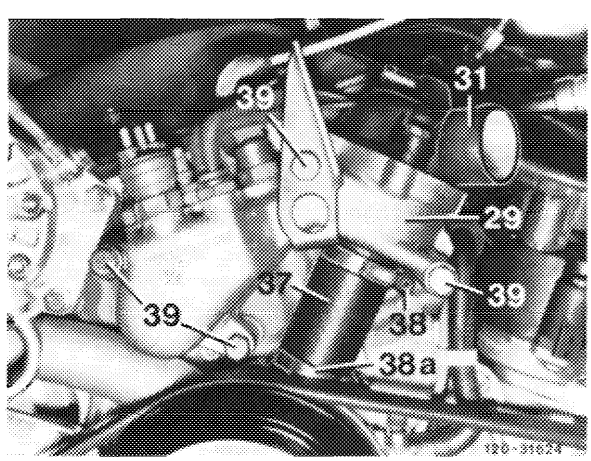


Fig. 01/31

Remove screws (402) and pull return pipe (399) out of cylinder head.

Note: If the pipe cannot be pulled out by hand, slightly rotate (direction of arrow) and force off with two screwdrivers, also refer to Fig. 01/13.

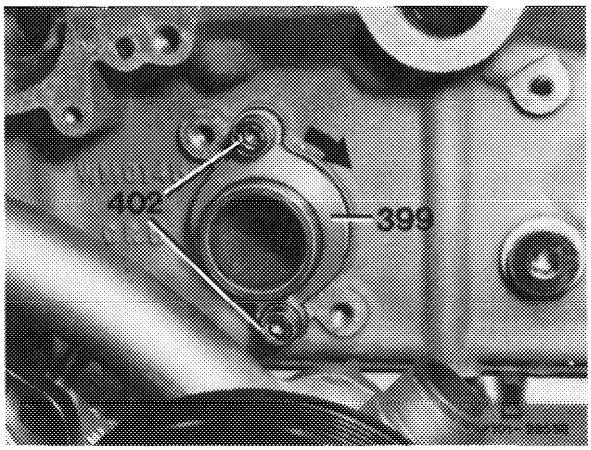


Fig. 01/32

Installation

Prior to installation, measure shaft length (L) of double hex. socket head stretch bolts.

Double hex. socket head stretch bolt

Threads	Shaft length	
	New	Max. length (replace)
M12	110 mm	113 mm

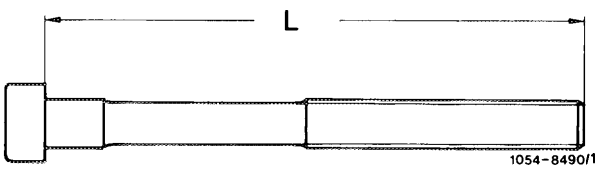


Fig. 01/33

Torque specifications and tightening diagram for cylinder head bolts are identical to other engines 102.

Replace O-rings and flange gasket on coolant return pipe (cylinder head-thermostat housing).

Install intake camshaft sprocket first, then exhaust camshaft sprocket. Note markings on timing chain and camshaft sprockets.

Check marking of camshaft sprockets in ignition TDC position of 1st cylinder.

For mounting and tensioning of poly-V-belt refer to maintenance jobs section.

Crankshaft assembly

Crankshaft

The crankshaft is similar to the other engines 102 with respect to material and dimensions.

All crankpin fillet radii are hardened. On the other engines 102 only crankpins 3 and 4, as well as pin 1, at front end are hardened.

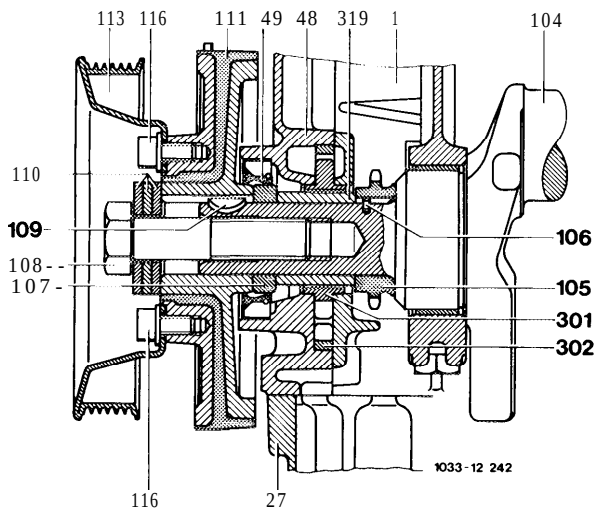


Fig. 03/1

1 Crankcase
27 Oil pan
48 Timing chain housing cover
49 Seal ring
104 Crankshaft
105 Crankshaft sprocket
106 Dowel pin 3 x 5 mm
107 Spacer
108 Screw, M 18 x 1.5 x 75
109 Woodruff key
110 Belleville washer
111 Vibration damper
113 Pulley
116 Screws, M 8 x 16
301 Internal gear, oil pump
302 External gear, oil pump
319 Driving sleeve, oil pump

A dowel pin (147) for locating the flywheel or the flex plate is inserted in the rear flange.

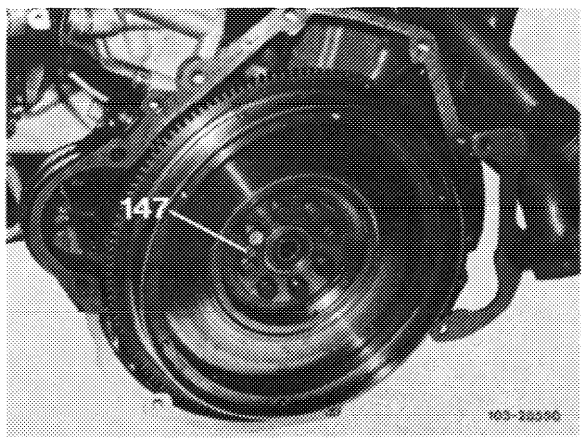


Fig. 03/2

Repair sizes are identical to the other engines 102.

Vibration damper (111)

Due to the higher engine speeds and the resulting higher load the adhesive surfaces between rubber and metal were designed larger than on the vibration damper of engine 102.985.

The TDC markings are located on the rubber surface.

Flywheel (manual transmission)

Due to higher engine speeds the material for the flywheel is of increased strength.

It is also lighter in weight than that of engine 102.985. The two 55° segments (A) on the back are located at an angle of 180° (Fig 03/3 and 03/4) in relation to each other. The installation position is fixed by a dowel pin (for bore refer to arrow).

Together with the position indicator in crankcase the segments are transmitting a signal to the control module of the ignition system.

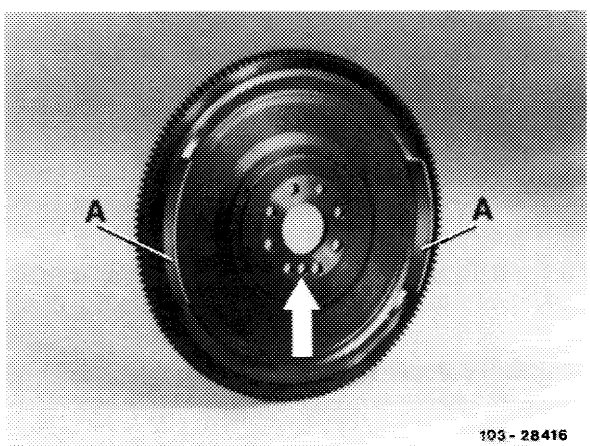


Fig. 03/3

A Segments
Arrow Locating bore

Flex plate (automatic transmission)

Due to the higher loads, the flex-plate is reinforced with 2 mm thick steel rings riveted to the ring gear (engine 102.985 has one 2.4 mm thick steel ring).

The two 55° segments (A), spaced 180° apart (Fig. 03/3 and 03/4), produce together with the ignition position sensor in the engine block an alternating current signal which is transmitted to the ignition control module. Due to the segments, the flywheel or the flex plate must be assembled to the crankshaft in a specific fixed position. This position is determined by a dowel pin in the crankshaft flange.

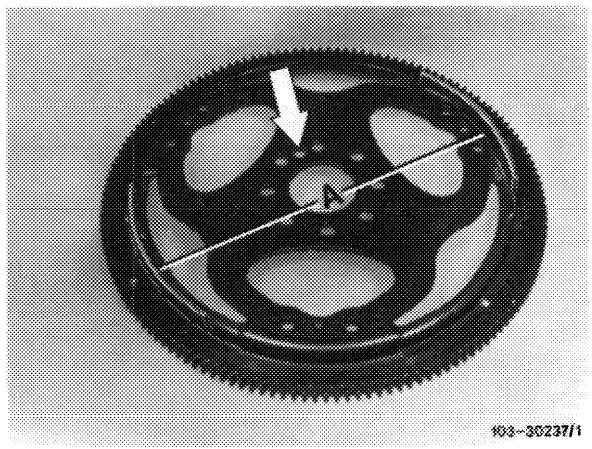


Fig. 03/4

A Segments
Arrow Locating bore

Pistons

The light-alloy pistons are manufactured by a hot forging process to provide higher strength.

Four valve recesses are located on the flat piston top.

The piston play is 0.051 – 0.075 mm (on engine 102.985 = 0.016 – 0.040 mm).

Designation and repair sizes are identical to other engines 102.

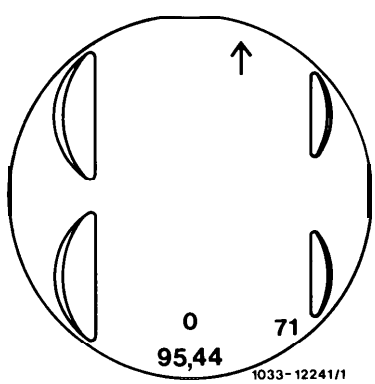


Fig. 03/5 Piston top

Compared with rings of engine 102.985 the rectangular and baffle taper compression rings are lower in height by 0.25 mm. Ring height 1.5 or 1.75 mm. The chamfered oil control ring is made of a higher strength material.

The piston wrist pin has been reinforced.

ID 14 mm
Length 65 mm.

Contrary to engine 102.985 the connecting rods on this engine are guided at the crank pins.

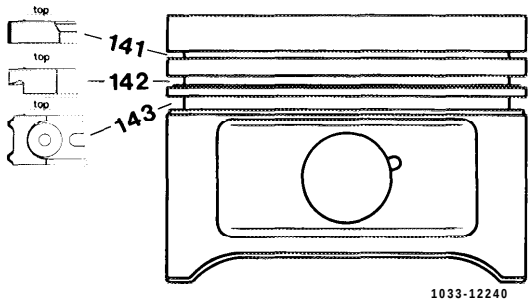


Fig. 03/6

141 Rectangular ring, contact surface molybdenum-laminated, 1 5 mm high
142 Baffle taper compression ring, with precision turned contact surface (not laminated), 1.75 mm high
143 Chamfered oil control ring with expander, contact surfaces chromed

Engine timing, valves

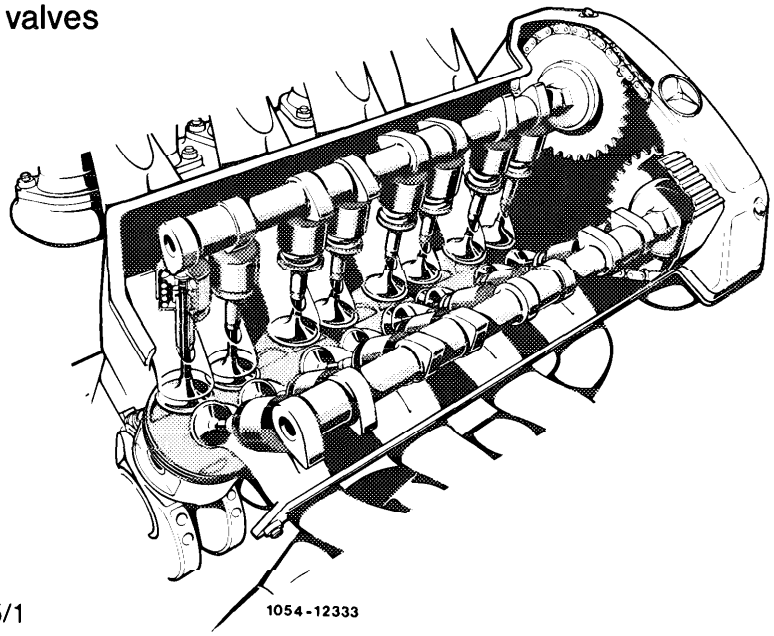


Fig. 05/1

Camshaft

The hollow-bored camshafts are made of chilled cast iron and are left and right of identical design.

The bearings are supplied with oil through the longitudinal bore. At the rear end, the camshaft is closed by a sheet metal cap.

Each camshaft is mounted in four bearings (28 mm dia.).

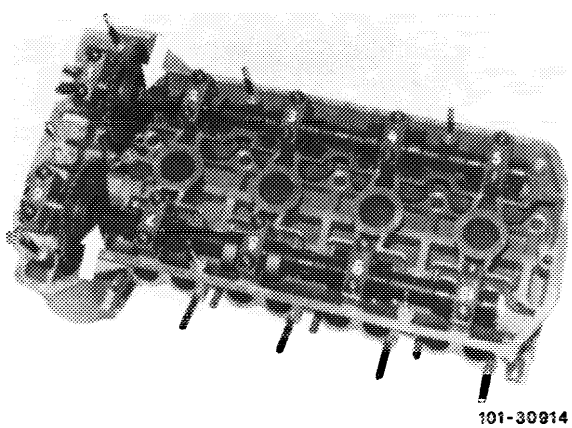


Fig. 05/2

With the camshaft sprocket removed, the camshaft can be rotated or counterheld at the 24 mm hex. (arrows).

If the timing is correct, the bores (2 mm dia.) in the camshaft sprockets (arrows, Fig. 05/9) are opposite to each other in ignition TDC position of 1st cylinder.

Repair notes

When replacing *camshafts,* also replace valve tappets.

When removing and installing camshafts, note installation position of bearing caps. (Refer to Group 01, page 33).

Carefully and uniformly tighten fastening nuts of bearing caps.

Tightening torque 21 Nm.

Checking valve timing

Check valve timing on 1. cylinder:
Check intake camshaft – begin of opening
Check exhaust camshaft – end of closing

The test procedure is the same as on engine 110 (see repair instructions on microfiche, Engine 110, Mechanical II).

Slip gauge blade on intake camshaft in from outside and on exhaust camshaft from inside. Hold down cup-type tappet with suitable tool which has no sharp edges.

Minor deviations (approx. 4 – 5°) are within tolerance and cannot be corrected. If deviations are higher, e. g. due to timing chain elongation, install new chain.

Testing and adjusting values

Timing in crank angle degrees at 2 mm valve lift

Camshafts 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			
Left	7°	26”		
Right	–		32°	13°
	with used timing chain (approx. 20 000 km, 12 500 mi)			
Left	8°	27”		
Right	–		31°	12°

[1]) Installed are selectively: 102 050 24 01 without code no. or 102 050 28 01 with code no. 25.

Vatve arrangement

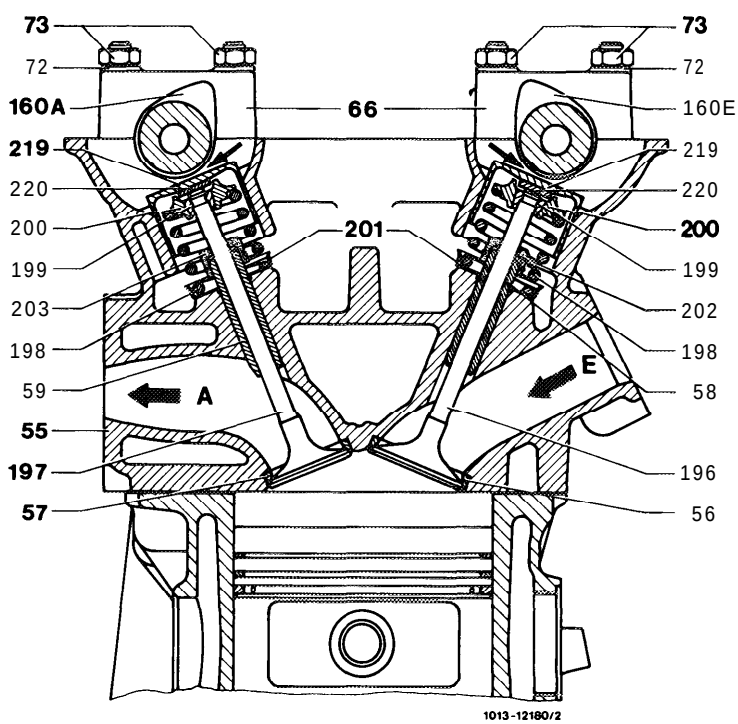


Fig. 05/3

55	Cylinder head
56	Valve seat ring, intake
57	Valve seat ring, exhaust
58	Valve guide, intake
59	Valve guide, exhaust
160E	Camshaft, intake
160A	Camshaft, exhaust
196	Intake valve
197	Exhaust valve
198	Valve spring
199	Valve keeper
200	Valve spring retainer
201	Thrust ring
202	Valve stem seal, intake valve
203	Valve stem seal, exhaust valve
219	Valve tappet
220	Thrust plate
E	Intake
A	Exhaust

The intake and exhaust valves (two each per cylinder) are mounted overhead at an angle of 45° in relation to each other. They are actuated by the intake or exhaust camshaft and case-hardened cup type valve tappets (219).

Intake and exhaust valves

Valve seat angle 45°

Inta ke valve

Valve seat and valve stem bath nitrited.

Exhaust valve

Valve seat is high quality sintered metal

Valve stem induction hardened and filled with sodium.

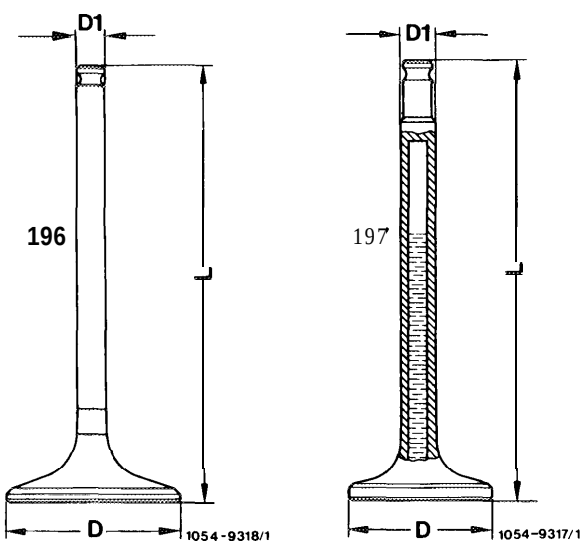


Fig. 05/4

196 Intake valve
D = 38 mm Ø
D1 = 6.97 mm Ø
L = 111 65 mm

197 Exhaust valve
D = 33 mm Ø
D1 = 7.96 mm Ø
L = 111.5 mm

Valve spring (198)

Each valve has a double progressive valve spring. The spring can be installed in either direction.

Color code: yellow-black.

Refer to special tool section for removal and installation tools.

Valve keepers (199)

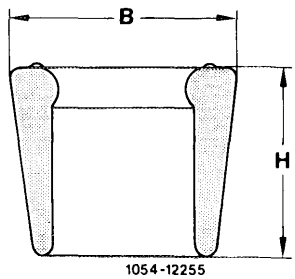


Fig. 05/5

B (mm)	9
H (mm)	9.2 - 9.8

Caution

The valve keepers must not be interchanged with those of the other 102 engines.

Valve stem seals (202 and 203)

Valve stem seal	Material	Wire ring Color	ID "D"
Intake	Viton	black	6.3 mm
Exhaust	Viton	yellow	7.2 mm

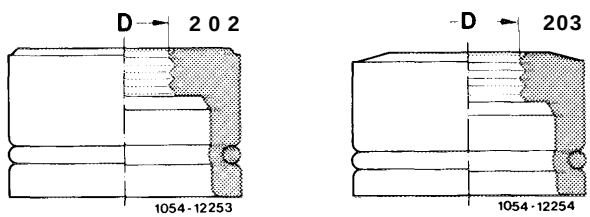


Fig. 05/6

202 Intake valve stem seal
203 Exhaust valve stem seal

Due to the different ID they are not interchangeable.

Checking and adjusting valve clearance

The valve clearance is measured between cam base circle and cup-type tappet (arrows, Fig. 05/3).

Valve clearance (in mm)

Valve	Coolant temperature up to 50 °C (engine cold)	60 – 80 °C (engine warm)
Intake	0.10 – 0.20	0.15-0.25
Exhaust	0.25 – 0.35	0.30 – 0.40

If the valve clearance is too large or too small install a thicker or a thinner thrust plate (220, Rg. 05/3).

There are 23 thrust plates of varying thickness (0.025 mm increments). 15 thrust plates are available for repair sector (0.05 mm increments). The thickness dimension is stamped into thrust plate.

A storage box is available for storing thrust plates (refer to special tools). For checking and adjusting refer to maintenance jobs.

The valve clearance must be checked during maintenance service every 24 000 km (15,000 miles) and adjusted, if required.

Chain drive

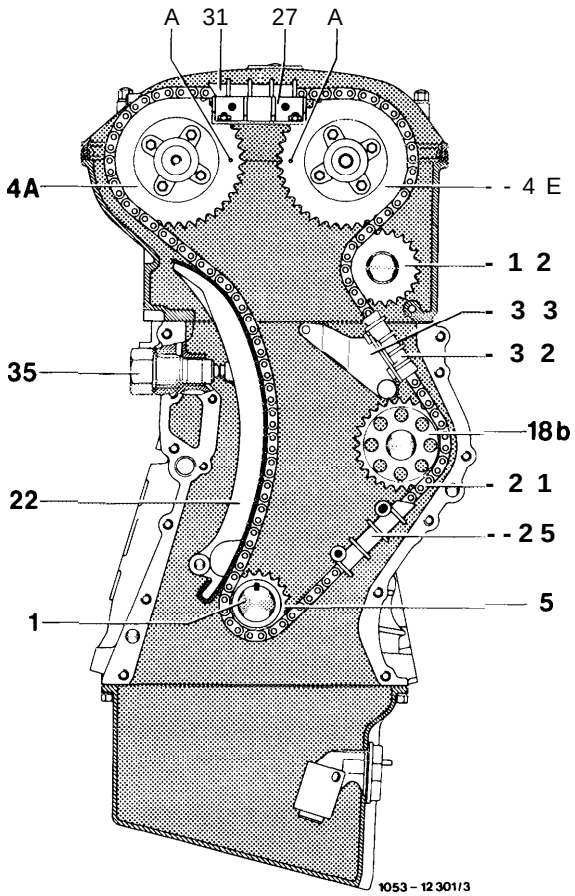


Fig. 05/7

1	Crankshaft	25	Guide rail
4A	Camshaft sprocket exhaust	27	Holder
4E	Camshaft sprocket intake	31	Guide rail
5	Crankshaft sprocket	32	Guide rail
12	Intermediate sprocket	33	Holder
18b	Idler sprocket	35	Chain tensioner
21	Single roller chain	A	Check bores
22	Tensioning rail		

Camshaft sprockets (4 A and 4 E)

The camshaft sprockets have a shaft end by which they are mounted in the cylinder head.

Bearing dia. 28 mm, same as camshaft bearing.

Each camshaft is fastened to a camshaft sprocket by four screws M 6 x 25 mm (10). The hole pattern of the four screws is non-symmetrical. Therefore, they can only be screwed on in one position.

Tightening torque 12 Nm.

The bearings are supplied with oil via the hollow camshaft sprockets.

The front bore on the intake camshaft sprocket is closed with a sheet metal plug.

On the exhaust camshaft sprocket the bore is closed by the hex. socket head screw for mounting the driver for the hydraulic oil pump of the level control system.

The camshaft sprockets are of a different design due to the shaft ends.

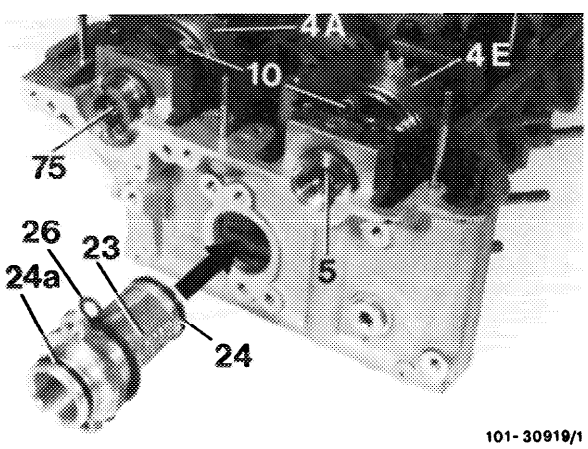


Fig. 05/8

The camshaft assembly with camshaft sprocket is axially fixed by a collar on the shaft end of the respective camshaft sprocket running in a groove in the cylinder head.

When the two bores (2 mm dia.) in the camshaft sprockets are opposite each other (arrows) the piston of the 1st cylinder is in TDC position of the compression stroke.

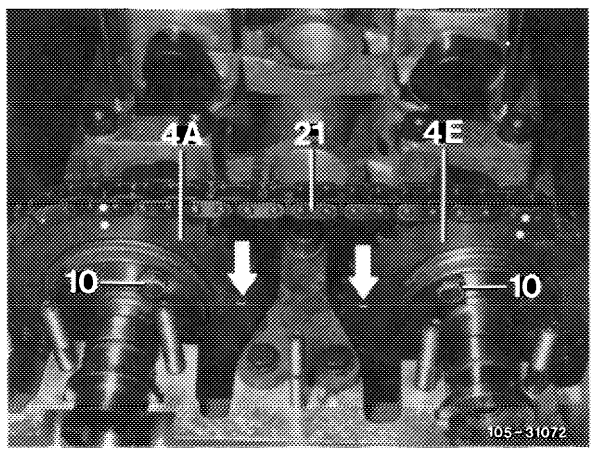


Fig. 05/9

Repair note

The camshaft sprockets need not be removed for removal and installation of camshafts.

Single roller chain (21)

The single roller chain has 134 links. For repairs, a timing chain with a connecting link is available. The connecting link is riveted with the riveting tool 000 589 58 43 00 (as on diesel engines) and the rivet set 103 589 01 63 00.

Guide rail (32)

Due to the longer timing chain drive, the guide rail (32) prevents vibrations between intermediate sprocket and idler sprocket. The guide rail is snapped into bracket (33). This bracket is fastened with a pin in a bore at the bottom and at the top with a timing chain housing cover screw at the boss (arrow) of the cylinder block.

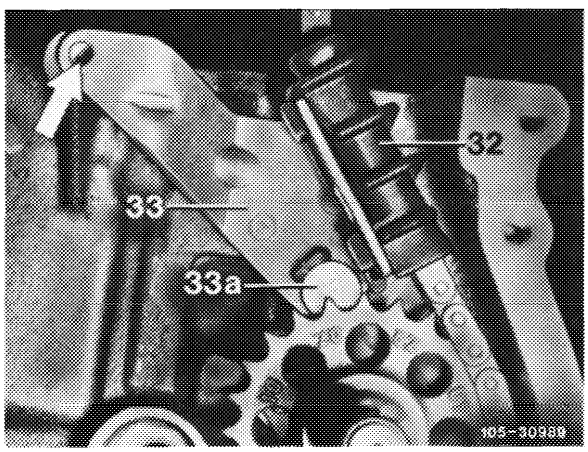


Fig. 05/10

Guide rail (31)

Guides the timing chain between the sprockets and floats on the two pins (27a) of bracket (27) and is secured by the lockrings (34). The axial clearance of the guide rail (31) is limited through the use of two spring washers (28).

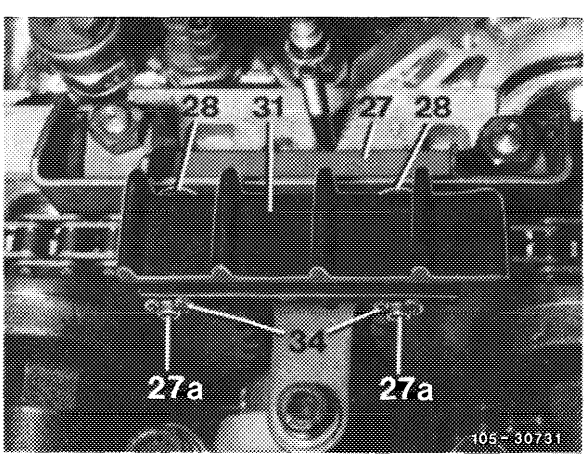


Fig. 05/11

Repair note
In case of noise complaints from the area of the cylinder head front, check if spring washers (28) are installed.

Tensioning rail (22)

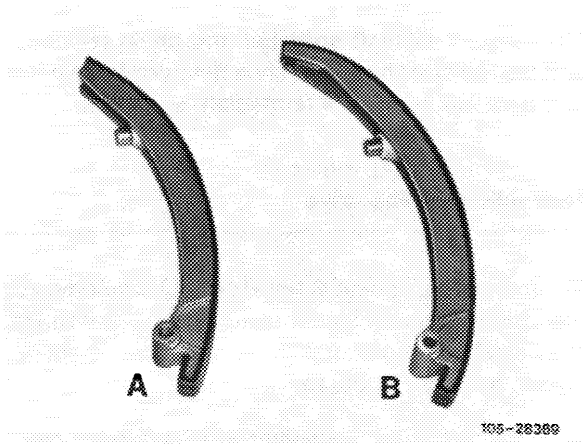


Fig. 05/12

Version A Engines 102.92/93/96/980
Version B Engine 102.983

The tensioning rail differs in shape and length from that of the other engines 102. They are not interchangeable.

Intermediate sprocket (12)

The intermediate sprocket floats on the shaft. The shaft is pressed into the cylinder head and closed by a plug M 18 x 1.5 mm (14) and a sealing ring (15) towards the outside.

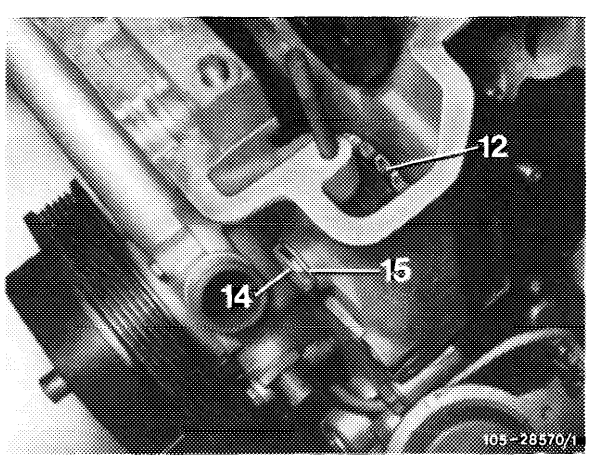


Fig. 05/13

Repair note

The intake camshaft sprocket, the chain tensioner and the radiator shroud must be removed for removal and installation of the intermediate sprocket.

Hydraulic oil pump drive

The hydraulic oil pump for level control is mounted to the cylinder head with a separate flange. It is driven by the camshaft sprocket of the exhaust camshaft. For layout, refer to Fig. 05/15.

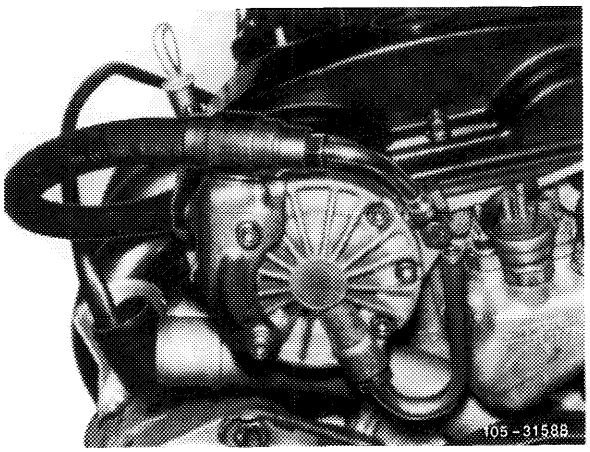


Fig. 05/14

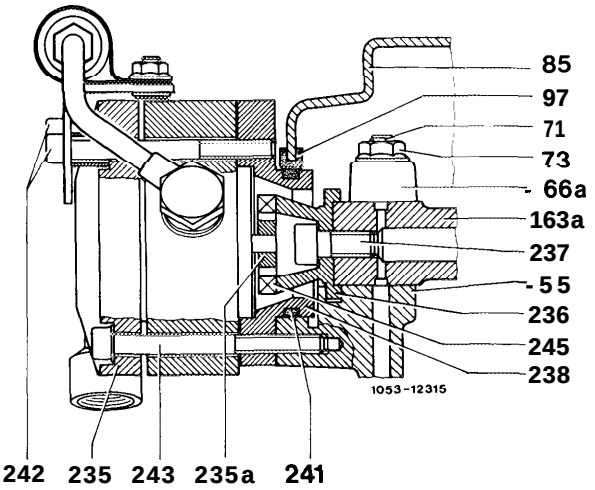


Fig. 05/15

55	Cylinder head	236	Drive sleeve
66 a	Bearing cap	237	Mounting screw, drive sleeve
85	Valve cover	238	Flange
97	Valve cover gasket	241	O-ring
163 a	Camshaft sprocket, exhaust		
235 a	Driver		

Mechanically/electronically controlled gasoline injection system (CIS-E)

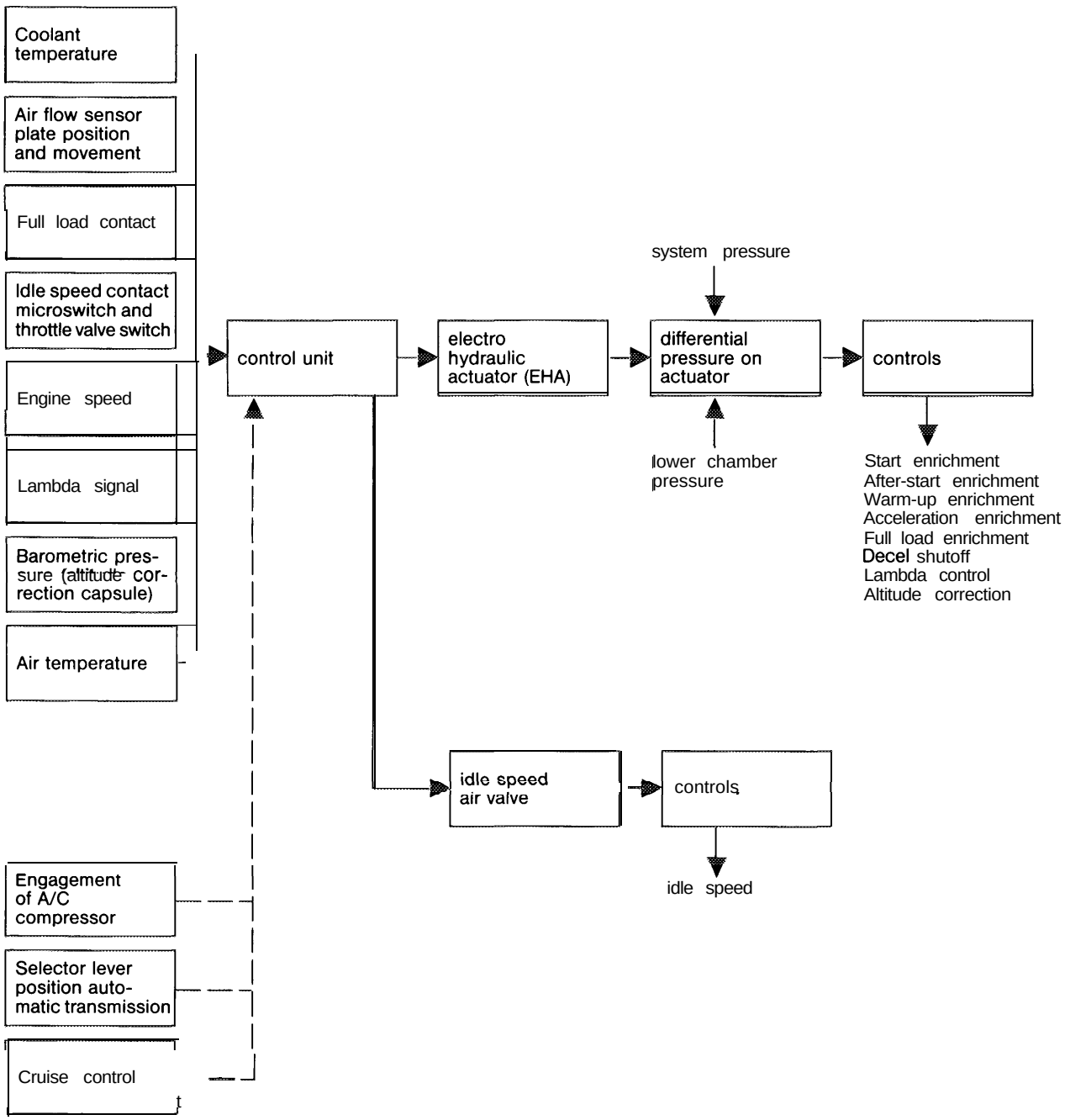
The construction and function of the gasoline injection system is similar to engine 102.985 except for the following modifications:

For this reason, the following description covers only the modifications and not the complete system.

Modifications:

- Maximum engine speed cut-out is controlled by the fuel pump relay
- Fuel pump (same as models 107 and 126) with integrated suction damper
- Fuel pump package suspended on rubber rings
- System pressure increased to 5.8 bar
- Fuel distributor and airflow sensor adapted to engine
- Air enveloped injection valves
- Location of injection valves and cold-start valve modified
- CIS-E electronic control unit with air/fuel mixture adaptation by microprocessor and logic circuit
- Intake air temperature sensor on air filter
- Altitude correction capsule
- Electronic idle speed control by a single coil rotary air valve. The bypass adjusting screw was eliminated
- Throttle valve switch with idle and full load contact
- Deceleration shutoff microswitch
- O_2-sensor replacement indicator was replaced by an O_2-sensor malfunction indicator.

Input signals affecting the electronically controlled mixture correction



Components and function

Fuel pump relay (N16/3 or N16/4)

The relay is located on the right side in the component compartment.

N16/3 is used on manual transmissions and N16/4 on automatic transmissions with the following functions:

- cold start valve activation
- rpm limitation
- kickdown shutoff (N16/4 only)

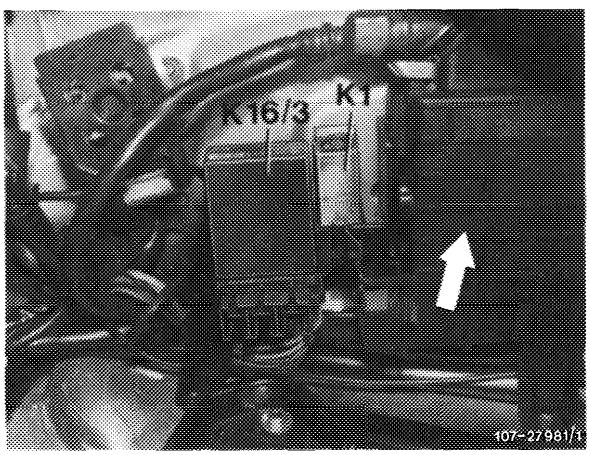


Fig. 07.3/1

Cold start valve activation

Its function depends on coolant temperature and cranking speed signal. Voltage supply is via the fuel pump relay. The length of time during which the cold-start valve injects fuel is dependent on the coolant temperature. For example, at — 20 °C the valve opens for 10 seconds. Above 15 °C the valve remains closed.

If the engine starts before the cold-start valve completes its cycle, cold-start injection is canceled immediately.

Maximum engine speed cut-out

If the fuel pump relay receives a certain frequency signal corresponding to the maximum engine rpm, the contact between circuit 30 and 87 is interrupted and the fuel pump is turned off.

Fuel pump package

The fuel pump package is located at the left in front of the rear axle on the frame floor, seen in driving direction. The fuel pump package is suspended on rubber rings (35).

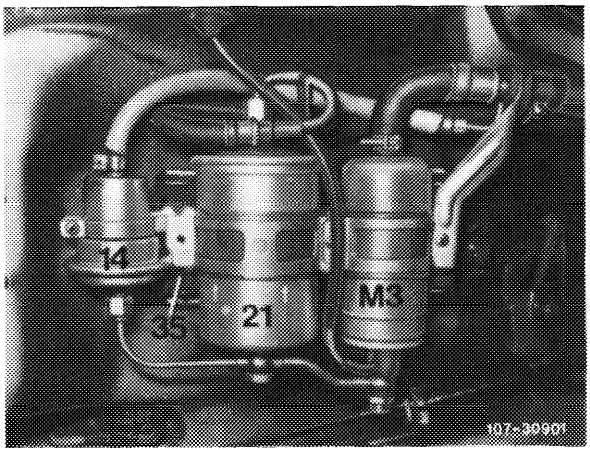


Fig. 07.312

14 Fuel accumulator
21 Fuel filter
M 3 Fuel pump
35 Rubber rings

Diaphragm pressure regulator (40)

The system pressure was increased to approx. 5.8 bar. The pressure is set by manufacturer and cannot be adjusted.

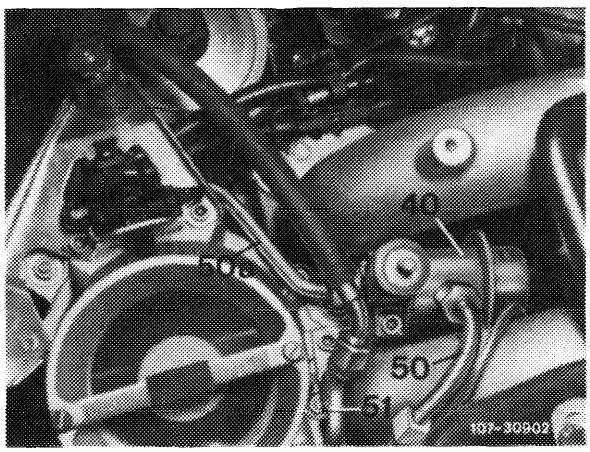


Fig. 07.3/3

40 Diaphragm pressure regulator
50 Supply system pressure
50a Line to fuel cooler
51 Fuel return flow

Mixture preparation

The fuel requirement is adapted to the various engine load conditions by wider metering slots (29) in the metering sleeve (28). The air funnel in the air flow sensor is designed for an air-fuel mixture ratio of $\lambda = 1$.

For better mixture preparation at idle air is injected around the injection valves similar to engines 1161 117.

Note: Due to the limited space, fuel line 117 070 28 32 must be used for measuring lower chamber pressure at the pressure connection.

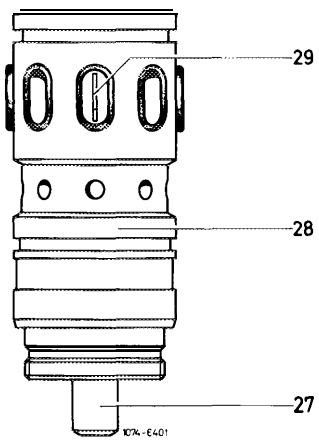


Fig. 07.3/4

27 Control plunger
28 Metering sleeve
29 Metering slot

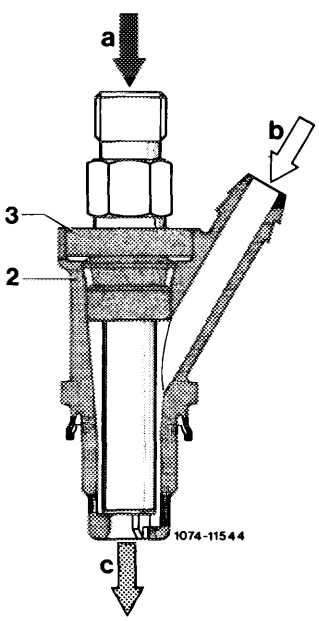


Fig. 07.3/5

2 Insulating sleeve
3 Plastic supporting ring
a Fuel
b Air
c Fuel-air mixture

Overvoltage protection relay (K1)

The relay is located in the component compartment in driving direction on the right side (K1). The wiring was correspondingly changed.

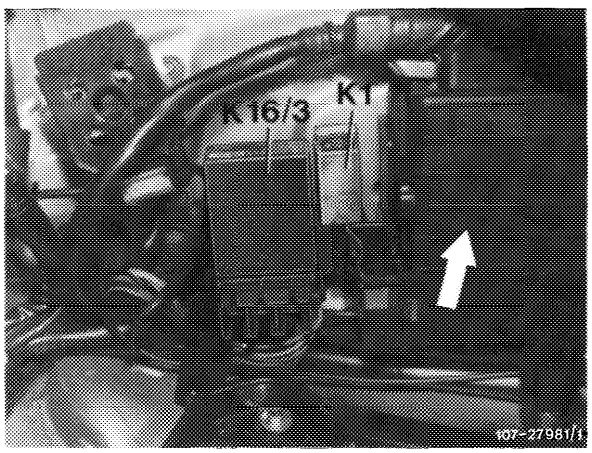


Fig. 07.3/6

Intake air temperature sensor (B17/2)

The temperature signal is transmitted to the CIS-E control unit. The resistance values are identical to the coolant temperature sensor. At low ambient temperatures a correction of the acceleration enrichment takes place.

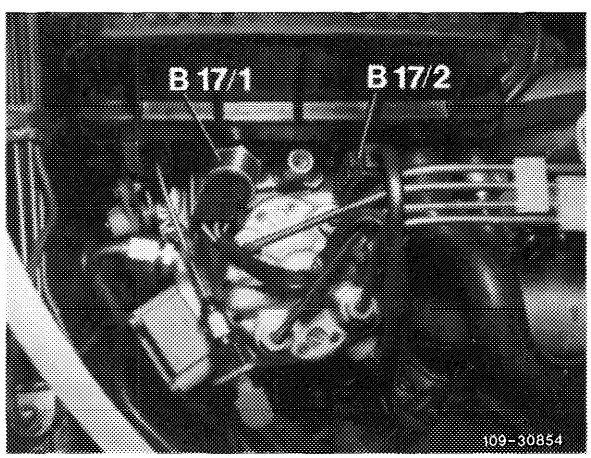


Fig. 07.3/7

B 17/1 Intake air temperature sensor (EZL)
B 17/2 Intake air temperature sensor (CIS-E)

Coolant temperature sensor (NTC)

The coolant temperature is picked-up by a dual temperature sensor (arrow). One temperature is transmitted to the CIS-E control unit and the other to the electronic ignition control module (EZL). The nominal test values are the same for both temperature signals. Their test values correspond with the coolant temperature sensor of model 201.024.

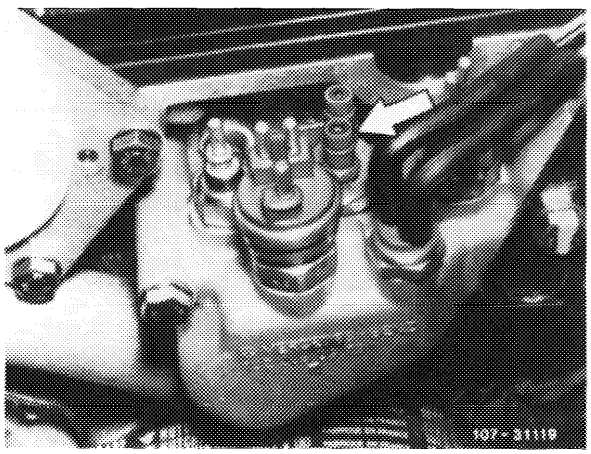


Fig. 07.3/8

CIS-E control unit

It is located in the component compartment in driving direction on the right side (arrow).

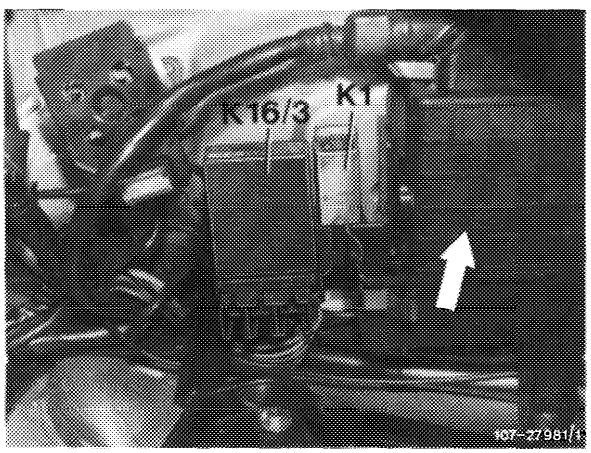


Fig. 07.3/9

The basic control functions of start enrichment, after-start enrichment, warm-up, acceleration and full load enrichment, as well as deceleration shutoff are the same as previously, however the control values are adapted to this engine.

Cranking enrichment/after-start enrichment

During cranking, the microprocessor in the control unit recognizes the cranking speed (start of cranking above 30 rpm, end of cranking approx. 500 rpm) from rpm impulses. When the cranking speed is attained, the control unit releases the start enrichment and the after-start enrichment. Extent and duration of enrichment (current on EHA) depend on coolant temperature.

The input of the cranking signal (terminal 50) into the CIS-E control unit is eliminated.

Acceleration enrichment

It becomes effective in the warm-up stage and with the engine at operating temperature. The current to the EHA is dependent on acceleration.

Full load enrichment

Effective with throttle valve fully opened. Depending on the engine speed, the current at the EHA can vary between 5 mA (–) to 10 mA (+). Lambda control is set by the control unit (no regulation).

An idle speed contact is additionally integrated in the switch. The idle speed signal is required by the electronic ignition switching unit.

Deceleration shutoff

Changes to the deceleration shutoff are as follows:

Restart of fuel injection begins at an engine speed of 1500 rpm.

Deceleration shutoff occurs only if the engine speed exceeds 2500 rpm.

Current to the electrohydraulic actuator (EHA) is approx. 45 mA (–).

New routing of wiring harness.

(For complete wiring diagram, refer to Fig. 07.3/13).

Logic circuit

Input signals from the various sensors and switches are continuously monitored by the electronic control unit. If, for example, with the engine at operating temperature, a rapid temperature change is simulated by unplugging the coolant temperature sensor – the microprocessor in the control unit will compare this momentary temperature with the temperature in its memory. The control unit will recognize the abrupt temperature change as a short circuit, and is programmed to the fixed operating mode.

The control unit does not recognize gradual changes as malfunctions, and will continue to operate normally.

Fixed operating mode

In the event of an illogical signal received by the control unit (i. e. system malfunction, open or short circuit) the control unit will automatically revert to a Fixed Operating Mode (FOM). This means that the engine will continue to run but not at its optimum, electronically controlled performance level.

O_2-sensor

The O_2-sensor replacement indicator is now an O_2-sensor malfunction indicator. The O_2-sensor malfunction light will come on only if a malfunction is present in the O_2-sensor circuit. The O_2-sensor malfunction indicator lamp receives voltage from the CIS-E control unit. The indicator lamp lights up briefly when ignition is turned on.

Electronic idle speed control

The function of the electronic idle speed control is essentially the same as previously.

The control unit processes the following information:

Engine speed (ignition terminal TD)
Coolant temperature
Idle speed signal (microswitch)
Air flow sensor, voltage
Voltage, altitude correction sensor
Automatic transmission, shift lever position
A/C compressor, cut-in signal

The function of the idle speed control system is extended by the air flow sensor voltage signal. As a result, the control unit recognizes the momentary air flow rate. In combination with the engine speed, the position of the microswitch and the coolant temperature, the activation of the idle speed air valve and thereby the idle speed will be determined.

Note: At deviating idle speed (too high or too low) the voltage signal must be checked on the air flow sensor.

Idle speed air valve

Designed as a single coil rotary actuator with a two-pin connection.

The adjusting screw for bypass air was eliminated.

The idle speed air valve has the following functions:

1. The electronic control unit supplies a specific voltage to the air valve which determines the respective valve opening and thereby the engine speed.
2. The nominal idle speed is controlled depending on temperature, between 1200 rpm at – 30 °C to 890 ± 50 rpm at + 70 °C.
3. With the ignition switched on (engine not running) the idle speed air valve is activated by a specific voltage. The port for the fixed operating mode is closed and the control port is opened.
4. If the voltage supply fails, the port for the fixed operating mode is opened automatically.

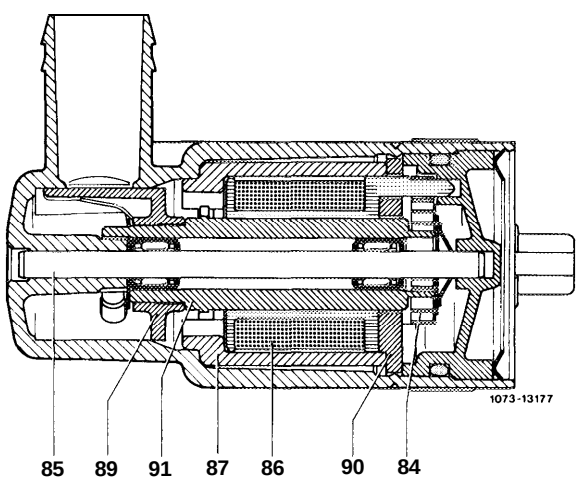


Fig. 07.3/10

84 Spiral spring
85 Shafl
86 Magnetic coil
87 Coil Jacket
89 Aperture valve
90 Coil cap washer
91 Hollow shaft

Rpm stabilization on engines with A/C compressor engaged

When the air conditioning system is switched on, the CIS-E control unit (terminal 19) is connected to voltage. This signal goes over a time delay relay (350 ms) to the A/C compressor control unit. The CIS-E control unit processes the signal and gives a specific signal to the idle speed air valve. The control opening in the air valve becomes larger before the A/C compressor is engaged and the idle speed deviates only slightly.

Idle speed stabilization on engines with automatic transmission

With the selector lever in a driving position, the ground connection to the starter is interrupted at terminal 50 of the starter lockout switch.

Ground is present in position P and N. The control unit processes the signal change and transmits a defined voltage signal to the idle speed air valve, so that a specific idle speed will result.

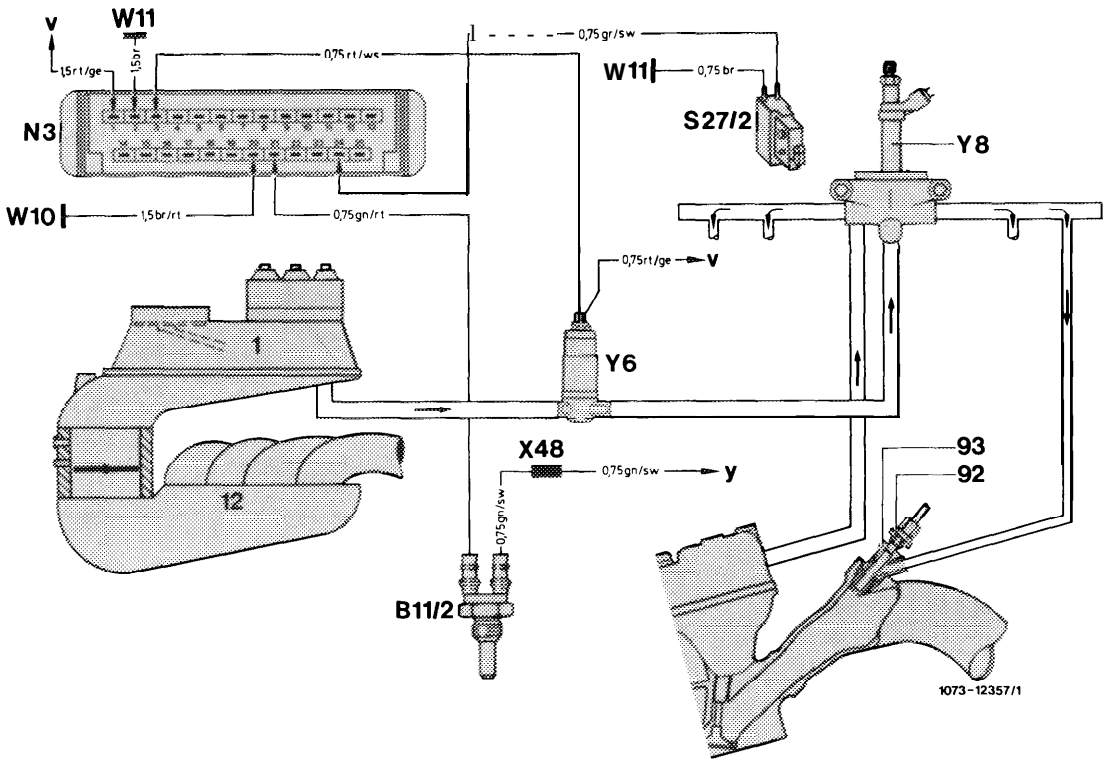


Fig. 07.3/11 Function diagram of electronic idle speed control

1	Fuel distributor	W	10	Ground, battery	bl	=	blue
12	Intake manifold	w	11	Ground, engine (electric wire connection)	br	=	brown
92	Injection valve	Y	6	Idle speed air valve	ge	=	yellow
93	Insulating sleeve	Y	8	Cold start valve	gn	=	green
B 1 1/2	Coolant temperature sensor (2-pin)	X	48	Solder terminal in wiring harness	gr	=	grey
N 3	CIS-E control unit (25-pin connector)	v		to overvoltage protection relay (pin 2) circuit 87	rt	=	red
S 27/2	Micro switch, deceleration shut off	Y		to ignition control module connector (teminal 1)	SW	=	black
					ws	=	white

Idle speeds depending on transmission are shown in the following table.

Idle speeds above 70 °C coolant temperature

		Idle speed rpm	
Manual transmission		890 ± 50	
Automatic transmission	shift lever position "P" or "N"	890 ± 50	
	driving position engaged	670 ± 50	

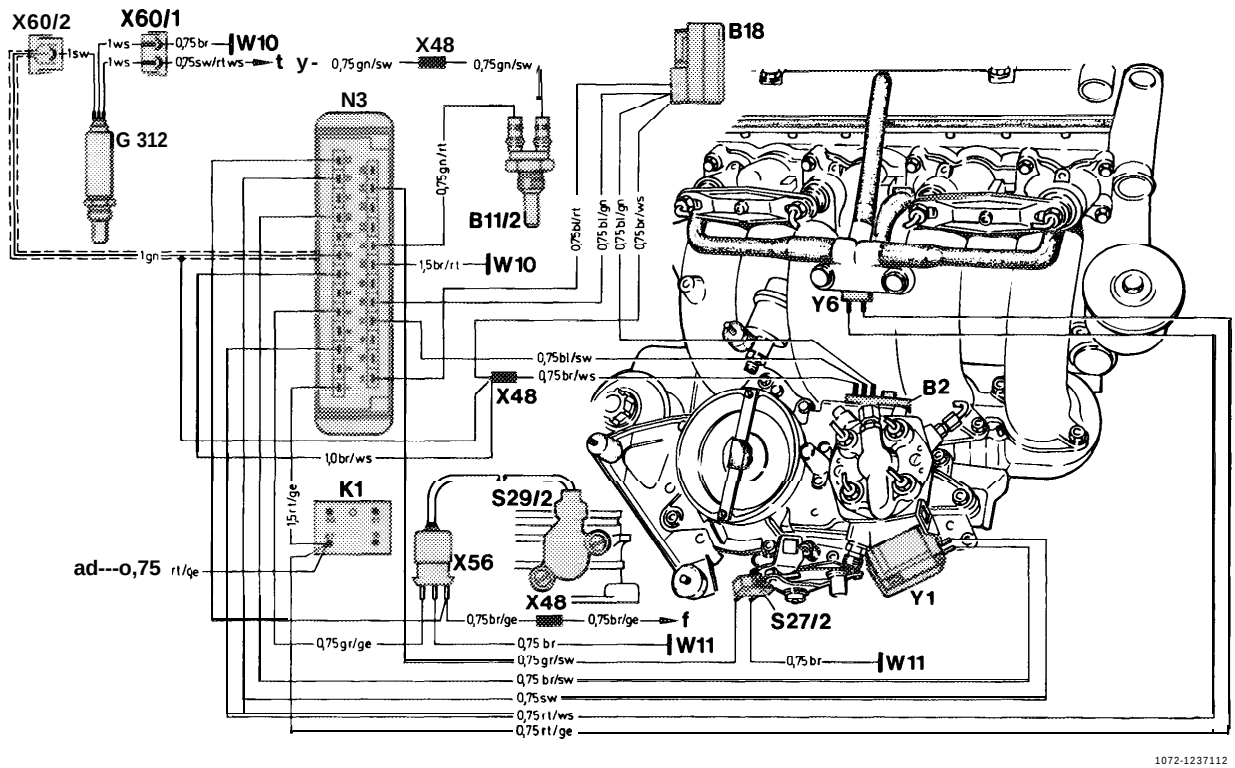


Fig. 07.3/12 Function diagram, CIS-E gasoline injection system

B	2	Air flow sensor position indicator
B	11/2	Coolant temperature sensor (2-pin)
B	18	Altitude correction capsule
G	3/2	O_2-sensor, heated
K	1	Overvoltage protection relay
N	3	CIS-E control unit (25-pin connector)
s	27/2	Micro switch, deceleration shut off
s	29/2	Throttle valve switch, idle and full load contacts
w	10	Ground, battery
w	11	Ground, engine (electric wire connection)
X	48	Solder terminal in wiring harness
X	56	Plug connection, throttle valve switch
X	60/1	Plug connection, O_2-sensor heating coil
X	60/2	Plug connection, O_2-sensor signal
Y	1	Electrohydraulic actuator (EHA)
Y	6	Idle speed air valve
	a	to Indicator lamp, O_2-sensor malfunction
	t	to Fuel pump relay, circuit 87 connector (terminal 2)
	Y	to ignition control module connector (terminal 1)
	f	to ignition control module (EZL) connector (terminal 2)

bl	= blue
br	= brown
ge	= yellow
gn	= green
gr	= grey
rt	= red
SW	= black
ws	= white

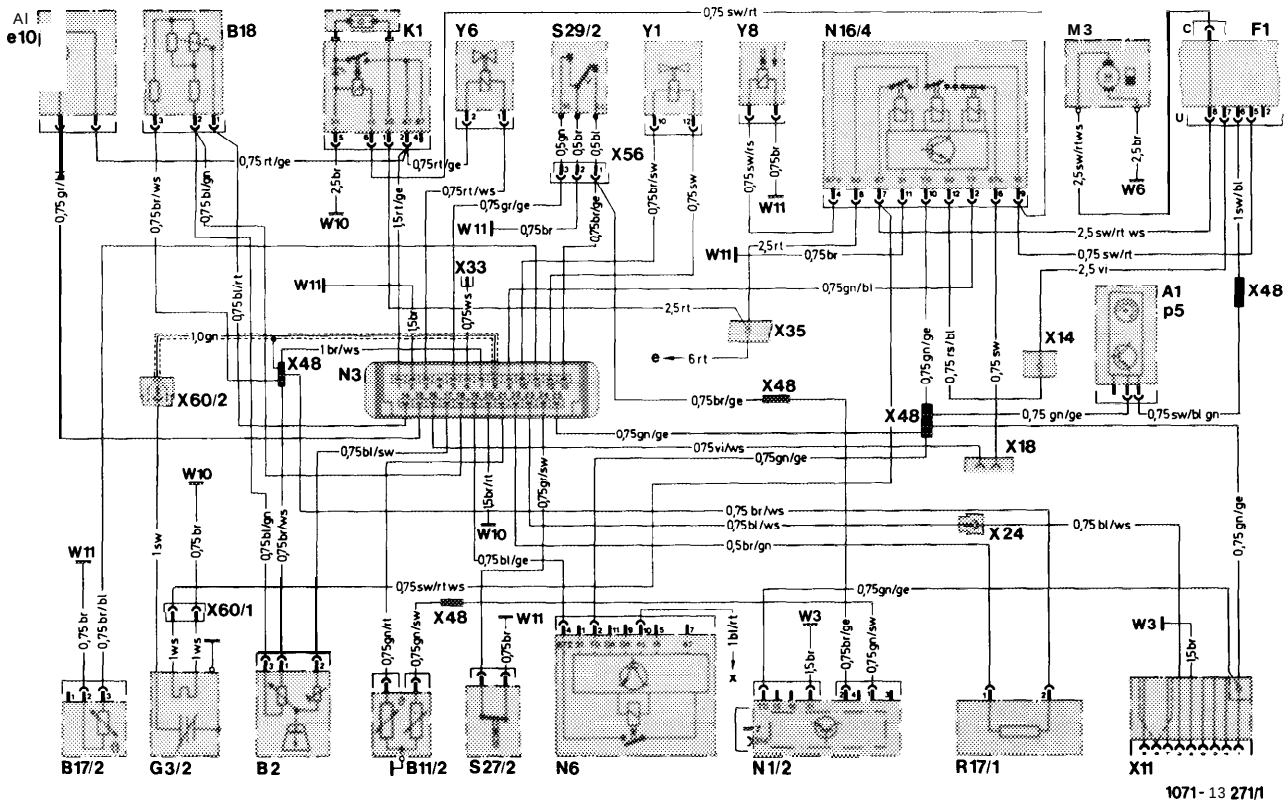


Fig. 07.3/13 Wiring diagram, CIS-E gasoline injection system

A	1e10	Indicator lamp, O_2-sensor
A	1p5	Tachometer
B	2	Air flow sensor position indicator
B	11/2	Coolant temperature sensor (2-pin)
B	17/2	Intake air temperature sensor
B	18	Altitude correction capsule
F	1	Electrical center
G	3/2	O_2-sensor, heated
K	1	Overvoltage protection relay
M	3	Fuel pump
N	1/2	Ignition control module (EZL)
N	3	CIS-E control unit (25-pin connector)
N	6	A/C compressor cut-out control unit
N	16/4	Fuel pump relay (automatic transmission)
R	17/1	Bridge, CIS-E
S	27/2	Micro switch, deceleration shut off
s	29/2	Throttle valve switch, idle and full load contacts
w	3	Ground, left front wheel housing
W	6	Ground, in trunk on left wheel housing
w	10	Ground, battery
w	11	Ground, engine (electric wire connection)
x	11	Diagnostic socket/wire connector, terminal TD
x	14	Plug connection, circuit 50
X	18	Plug connection, tail lamp harness
x	24	Plug connection, head lamp harness
x	33	Plug connection, CIS-E system to cruise control (1 -pin)
x	35	Plug connection, circuit 30/circuit 61 (battery)
X	48	Solder-terminal in wiring harness
X	56	Plug connection, throttle valve switch
X	60/1	Plug connection, On-sensor heating coil
X	60/2	Plug connection, O_2-sensor signal
Y	1	Electrohydraulic actuator (EHA)
Y	6	Idle speed air valve
Y	8	Cold start valve
e		to wire connector, circuit 30 (fuse and relay box)
x		to pressure switch, A/C compressor

Note: Unmarked ground connections are grounded on engine or chassis. The wire on terminal 6 (circuit 87 K) on the fuel pump relay connector does not apply to vehicles with manual transmission.

Altitude correction

Depending on altitude, the amount of fuel is changed based on a signal from the altitude correction capsule (B 18).

With the ignition switched on or with the engine running, the altitude correction capsule will receive a constant voltage signal (approx. 5 volts) from the control unit.

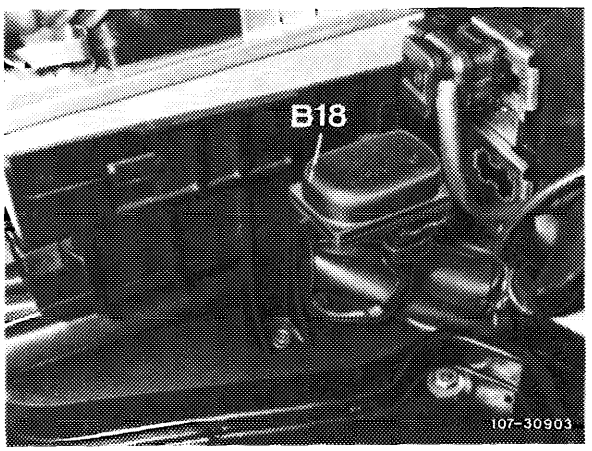


Fig. 07.3/14

If the electronic control unit operates in a fixed mode, correction for altitude will not take place.

With increasing altitude, i. e. decreasing air pressure, the mixture will be adapted to the altitude by a reduction of the voltage.

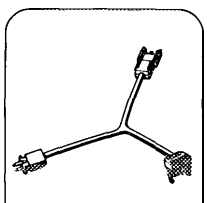
Measurements are made between terminal 1 and terminal 3 of the altitude correction capsule.

Height above sea level	Barometric pressure	Voltage at altitude correction capsule, plug connected
m	mbar	volts
0	1013	4 ± 1
1000	899	3 ± 1
2000	795	2 ± 1

Checking electric components of CIS-E injection system

(after checking fuel pressures and for internal leaks)

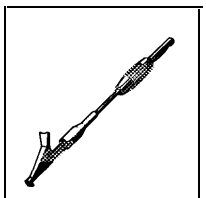
Special tools



102 589 04 63 00

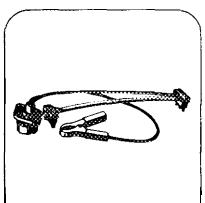
Adapter plugs for test cable

903589036300



102 589 05 63 00

201 589 00 99 00



103589006300

On-off ratio tester (e. g. Bosch KDJE-P 600)

909 589 00 21 00

Conventional testers

Multimeter')	e.g. SUN DMM-5

') Available through the MBNA Standard Equipment Program

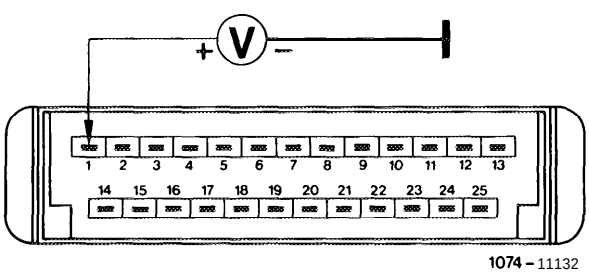
Testing overvoltage protection relay (K 1)

Switch-on ignition, test voltage from control unit plug (terminal 1) to ground.

Battery voltage

OK	Not OK

End of test



1074 – 11132

Fig. 07.3/15

Test fuse of overvoltage protection relay.

Fuse OK | Fuse not OK

Switch-off ignition.
Replace fuse.

Switch-on ignition.

Fuse OK | Fuse blows

Repair short circuit

Unplug overvoltage protection relay.
Jump connector terminals 1 and 2.

Battery voltage present at terminal 1 of control unit plug.

OK | Not OK

Repair circuit

Test voltage at terminals 6 and 5 on plug of overvoltage protection relay.

Battery voltage

OK | Not OK

Replace overvoltage protection relay

Repair circuit

End of test

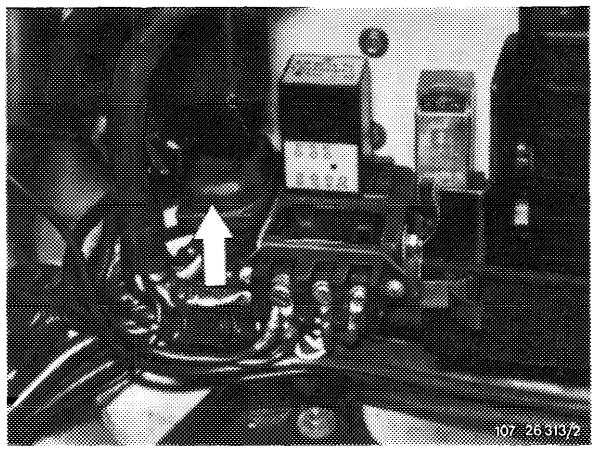


Fig. 07.3/16

Testing coolant temperature sensor

Unplug coolant temperature sensor. Test resistance from sensor terminal to ground.

For nominal value, refer to diagram.

Test sensor resistance at two temperatures.

Example:

+ 20 °C ≙ 2.2–2.8 kΩ
+ 80 °C ≙ 290-370 Ω

OK	Not OK

Not OK → Replace temperature sensor.

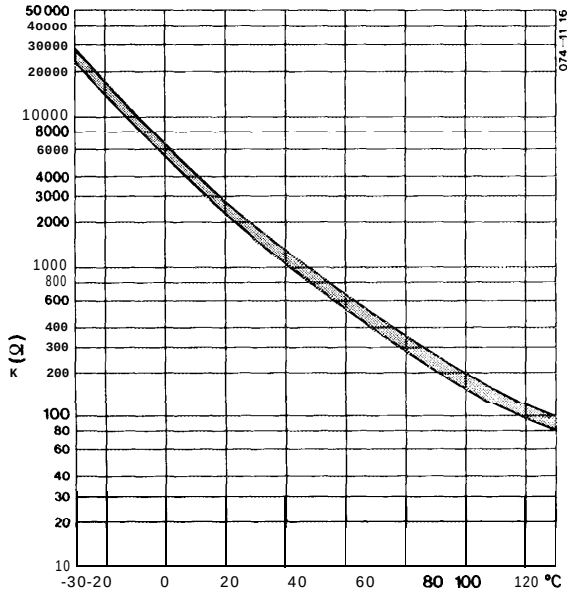


Fig. 07.3/17

Connect test cable to EHA. Set multimeter to mA. Switch on ignition. Read current value.

- Engine not running, reading approx. 50 mA.
- Engine at idle speed and operating temperature – reading fluctuates.
- Engine at idle speed, + 20 °C coolant temperature simulated with 2.5 kΩ tost cable (Fig. 07.3/20). O_2-sensor plug disconnected – Reading 5 – 15 mA.

OK	Not OK

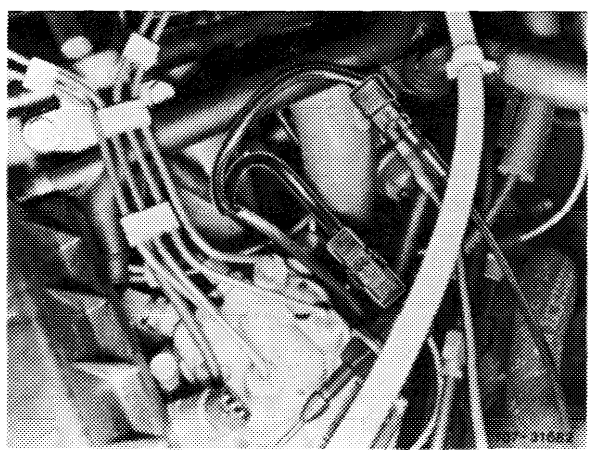
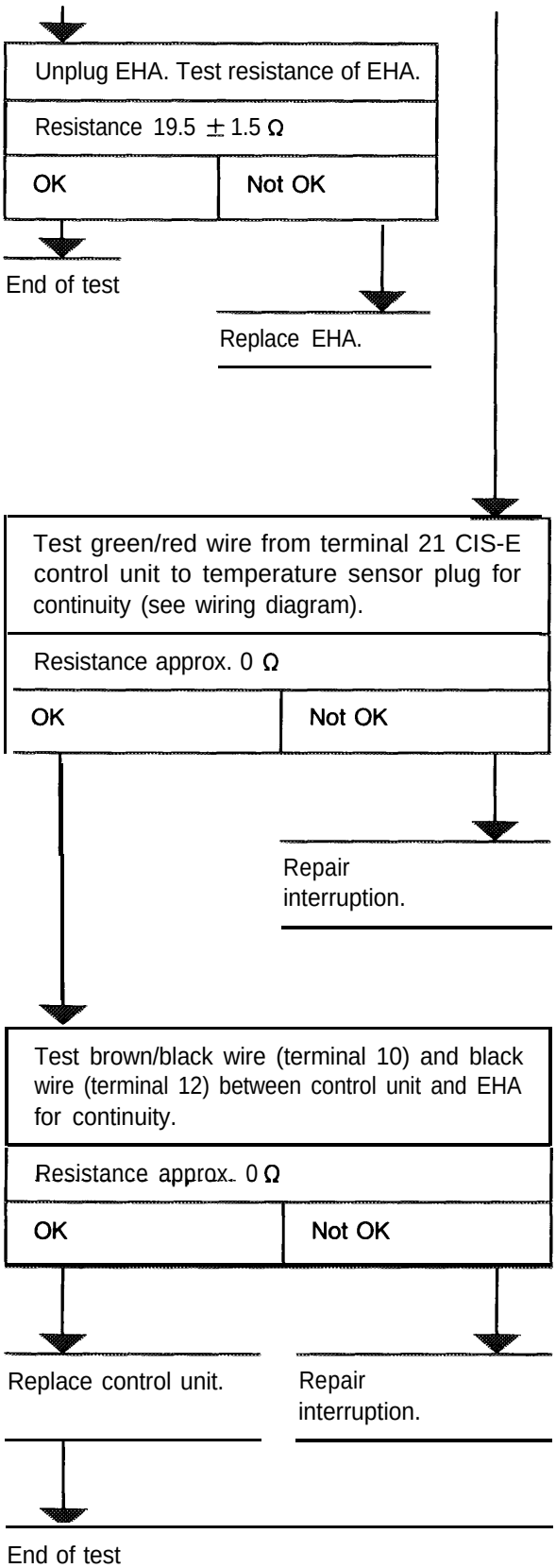


Fig. 07.3/18


Unplug EHA. Test resistance of EHA.
Resistance 19.5 ± 1.5 Ω
OK
Not OK
End of test
Replace EHA.
Test green/red wire from terminal 21 CIS-E control unit to temperature sensor plug for continuity (see wiring diagram).
Resistance approx. 0 Ω
OK
Not OK
Repair interruption.
Test brown/black wire (terminal 10) and black wire (terminal 12) between control unit and EHA for continuity.
Resistance approx. 0 Ω
OK
Not OK
Replace control unit.
Repair interruption.
End of test

Testing acceleration enrichment and air flow sensor position indicator

Connect test cable to EHA. Set multimeter to mA. Simulate + 20 °C with 2.5 kΩ test cable (Fig. 07.3/20). Disconnect O_2-sensor plug. Start engine (increased idle speed).

Nominal value 5-l 5 mA. Increase engine speed quickly, current value should increase.

OK	Not OK

End of test

Stop engine. Deflect air flow sensor plate with adjusting device from fuel quantity comparison tester until the upper edge of the air flow sensor plate is in alignment with lower edge of the cylindrical part of the air funnel. Loosen plug of air flow sensor position indicator so that the voltage can be measured at the pins (do not disconnect plug). Switch on ignition.

(Refer to Fig. 07.3/22)
Terminal 3 and terminal 1 : approx. 5 V
Terminal 2 and terminal 1 : 0.2-0.5 V

OK	Not OK

Slowly deflect air flow sensor plate.

Voltage increases continuously to approx. 5 Volts.

OK	Not OK

Replace air flow sensor position indicator.

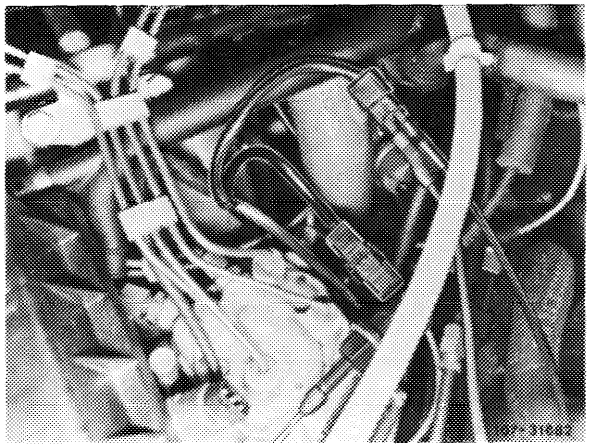


Fig. 07.3119

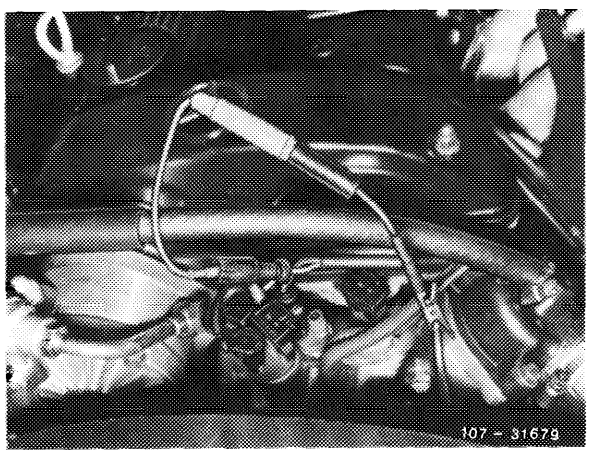


Fig. 07.3/20

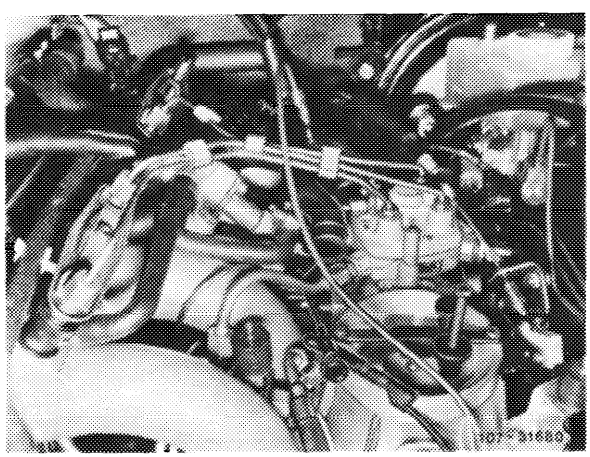


Fig. 07.3121

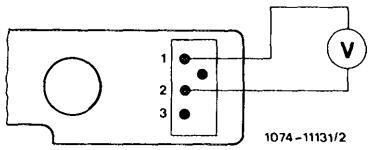


Fig. 07.3/22

Test wires between air flow sensor plug and CIS-E control unit plug for continuity (see wiring diagram for wire colors and terminal numbers).

Resistance approx. 0 Ω

OK | Not OK

Not OK → Repair interruption

Test rpm signal on CIS-E control unit plug terminal 25 (green/yellow).

Voltage 6 – 12 Volts.

OK | Not OK

Not OK → Repair interruption

Test wires between CIS-E control unit plug and EHA plug for continuity (see wiring diagram for wire colors and terminal numbers).

Resistance approx. 0 Ω

OK → Replace CIS-E control unit.

Not OK → Repair interruption.

End of test

Testing throttle valve switch

Disconnect plug between throttle valve switch and CIS-E control unit. Test resistance of throttle valve switch.

Idle contact: Idle position approx. 0 Ω
Full-load position approx. ∞ Ω

Full-load contact: Idle position approx. ∞ Ω
Full-load position approx. 0 Ω
Partial-load position approx. ∞ Ω

OK	Not OK

Not OK → Adjust or replace throttle valve switch

End of test

Note: Without an idle speed signal, idle speed will be irregular.

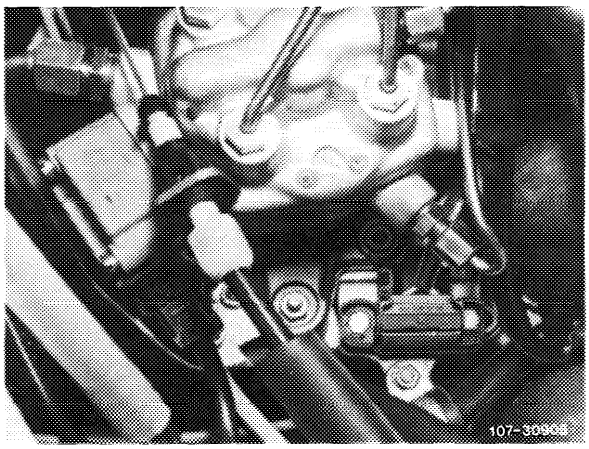


Fig. 07.3/23

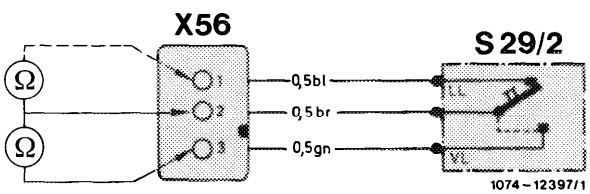


Fig. 07.3/24

S 29/2 Throttle valve switch plug (idle and full load contacts) full load/idle speed stabilization
X 56 Throttle valve switch plug
1 Idle contact (LL)
2 Common
3 Full-load contact (VL)

Testing cold start valve activation

ignition turned off. Pull plug off coolant temperature sensor. Unplug green cable on ignition control module. Crank engine and check voltage at plug of cold start valve.

Minimum voltage 10 V for 10 to 15 seconds

OK | Not OK

Check wire from cold start valve to fuel pump relay, terminal 4 (circuit 87 V) and ground wire to engine ground for continuity.

Resistance approx. 0 Ω

OK | Not OK

Repair interruption

Check voltage between fuel pump relay plug terminal 12 as well as terminal 2 and engine ground. Crank engine.

Minimum voltage at terminal 12 = 10 V. Voltage at terminal 2 = 3 to 5 V (coolant temperature sensor plug disconnected).

OK | Not OK

Replace fuel pump relay

Repair interruption

End of test

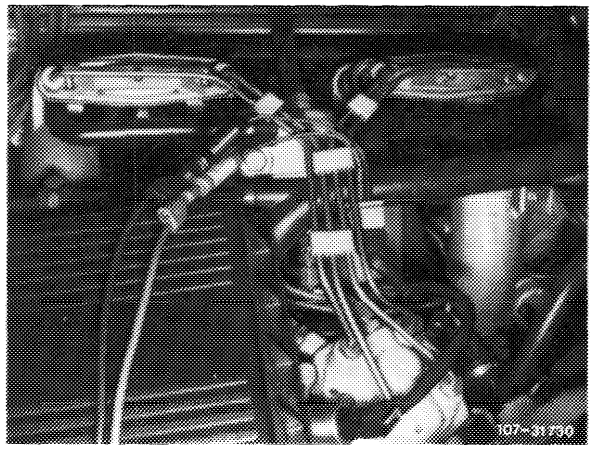


Fig. 07.3/25

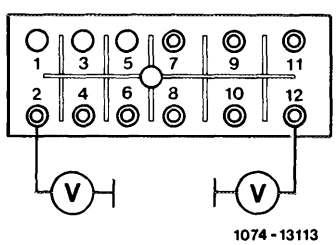


Fig. 07.3/26

Testing intake air temperature sensor

Unplug intake air temperature sensor. Test resistance from sensor terminal to ground.

For nominal value, refer to diagram.

Example

+ 20 °C = 2.2 – 2.8 kΩ
0 °C = 5.5 – 6.1 kΩ

OK	Not OK

Replace intake air temperature sensor

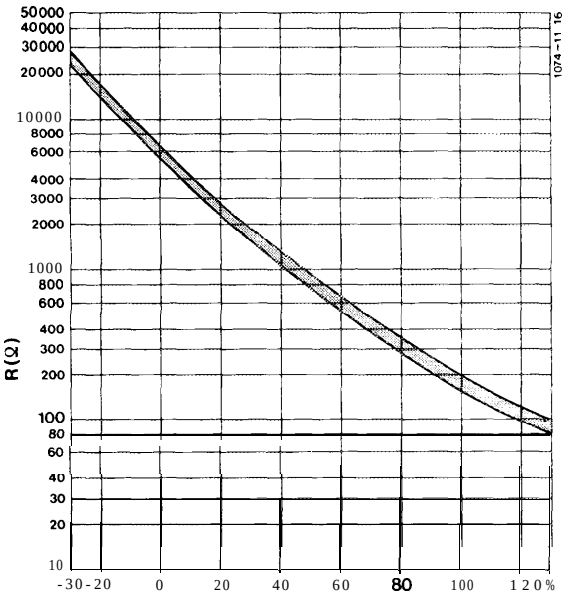


Fig. 07.3/27

Check wire between intake air temperature sensor and ground as well as wire to CIS-E control unit terminal 11 for continuity.

Resistance approx. 0 Ω

OK	Not OK

Repair interruption

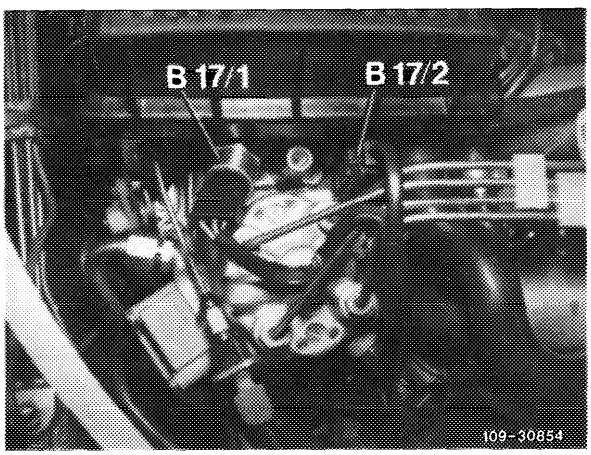


Fig. 07.3/28

End of test

Testing electronic idle speed control

Connect test cable to idle speed air valve and to lambda control tester 909 589 00 21 00 (Bosch KDJE-P600). Push IR 100 % button.
Engine at idle (operating temperature).

Nominal value: 35 to 45 % at 890 ± 50/min.

OK	Not OK

Perform idle speed stabilization test on page 75.

Readout 0 % or 100 %.

Disconnect plug from idle speed air valve. Connect battery voltage to idle speed air valve.

The idle speed air valve switches audibly. This can also be felt.

OK	Not OK

Replace idle speed air valve

Test voltage supply according to wiring diagram.

Switch on ignition. Voltage on terminal 2 of idle speed air valve plug (red/yellow wire) approx. 12 Volts.
Test red/white wire for continuity between terminal 1 of idle speed air valve plug and terminal 3 of CIS-E control unit plug.

OK	Not OK

Test input signals:
Coolant temperature sensor, Air flow sensor position indicator, Idle speed contact on throttle valve switch
or replace control unit

Repair interruption

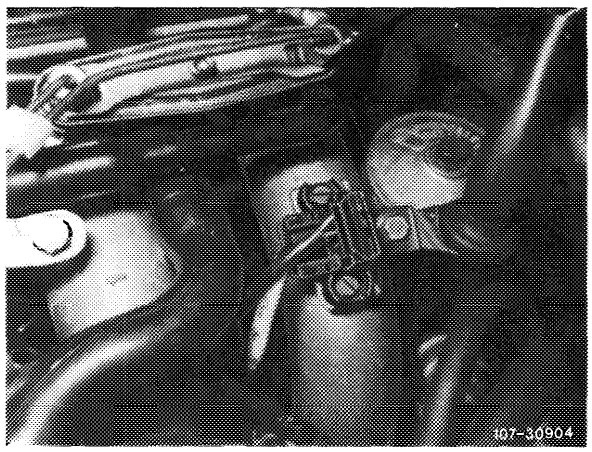
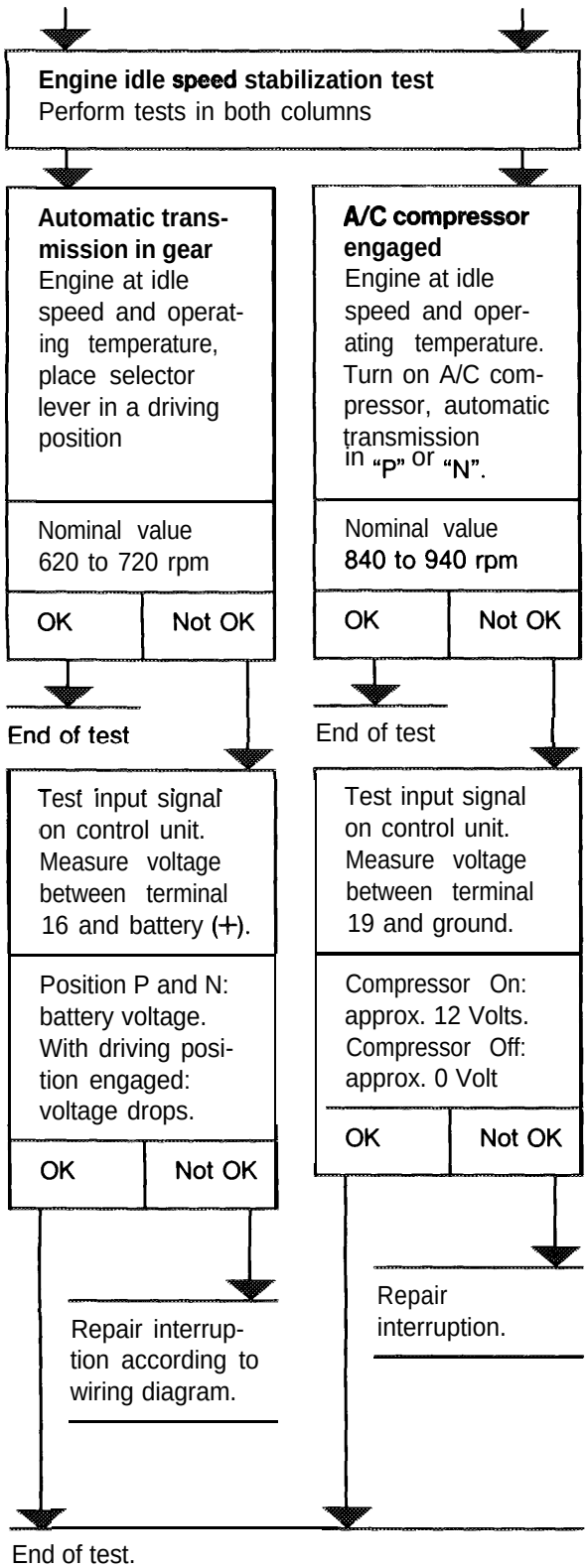
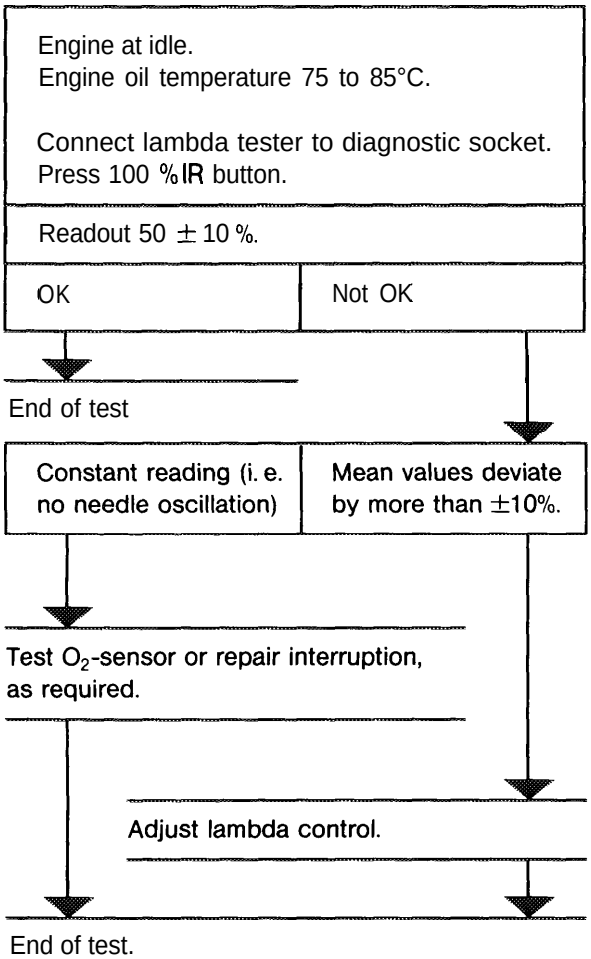


Fig. 07.3/29

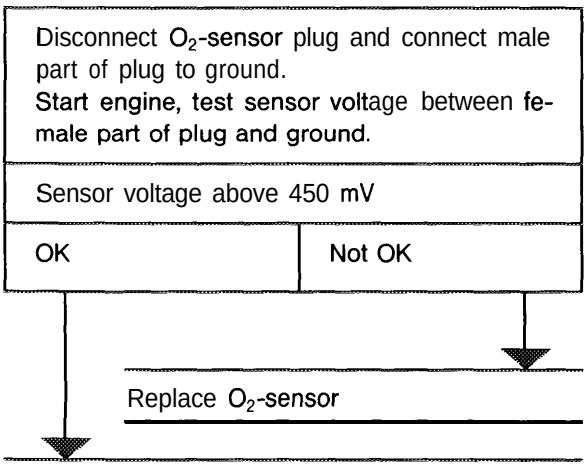

Engine idle speed stabilization test
Perform tests in both columns
Automatic transmission in gear
Engine at idle speed and operating temperature, place selector lever in a driving position
Nominal value 620 to 720 rpm
OK
Not OK
End of test
Test input signal on control unit. Measure voltage between terminal 16 and battery (+).
Position P and N: battery voltage. With driving position engaged: voltage drops.
OK
Not OK
Repair interruption according to wiring diagram.
A/C compressor engaged
Engine at idle speed and operating temperature. Turn on A/C compressor, automatic transmission in "P" or "N".
Nominal value 840 to 940 rpm
OK
Not OK
End of test
Test input signal on control unit. Measure voltage between terminal 19 and ground.
Compressor On: approx. 12 Volts. Compressor Off: approx. 0 Volt
OK
Not OK
Repair interruption.
End of test.

Testing lambda control



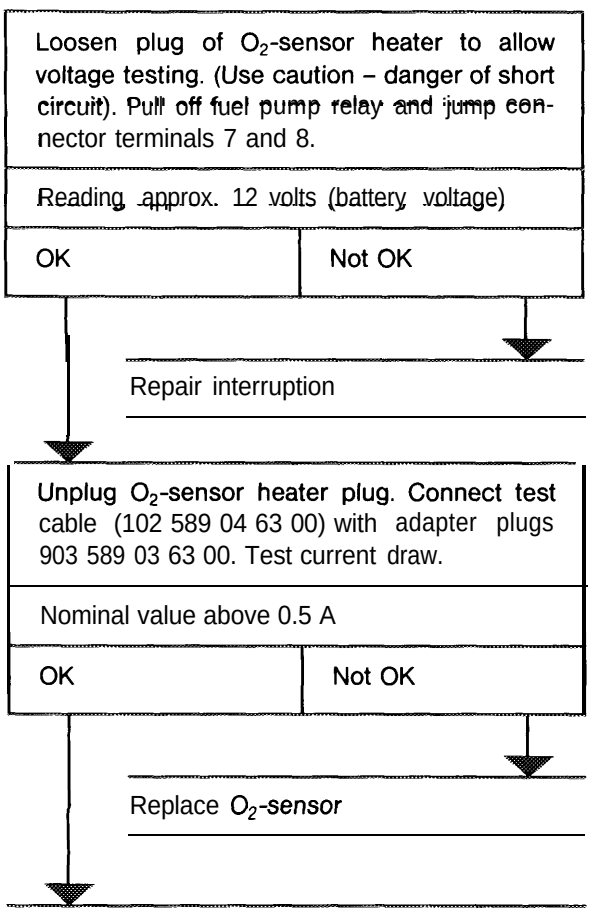
Testing O_2-sensor

Note: The O_2-sensor must be tested with the engine at operating temperature.
Function test: With the engine running, deflect airflow sensor plate slightly by hand. The needle on the lambda tester must move to the lean mixture stop. If not, perform the following test:



End of test.

Testing O_2-sensor heater (engine shut off)



End of test.

Test and adjustment data

Static current at EHA	Engine not running, ignition "ON"		approx. 50 mA
Coolant temperature sensor	Coolant temperature + 20 °C (basic warm-up value) Coolant temperature + 80 °C	Resistance Current on El-IA Resistance Current on EHA	2.2-2.8 kΩ 5-15 mA 290-370 Ω value fluctuating
Lambda control	Engine at idle		50 ± 10 %
Deceleration shutoff		Current on EHA	approx. 45 mA (-)
Rpm and control range	Idle speed Max. engine speed		890 ± 50 rpm 6800 ± 50 rpm

Fuel pressures

System pressure at idle with engine cold or at operating temperature		5.7 – 5.9 bar
Lower chamber pressure with engine at operating temp.		0.4 bar below previously measured system pressure
Lower chamber pressure at + 20 °C coolant temperature	with the vehicle at standstill, at idle speed	0.5 bar below previously measured system pressure
	Acceleration enrichment	above 3.8 bar
Decel shutoff		lower chamber pressure equal to system pressure
Return flow quantity at orifice in fuel distributor		130 – 150 cc/minute

Fuel pump

Bosch No.		0 580 254 974
Measuring instruction		with engine stopped and a voltage of min. 11.5 volts at fuel pump
Delivery capacity')	Measuring point	Fuel line after diaphragm pressure regulator
	min. 1 liter	in 40 seconds
Current draw		approx. 7.5 amps

') For measuring delivery capacity the fuel tank should be at least half full

Model Year 1987 changes to Mechanically/electronically controlled gasoline injection system (CIS-E)

Mechanically/electronically controlled gasoline injection system (CIS-E)

Fuel pump package

The two fuel pumps are arranged in series. A diaphragm damper is integrated in the fuel pumps on the suction side.

The fuel pump package is located as before on the left side in front of the rear axle on the frame floor.

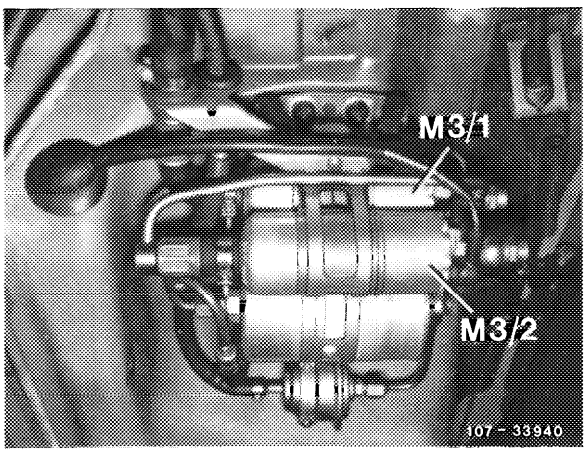


Fig. 07.3/1

55 Fuel filter
57 Fuel accumulator
M3/1 Fuel pump
M3/2 Fuel pump

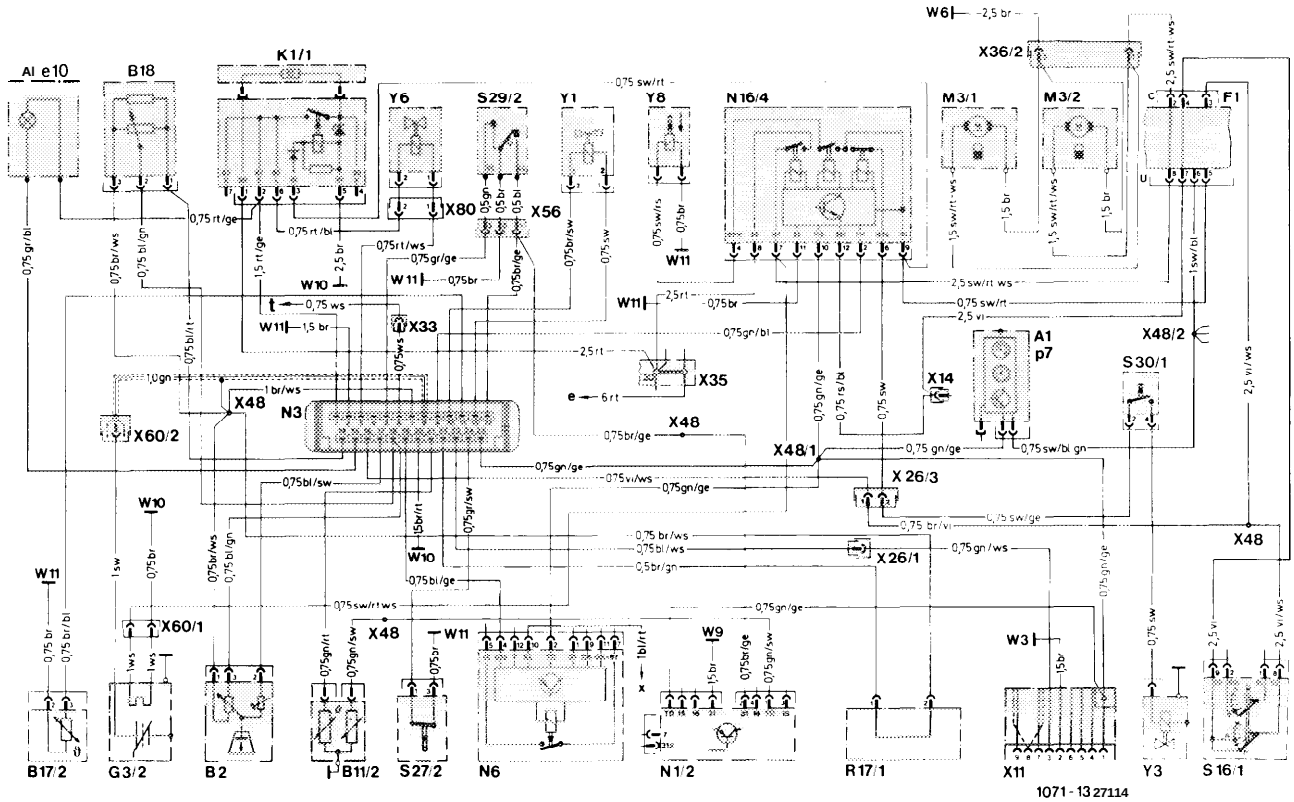


Fig. 07.312 Wiring diagram, CIS-E gasoline injection system

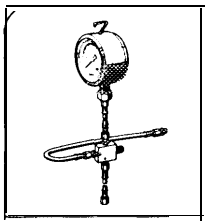
A	1e10	O_2-sensor, indicator lamp
A	1p7	Electronic clock/tachometer
B	2	Air flow sensor position Indicator
B	11/2	Coolant temperature sensor
B	17/2	Intake air temperature sensor
B	18	Altitude correction capsule
F	1	Electrical center
G	3/2	Heated O_2-sensor
K	1/1	Overvoltage protection relay
M	3/1	Fuel pump
M	3/2	Fuel pump
N	1/2	Electronic Ignition control unit
N	3	CIS-E control unit
N	6	A/C compressor control unit
N	16/4	Fuel pump relay (with starting valve control, kick-down cut-out and rpm limiting)
R	17/1	Reference resistor, (CIS-E)
S	27/2	Deceleration shut-off, microswitch
s	29/2	Throttle valve switch, full load/idle
s	30/1	Kick-down switch
W	3	Ground, left front wheel housing (at ignition coil)
W	6	Ground, left rear wheel housing (in trunk)
w	10	Ground, battery
w	11	Ground, engine (connectron point for ground wires)
x	11	Diagnostic socket/terminal block (circuit TD)
x	14	Connector, circuit 50
X	18	Connector, tail lamp harness
X	24	Connector, head lamp harness
X	26/1	Connector, engine/headlamp harness (1 -pole, diagnostic)
X	26/3	Connector, engine/stop lamp harness (2-pole)
x	33	Connector, CIS-E system to cruise control (1 -pole)
x	35	Terminal block, circuits 30/61 (battery)
X	36/2	Connector, fuel pump wiring harness/taillamp wiring harness
x	48	Connector sleeve (sholder joint in harness)
X	56	Plug connection, throttle valve switch
X	48/1	Connector sleeve, circuit TD (solder joint in harness)
X	48/2	Connector sleeve, circuit 15 (solder joint in harness)
X	60/1	Connector, O_2-sensor heater
X	60/2	Connector, O_2-sensor signal
Y	1	Electra-hydraulic actuator (EHA)
Y	3	Kick-down solenoid (automatic transmission)
Y	6	Idle speed air valve
Y	8	Starting valve

e	to wire connector, circuit 30 (fuse and relay box)
t	to cruise control amplifier pin socket 5
x	to pressure switch, A/C compressor

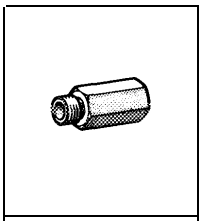
Note: Unmarked ground connections are grounded on engine or chassis. The wire on terminal 6 (circuit 87 K) on the fuel pump relay connector does not apply to vehicles with manual transmission

Testing fuel pump delivery

Special tools



103 589 00 21 00



103 589 02 63 00

Testing fuel pump delivery

(see Service Microfiche, Job No. 07.3-130)

Nominal value: 1 liter minimum in 40 seconds. If this delivery quantity is not obtained determine cause by performing a pressure test.

Testing fuel pressure

1 Remove fuel pump package cover (Fig. 07.3/3)

2 Unscrew cap nut on fuel pump M 3/1. Attach connection fitting and pressure gauge 0 to 10 bar (Fig. 07.3/4)

3 Unplug fuel pump relay and bridge terminals 7 and 8 (circuit 30 and 87).

4 Reading on pressure gauge must be between 2 and 4 bar. If the pressure is below 2 bar, fuel pump M 3/1 is defective. If the pressure is above 4 bar, fuel pump M 3/2 is defective.

5 Disconnect pressure gauge, unscrew connection fitting and install cap nut.

6 Install fuel pump package cover.

Note:

This test can also be used on engines 103,116 and 117 equipped with two fuel pumps.

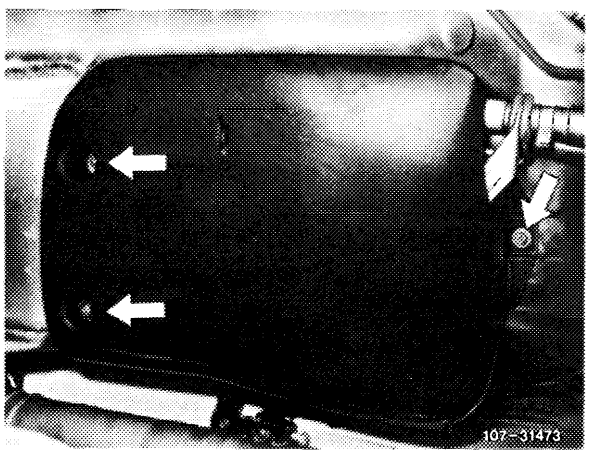


Fig. 07.3/3

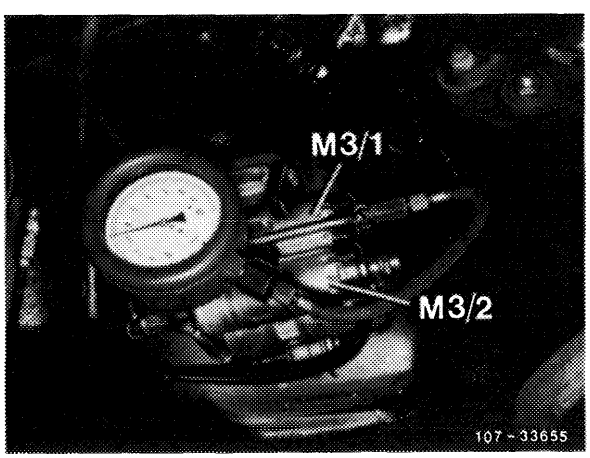


Fig. 07.3/4

Air filter

The air filter housing is adapted to the installation conditions. It is fastened by one clip and two nuts.

The air is drawn in form outside the engine compartment via plastic scoop (arrow) and air hose (1).

The filter element is a plate-type filter.

Note: Two temperature sensors are installed in the air cleaner housing.

Repair note

To prevent damage to the air filter housing, disengage carefully rearward out of clip fastener after the two mounting nuts have been removed.

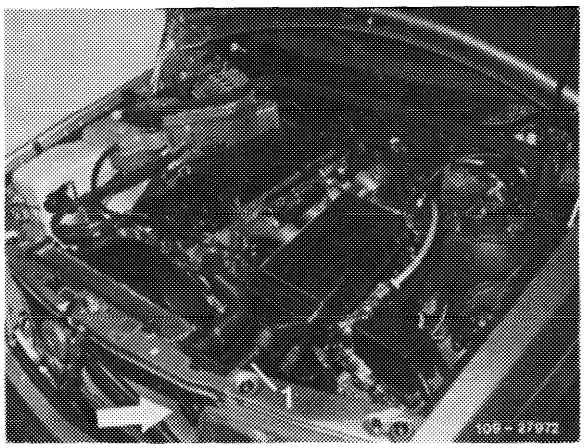


Fig. 09/1

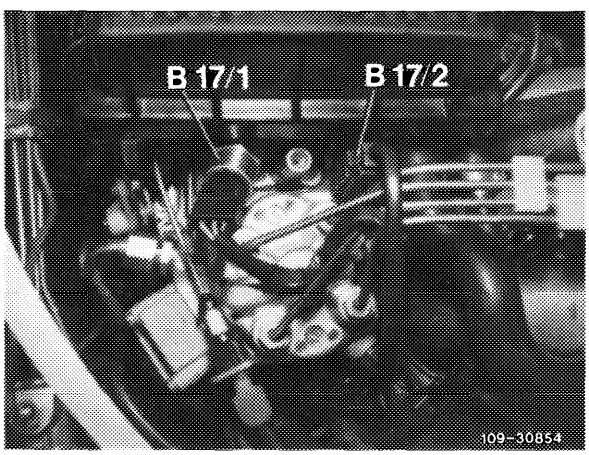


Fig. 09/2

B 17/1 Intake air temperature sensor (EZL)
B 17/2 Intake air temperature sensor (CIS-E)

Belt drive

Single-belt drive

Similar to engine 102.985, all the accessories are driven by a poly-V-belt.

Shock absorber (28) for the tensioning device (1) of the poly-V-belt (27) and bracket (29) were changed.

The modified shock absorber can be recognized by its circular grooves.

Length of belt ⎓ 1885 mm

Repair note:

In case of repairs, the shock absorber must be fastened in bore (B) of the bracket (29).

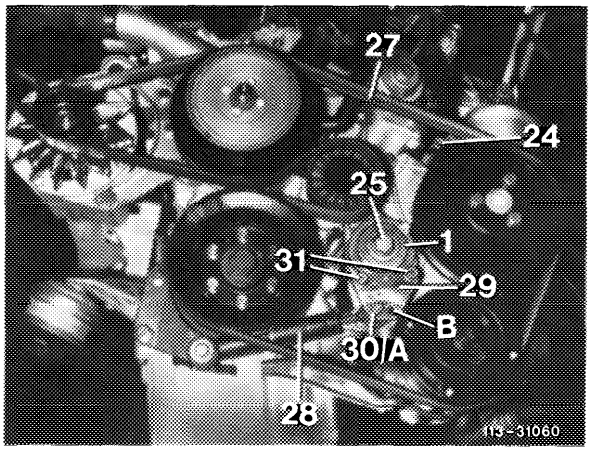


Fig. 13/1

Intake manifold, exhaust manifold

Intake manifold

The intake manifold is adapted to installation conditions and to engine. The diameter of the intake ducts (per intake valve) is approx. 26 mm. The intake ducts are fork-shaped prior to cylinder head. As a result, each intake valve has one intake duct.

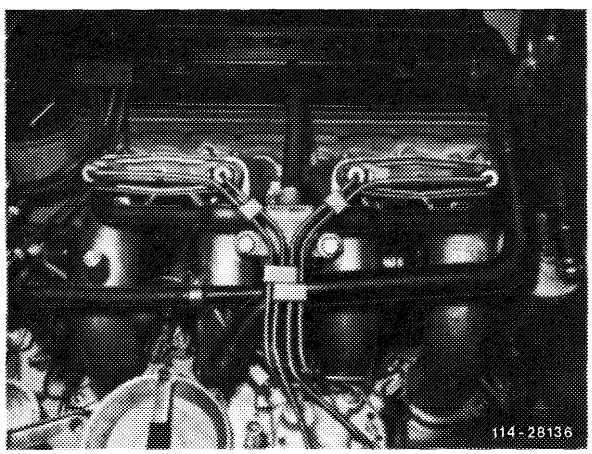


Fig 14/1

Exhaust manifold

The exhaust manifold is designed as a steel pipe manifold and enters a dual pipe exhaust system. The pipes of cylinder 1 and 4, as well as of cylinder 2 and 3 are joined. The pipe diameter is approx. 42 mm.

A sheet metal gasket per cylinder is installed as an exhaust manifold seal.

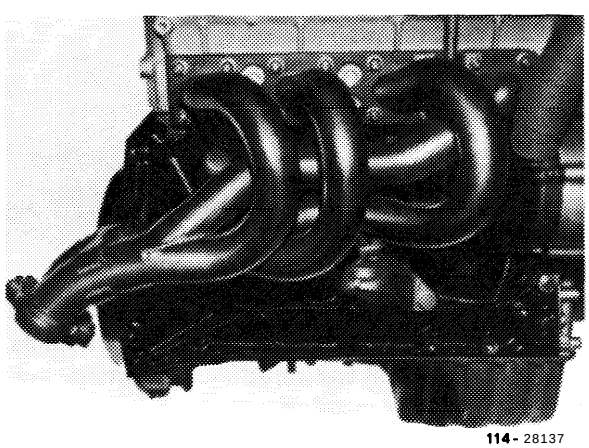


Fig. 14/2

Repair note
For removal and installation of exhaust manifold remove screw (arrow) from heater return flow pipe and pull return flow pipe in direction of engine.

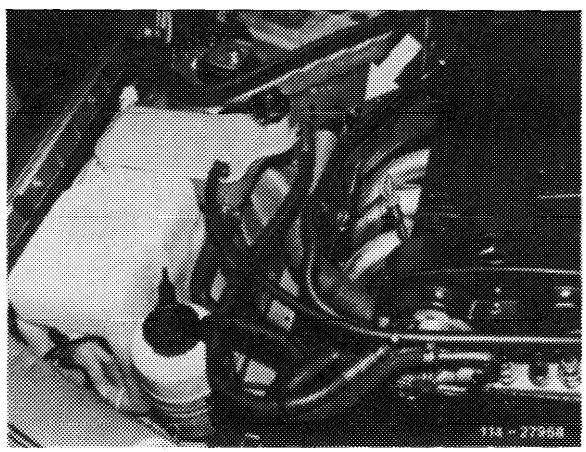


Fig 14/3

During assembly proceed as follows:

1 Insert screw for holder (on transmission bell) hand tight.

2 Tighten nuts for exhaust manifold on cylinder head.

3 Tighten screw for holder.

Catalyst

The exhaust system is equipped with two primary catalysts (Fig., **14/4)** and one under floor catalyst.

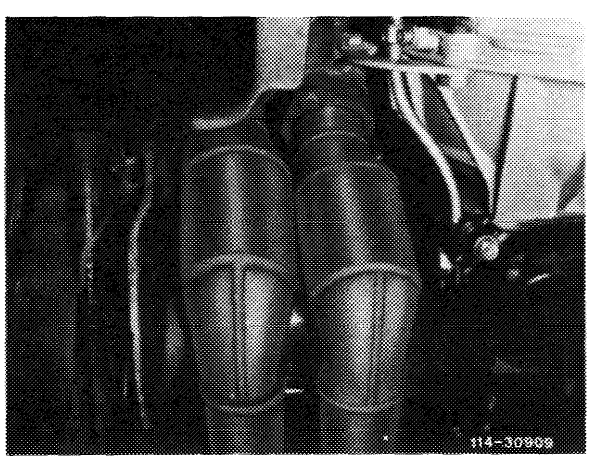


Fig. 14/4

Electrical system, engine

Electronic ignitiin system with electronic timing adjustment (EZL)

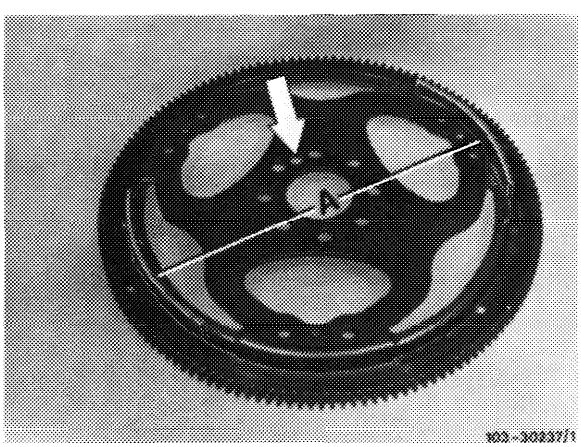
The ignition system corresponts to that of model 124.030 except for the following modifications:

- The ignition control module was adapted to engine 102.983.
- Position indicator with longer cable.
- Flywheel or flex plate with two segments.
- An additional intake air temperature sensor is installed in the air filter.
- High voltage distributor with modified internal construction.
- New spark plug connectors.

Components of ignition system

flywheel or flex plate with segments

Two segments offset by 180° on the ring of the flex plate or flywheel are used for controlling ignition timing.



Pig. 15/1

A Segment
arrow Locating bore

Temperature sensor intake air with electronic control 25 °C

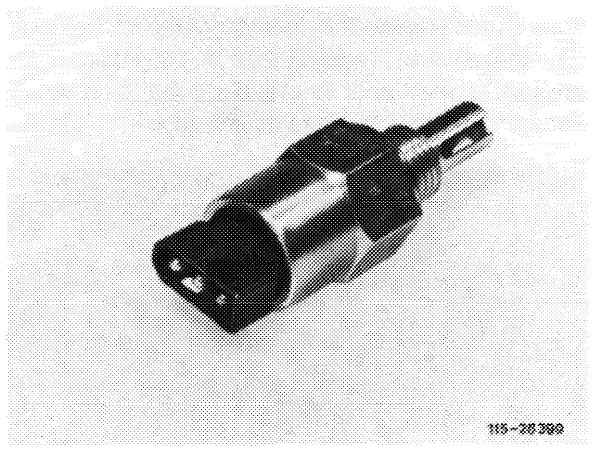


Fig. 15/2

The intake air temperature sensor has an electronic device, which retards the full load characteristic at temperatures above 25 °C.

High voltage distributor (ignition distributor)

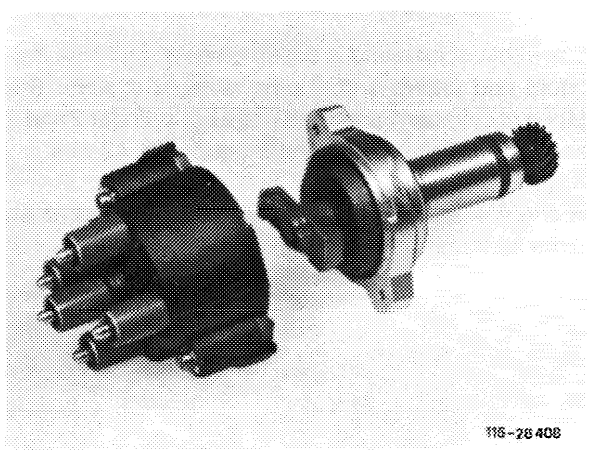


Fig. 15/3

The high voltage distributor is now only serving the purpose of high voltage distribution. Flyweights, vacuum control unit and inductance transmitter system are no longer installed.

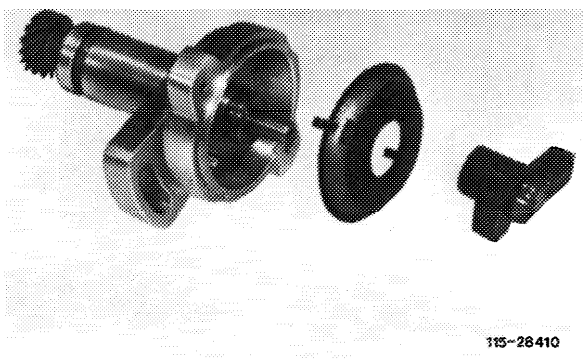


Fig. 15/4

The distributor cap is attached to ignition distributor by special M 6 screws. The protective cap for the interference suppression is mounted on distributor cap and fastened with two star washers.

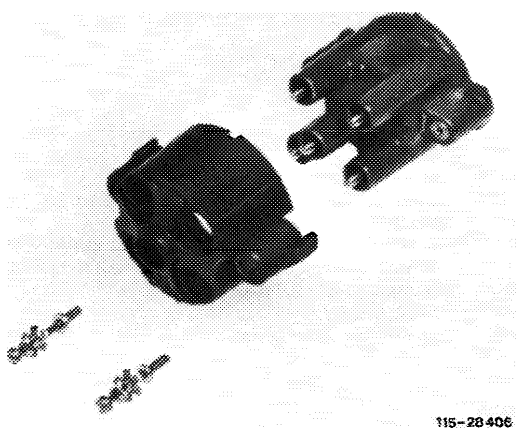


Fig. 15/5

Interference suppression resistors: on distributor cap per connection 1 kΩ, distributor rotor 1 kΩ.

Spark plug connector

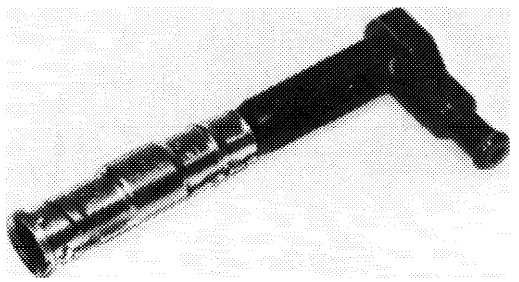


Fig. 15/6

A new spark plug connector with 1 kΩ interference suppression resistor is installed.

Note: Twist spark plug connector prior to pulling.

Reference input resistor plug (EZL, R 16/1)

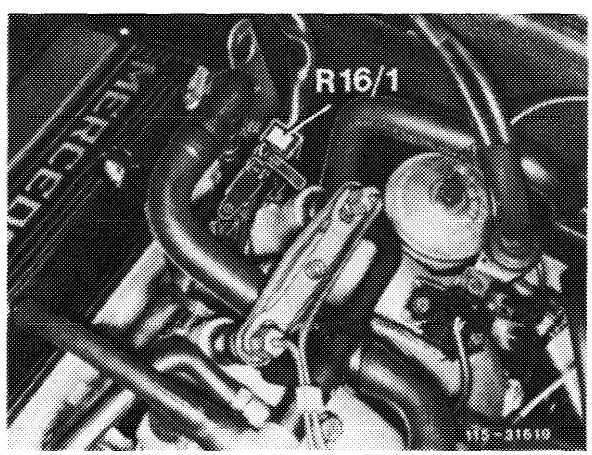


Fig. 15/6a

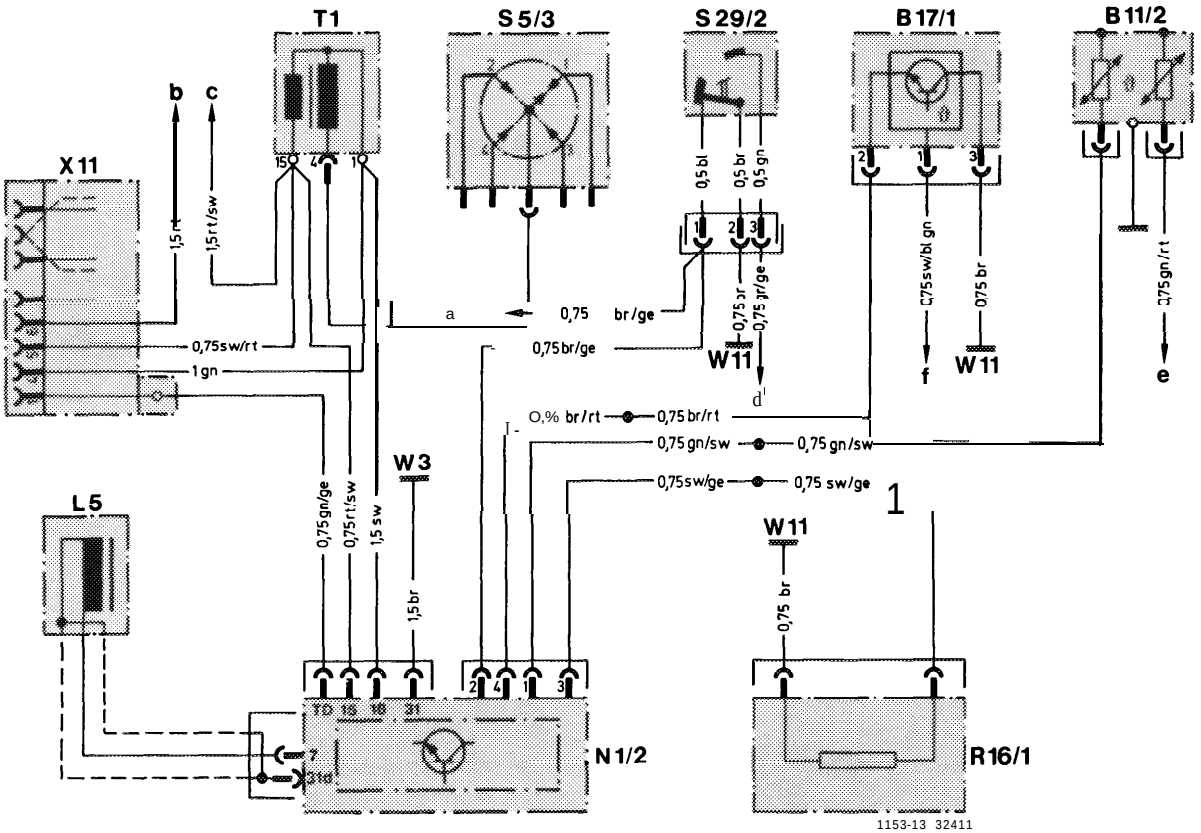


Fig. 15/7 Wiring diagram, electronic ignition system with electronic timing adjustment (EZL)

B	11/2	Coolant temperature sensor
B	17/1	Intake air temperature sensor (EZL)
L	5	Position indicator, flywheel/flex plate
N	1/2	Ignition control module
R	16/1	Reference input resistor plug (EZL)
S	5/3	High voltage distributor
S	29/2	Throttle valve switch, full load/idle speed contacts
T	1	Ignition coil
w	3	Ground, front left wheelhousing (ignition coil)
w	11	Ground, engine (electric wire connection)
x	11	Diagnostic socket, terminal block, terminal TD
a		to CIS-E control unit plug (terminal 13)
b		to electrical center, connector S, terminal 11 (circuit 30)
c		to electrical center, connector S, terminal 4 (circuit 15)
d		to CIS-E control unit plug (terminal 5)
e		to CIS-E control unit plug (terminal 21)
f		to electrical center, connector U, terminal 6 (circuit 15 R)

Removal and installation of high voltage distributor

Removal/installation is as before. Pay attention to the following items:

1 Ignition distributor cap is fastened with screws.

2 Adjustment of ignition timing is no longer required. The ignition timing is determined by the switching unit.

Removal and installation of spark plug connectors and spark plugs

Note

Clean ignition cable cover, loosen the 3 screws and remove.

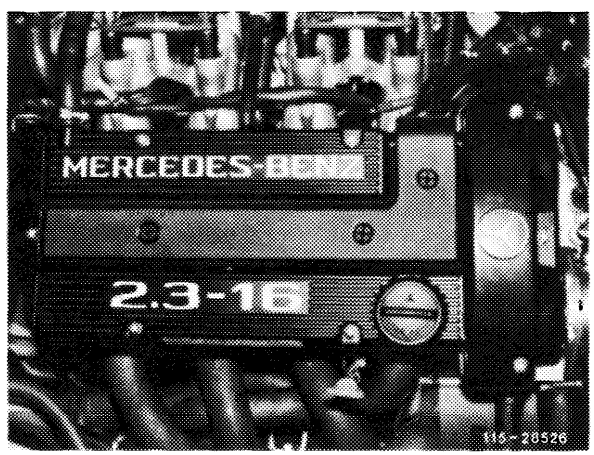


Fig. 15/8

Loosen spark plug connectors by twisting to the right and left and pulling off.

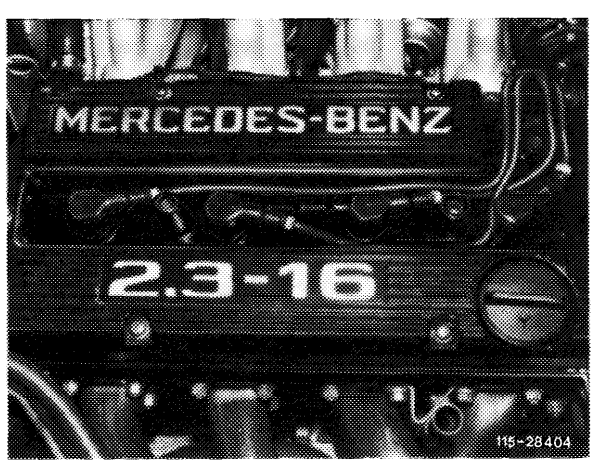


Fig. 15/9

Testing EZL electronic ignition system

Test **values**

Voltages

Ignition on (engine off)	Coil terminal 15 (terminal 5 diagnostic socket)		Battery voltage
	between coil terminal 15 and 1 (terminal 5 and 4 diagnostic socket)		o v
	4-pole round plug (ignition control module)	Terminal 15 and terminal 31	Battery voltage
		Terminal 16 and terminal 31	Battery voltage

Resistances (test data at 0 °C to 100 °C)

Ignition coil	Primary (terminal 1 and 15)	0.3-0.6 Ω
	Secondary (terminal 1 and 4)	7-13 kΩ
Position sensor		680-l 200 Ω
Reference input resistor (EZL)		750 Ω

Dwell angle

at cranking speed		1 O-54 % or 9-49 °
at 4000 rpm		30-60 % or 27-54 °

Ignition timing (firing point)

at cranking speed		TDC ± 2 °
at idle		below 20 °
at 4000 rpm	without vacuum, intake air temperature sensor plug pulled off	18-22 °
at 4000 rpm	with vacuum, intake air temperature sensor plug pulled off	29–33 °

Conventional testers

Multimeter')	SUN DMM-5
Engine tester')	SUN EMT-l 019, Master 3, MCM-2110
Tachometer')	All-Test 361 O-MB

') Available through the MBNA Standard Equipment Program

For test procedure see engine 103 with the following exception.

Disconnect intake air temperature sensor plug (arrow) when checking ignition timing at 4000 rpm.

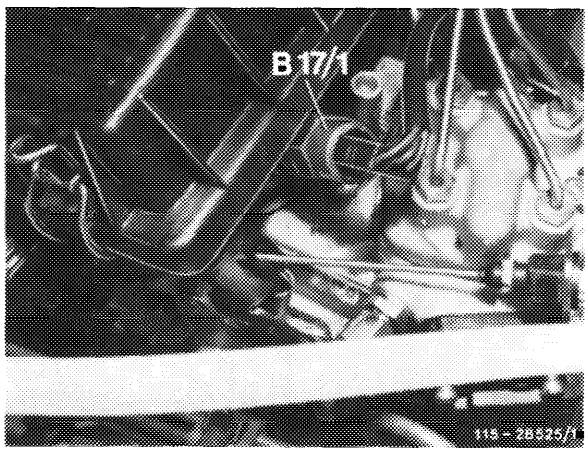


Fig. 15/10

B 17/1 Intake air temperature sensor (EZL)

Spark plugs (with conical seat)

BERU	BOSCH	CHAMPION
Designation	Designation	Designation
Electrode gap	Electrode gap	Electrode gap
Part number	Part number	Part number
14 **K- 6 DU**	**H 6 DC**	s7 YC
0.8	0.8	0.8
102 159 1203	102 159 1203	102 159 1203

Engine lubrication

Lubrication circuit

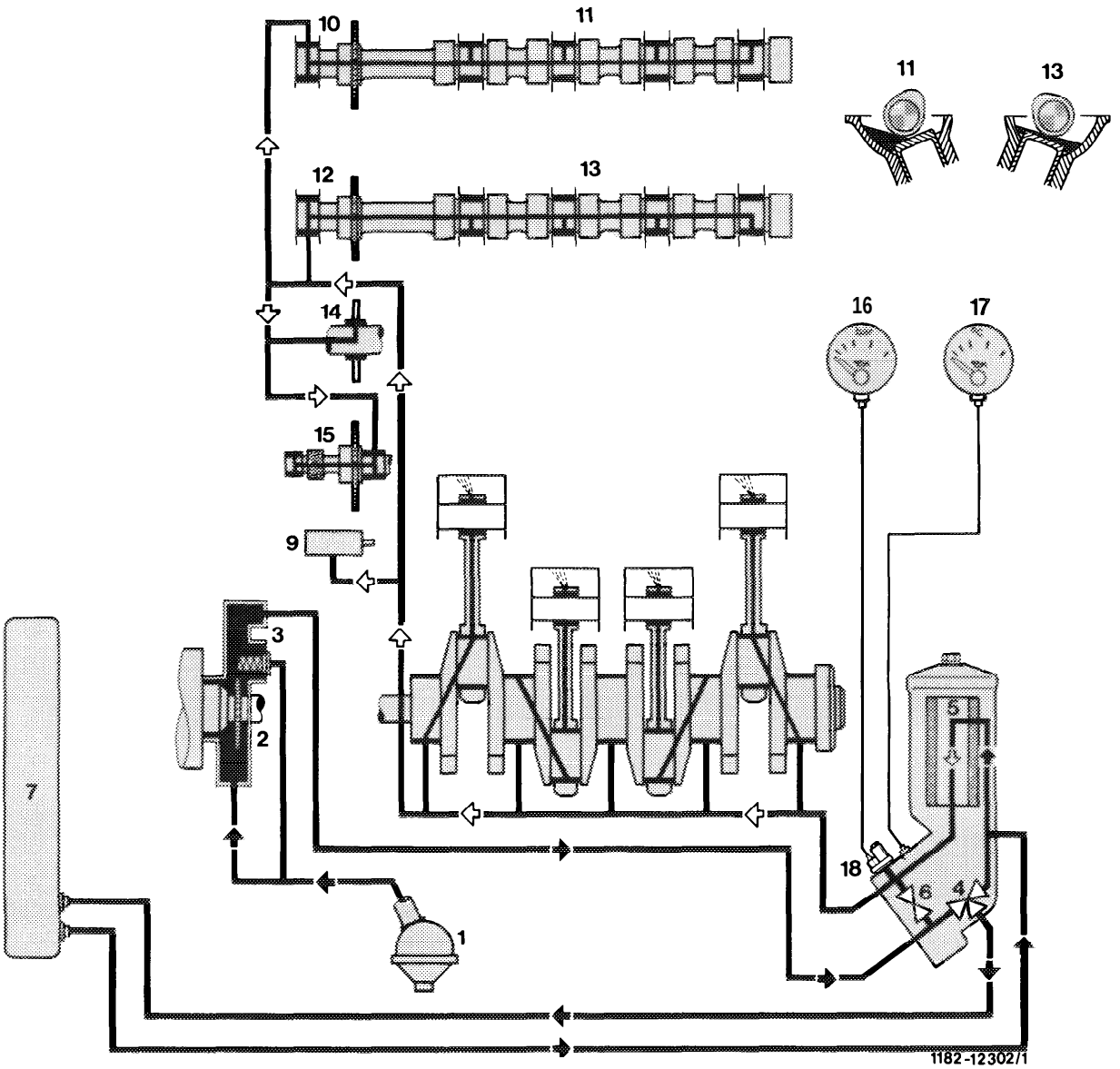


Fig. 18/1

1 Oil strainer
2 Oil pump
3 Oil pressure relief valve
4 Thermostat 110 °C (in oil filter housing)
5 Oil filter element
6 Bypass valve oil filter element
7 Oil-to-air cooler
9 Chain tensioner
10 Camshaft sprocket – exhaust
11 Camshaft – exhaust
12 Camshaft sprocket – intake
13 Camshaft – intake
14 Intermediate sprocket
15 Idler sprocket
16 Oil pressure gauge (instrument cluster)
17 Oil temperature gauge
18 Oil pressure sensor

Oil filling capacities in liters (for approved engine oils, refer to Specifications for service products)

Total quantity for initial filling	5.5
Quantity at oil and filter change	5.0
Oil pan max./min	4.8/2.8

Oil filter

A thermostat (332 b, Fig. 18/2) in the oil filter controls the oil flow through the oil-to-air cooler.
Opening begins at 110 °C oil temperature. Fully opened at 125 °C oil temperature.

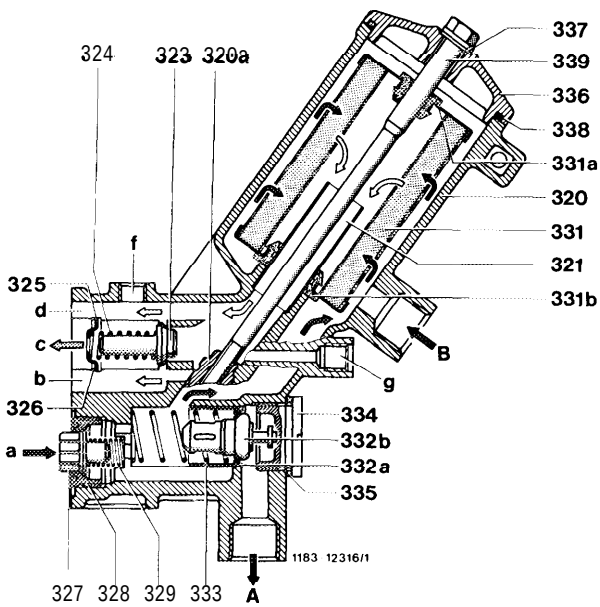


Fig. 18/2

320 Oil filter housing
320a Threaded bushing
321 Return tube
323 Valve cone
324 Compression spring
325 Spring retainer
326 Retaining ring
327 Valve cone
328 Valve seat ring
329 Compression spring
331 Oil filter element
331 a Rubber seal
331 b Rubber seal
332 a Slide
332 b Thermostat
333 Compression spring
334 Plug
335 Seal ring
336 Cover
337 Seal ring
338 O-ring
339 Center bolt
A Connection to oil-to-air cooler
B Connection from oil-to-air cooler
a Supply from oil pump
b Return flow to oil pan
c Uncleaned oil to main oil duct
d Cleaned oil to main oil duct
f Connection for oil temperature gauge
g Connection for oil pressure gauge

[1]) Filter element bypass valve
[2]) Return flow check valve

Note:
The oil filter is sectioned in different planes to show its function properly. Therefore, the connections for hoses and sensors are not always shown in the correct position.

Even with the thermostat fully opened, a given oil quantity will still flow directly to oil filter element.

The oil cooler lines are screwed directly into oil filter housing.

Cup-type tappet and cam lubrication (Fig. 18/1)

The cup-type tappet and cams are lubricated in an oil sump (sump lubrication). The oil sump is filled with the oil emerging laterally on camshaft bearings (leak oil).

Oil temperature gauge

For instrument refer to Group 54.

The oil temperature is picked up on the oil filter by a temperature sensor **(67).**

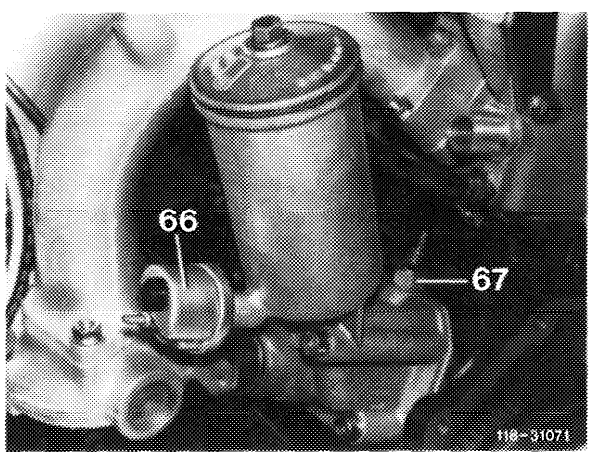


Fig. 18/3

The operating temperature of the oil is 80-l 20 °C.

An increase up to max. 150 °C is permitted. If this value is exceeded, check oil level first. Level should not be above max. mark.

Engine cooling

Coolant pump

To provide sufficient clearance for the cylinder head, the long feed connection (B, arrow) has been moved downward.

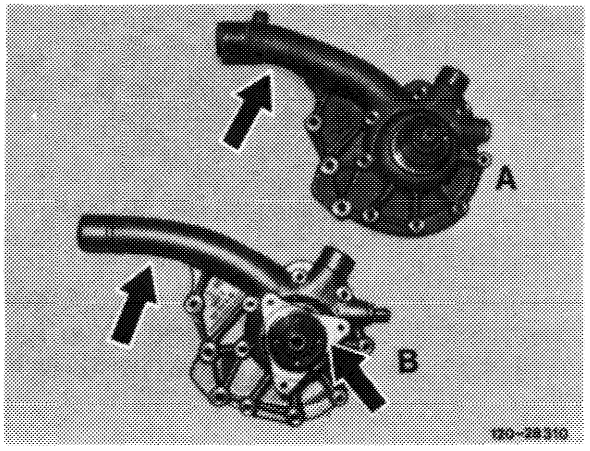


Fig. 20/1

A Coolant pump Engine 102.985

B Coolant pump Engine 102.983

Repair note

Coolant pumps are not interchangeable.

Thermostat housing and thermostat

The thermostat housing is sealed with an O-ring to the coolant return flow pipe in the cylinder head (109, Fig. 01/1 8) and is fastened by 4 screws.

Tightening torque 21 Nm.

The following temperature switches or temperature sensors are screwed into the thermostat housing:

Temperature sensor for coolant temperature gauge (B 13).

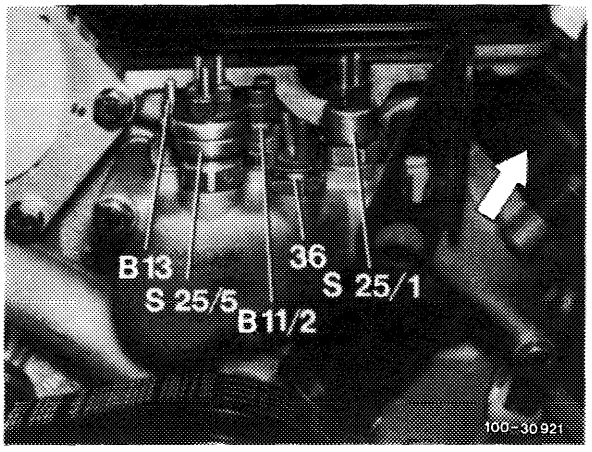


Fig. 20/2

2-pin temperature sensor for CIS-E injection and EZL ignition system (B 1 1/2).

100 °C temperature switch for fan clutch (S 25/1).

Thermovacuum valve for fuel evaporation system (38).

Temperature switch for auxiliary fan 105 °C and A/C compressor cutout at 115 °C (S 25/5).

The thermostat housing cover is made of plastic (arrow). The thermostat is the same as for the other 102 engines.

Fan clutch

Function and layout of fan clutch are the same as for fan clutch of the engine 102.985.
Diameter of the 5-blade fan is 430 mm.

Repair note

The fan cannot be interchanged with fan of other engines 102 in model 201.

Radiator

Light-alloy cross flow radiator (block depth 42 mm), with screwed on light-alloy oil-to-air cooler.

Engine mounts

All components of engine mounts are maintenance-free.

The right and left front engine mounts are the same (engine 102.985 has right and left different mounts). The rear engine mount is identical with model 201.024 with engine 102.985.

Throttle control

The throttle position is controlled by a **Bowden** cable (30) connecting the accelerator pedal to the engine.

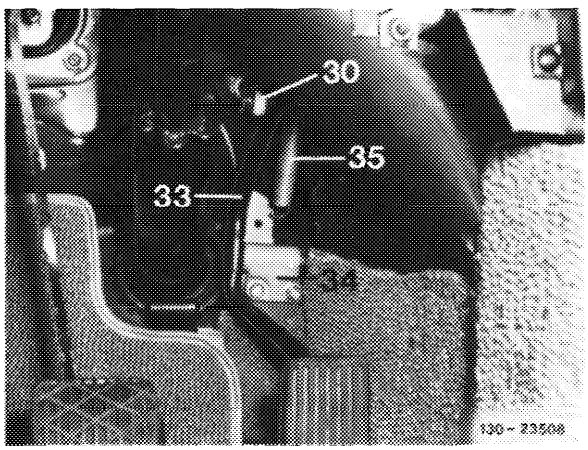


Fig. 30/1

30 Bowden cable
33 Accelerator pedal
34 Bearing
35 Return spring

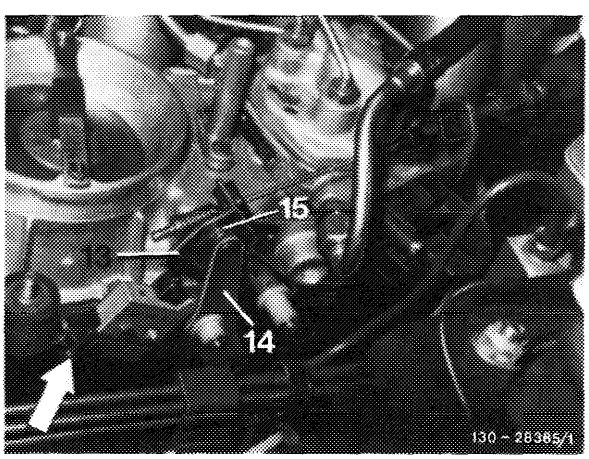


Fig. 30/2

The length of the connecting rod to the throttle valve housing is 82 ± 2 mm (measured from center of ball joint to center of ball joint).

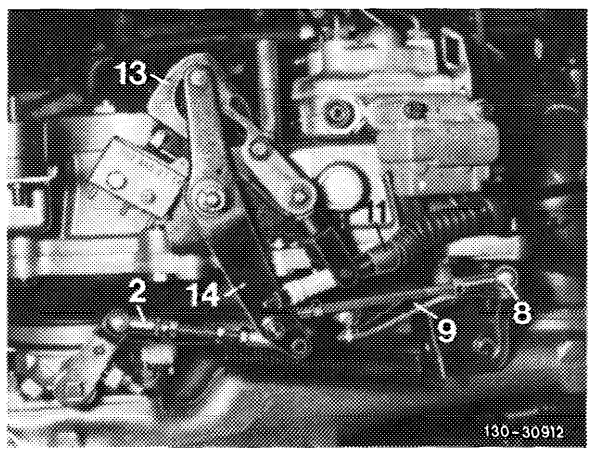


Fig. 30/3