Tightening torques	Nm
Self-locking nut on lateral support of clamp	7
Self-locking nut on exhaust manifold to exhaust flange	20—25

Removal and installation of exhaust system is not completely explained and attention is called only to particularly important items which must be observed during removal and installation or during partial renewal e. g. of resonance damper with plug connection.

Removal

1 If separation at plug connection is not possible, heat exhaust pipes. For safety reasons mount a shielding plate on vehicle between frame floor and exhaust pipes prior to heating the pipes.

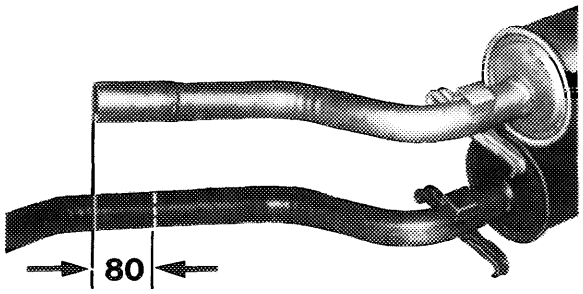
2 Check suspension members for re-use and renew, if required.

Installation

Renewal of resonance damper.

3 Place new resonance damper with plug connection exactly above removed components and trace pipe length of new resonance damper on removed system.

Separate pipe 80 minus 10 mm from marking (dashed line) in direction of resonance damper to make sure of a plug-in depth of 70—80 mm.

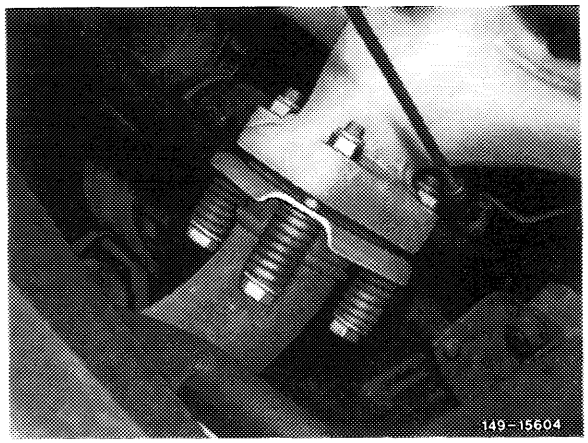


149-13368

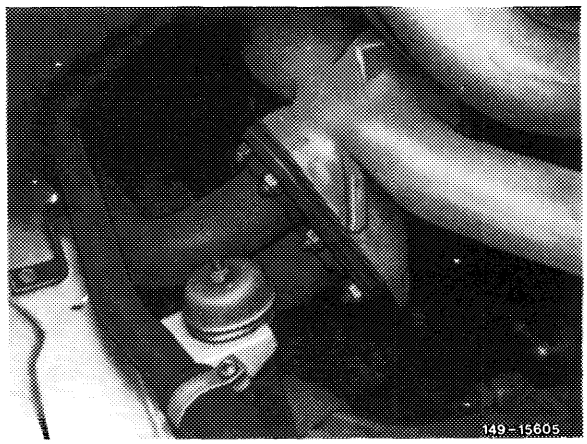
4 Always replace self-locking hex nuts.

Exhaust pipe – manifold connection on models 115.1 with engine 615 and 616.

Tighten spring uniformly until coils are in touch, then loosen again by 2–3 turns.

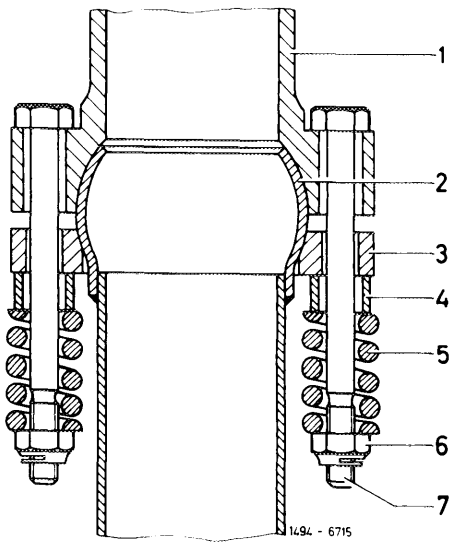


Exhaust pipe – manifold connection on model 115.114 with engine 617.



5 Exhaust pipe – manifold connection of 1st version on models 123.1 (except model 123.183 and 190).

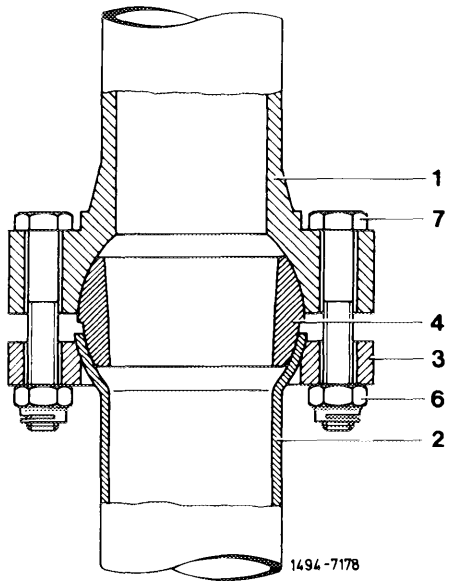
Tighten spring (5) uniformly until coils are in touch, then loosen again by 2–3 turns.



1 Exhaust manifold with inside ball
2 Exhaust pipe with ball
3 Flange
4 Spacer
5 Spring
6 Self-locking hex nut
7 Hex bolt

6 Exhaust pipe – manifold connection of 2nd version on models 123.1 (except model 123.183 and 190).

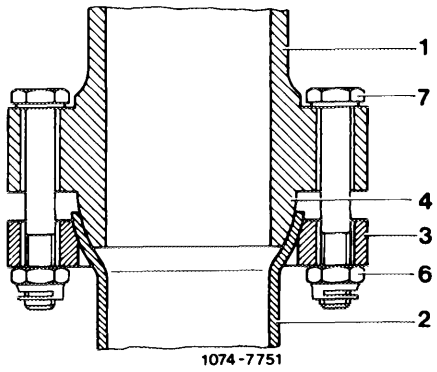
Tighten flange connection to exhaust manifold only when the complete system is hung up in rubber rings. Pay attention to correct seat of ball connection (4). Tightening torque of hex bolts 20–25 Nm.



1 Exhaust manifold with inner ball
2 Exhaust pipe with tulip
3 Flange
4 Ball connection (separate)
6 Self-locking hex nut
7 Hex bolt

7 Exhaust pipe – manifold connection of 3rd version on models 123.1.

Tighten flange connection to exhaust manifold only when the complete system is hung up in rubber rings. Tightening torque of hex bolts 20–25 Nm.



1 Exhaust manifold with outer ball
2 Exhaust pipe with tulip
3 Flange
4 Ball connection tightly connected to exhaust manifold
6 Self-locking hex nut
7 Hex bolt

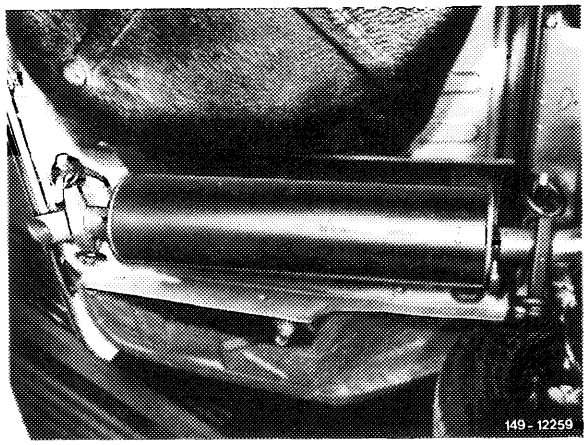
Note

As a result of a reduced spare parts stock, no exhaust manifolds with **inner ball** will be available any longer after stocks are used up. In the event of repairs, i. e. when changing an exhaust manifold with inner ball against one with outer ball, observe the following:

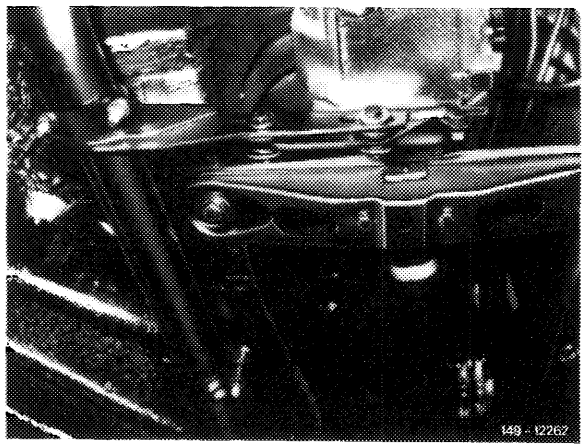
1. Exhaust pipes with ball connection (1st version) should also be replaced.

2. Exhaust pipes with tulip connection (2nd version) can still be used if the ball connection is removed.

8 Mount resonance dampers in such a manner that the holding clamps of the resonance damper are approx. 10 mm in front of holder on frame floor, so that the correct installation position is assured when the exhaust system is elongated.

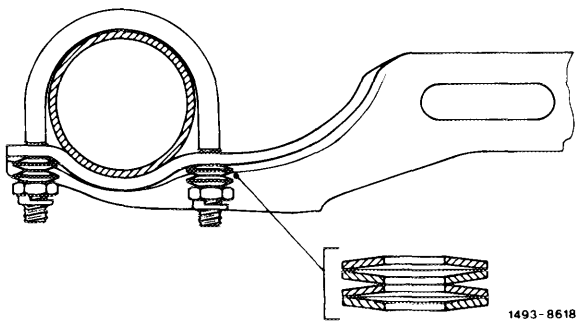


9 Mount lateral support on gearbox free of tension.

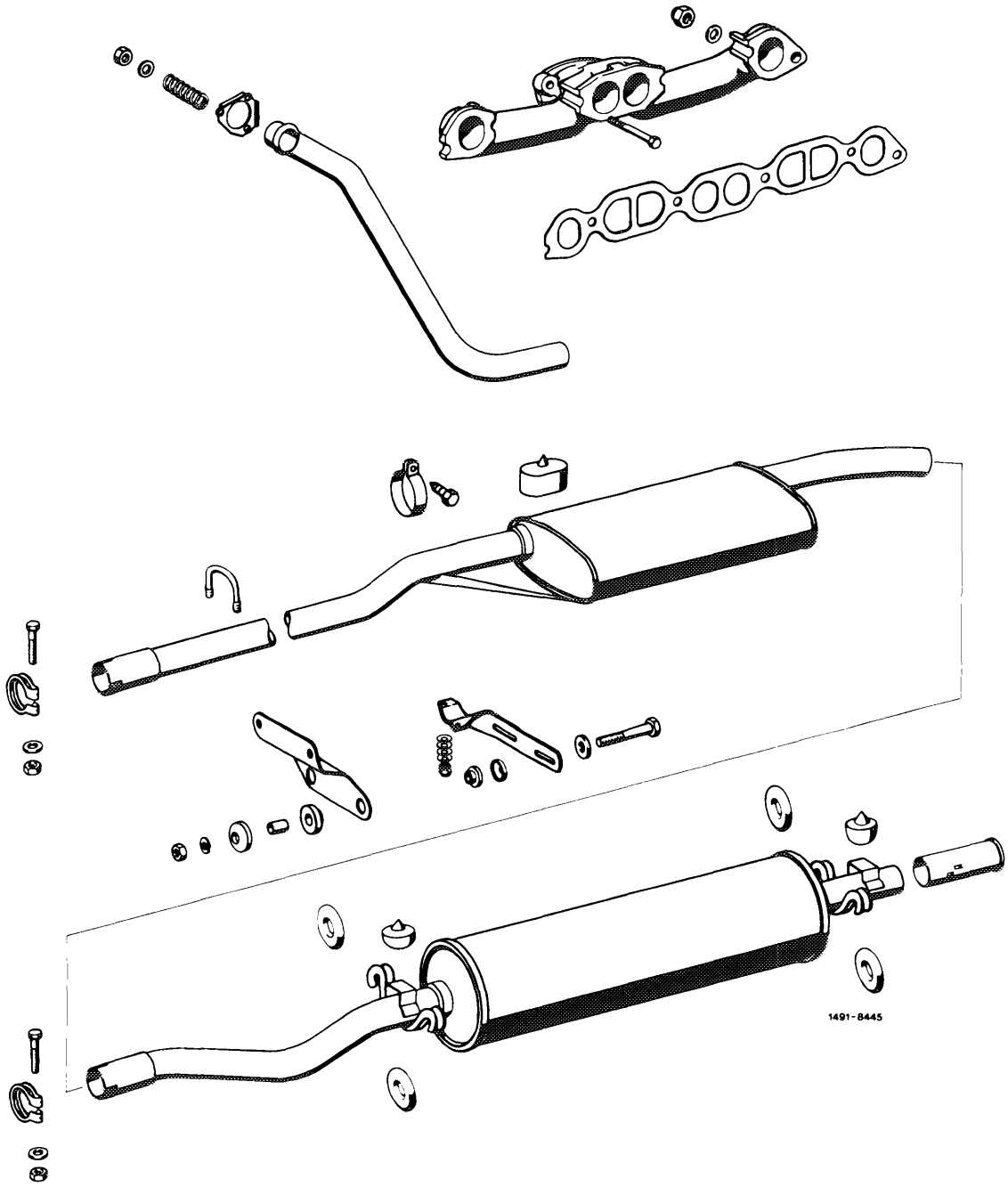


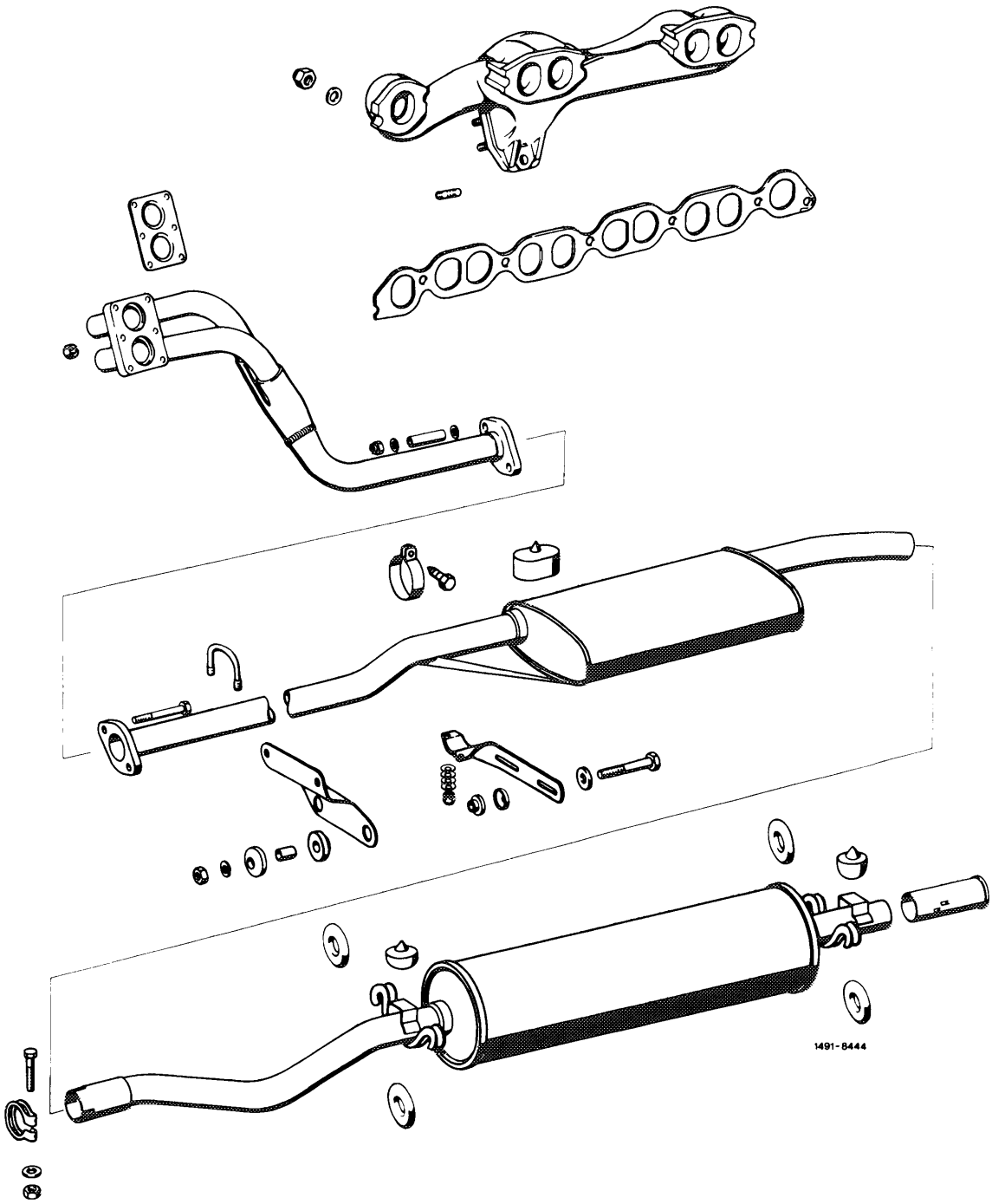
10 Mount clamp with 4 cap springs each in front of self-locking hex nuts and tighten to 7 Nm.

11 Run engine and check exhaust system for leaks.

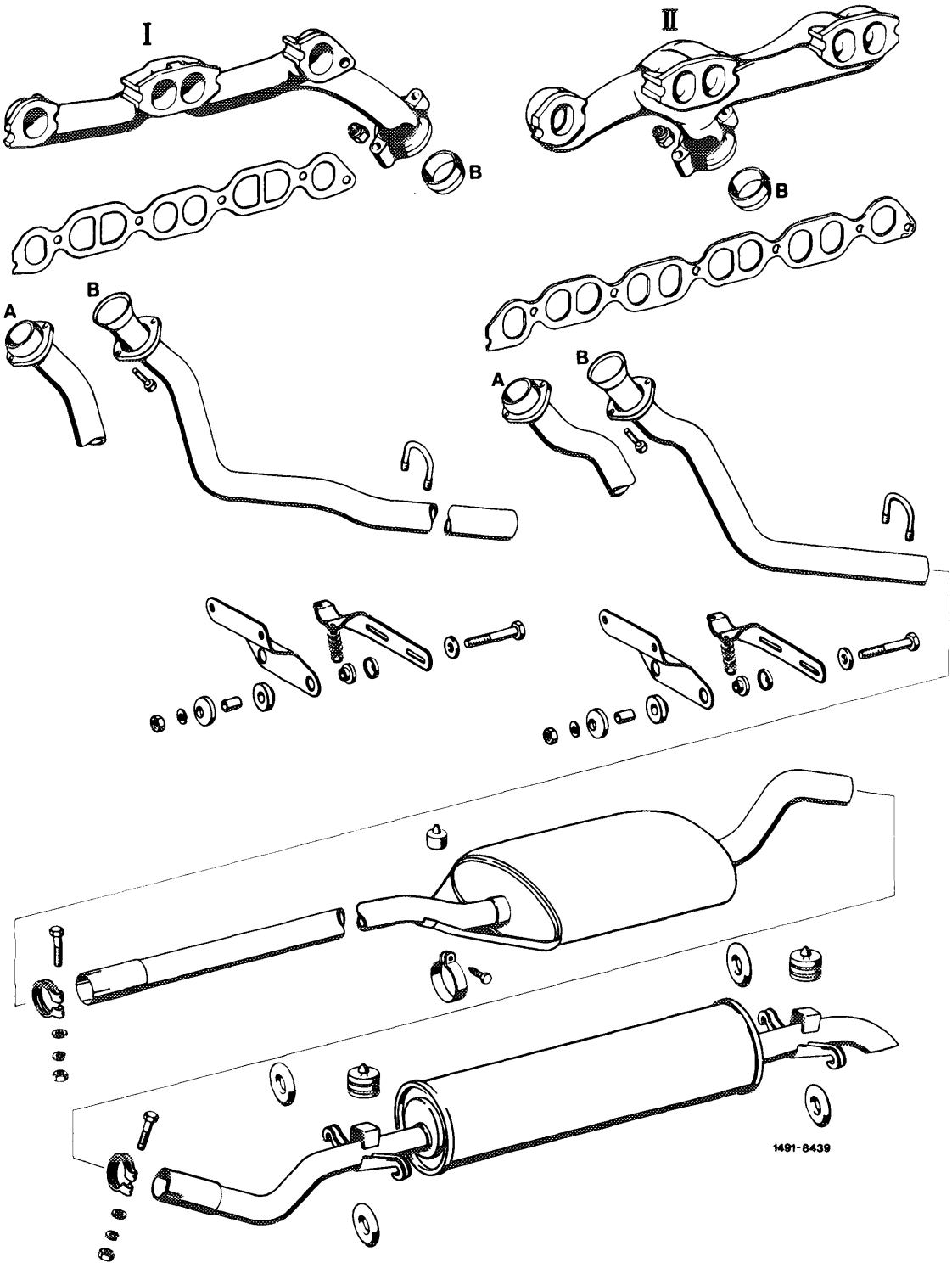


Exhaust manifold with complete exhaust system
model 115.1 (except 115.114)




1491-8444

Model 123.1



I For vehicles with engine 615 and 616
II For vehicles with engine 617
A 1st version – pipe with outer ball and exhaust manifold with inner ball connection
B 2nd and 3rd version – pipe with tulip and exhaust manifold with inner ball and ball connection or exhaust manifold with outer ball connection

Information for model year 1982

Extract from introductory brochure

Positive crankcase ventilation

The positive crankcase ventilation system is maintenance free.

The engine blow-by gases and crankcase vapors flow across the vent insert (1) and connection fitting (2) to the cyclone oil separator (3) which is attached to the intake manifold.

From here, they flow through the air intake duct (4) to the intake manifold and with the intake air into the combustion chambers.

At a very high intake manifold vacuum (caused by the throttle valve) the diaphragm in the differential pressure valve (3a) is pulled down, restricting the flow cross section to the intake manifold.

During this period, only a limited amount of blow-by gases will flow to the intake manifold.

The oil separated in the cyclone oil separator (3) flows through the return line (6) and the check valve (7), installed in the oil pan upper half, back into the oil pan. The check valve insures that no oil vapors from the oil pan are drawn into the intake system due to the existing vacuum.

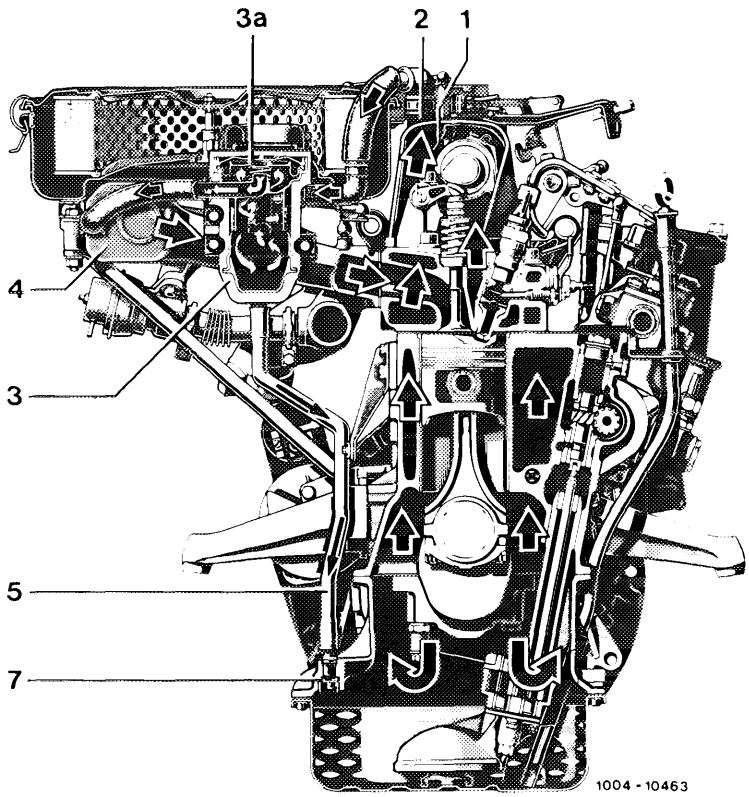


Fig 12

1 Vent insert
2 Connection fitting
3 Cyclone oil separator
3a Differential pressure valve
4 Intake manifold
6 Return line
7 Check valve

Cylinder head cover

Similar to engine 617.95 (turbodiesel) with EGR, the breather pipe screwed to the inside of the cylinder head cover has been replaced by a vent insert which is riveted into the cylinder head cover and sealed with silicone rubber.

As a result, the oil separating chamber (calm region) included in the engine ventilation system has been increased in volume.

Air cleaner

Air cleaner housings are made of both, aluminium or plastic, and either one may be installed.

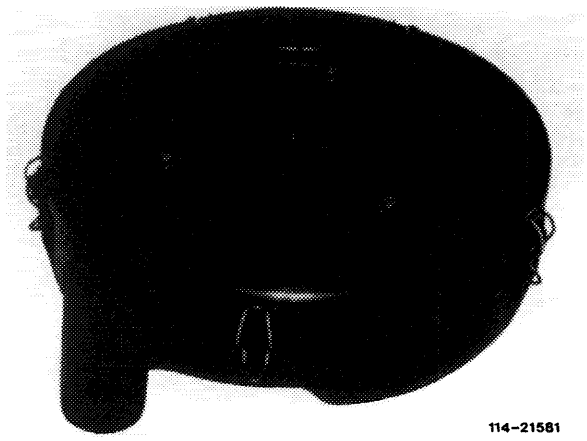


Fig. 13

Exhaust gas recirculation (EGR)

Engine 616 is provided with EGR, which is different in function and operation from that on engines 617.912 and 617.95.

EGR is controlled by way of a throttle valve housing attached to the intake manifold, as well as by an EGR valve.

In addition, the engine speed and the driving speed are monitored by an electronic control unit, which in turn activates a switchover valve. As a result, EGR is switched off when necessary.

Functional diagram with automatic transmission

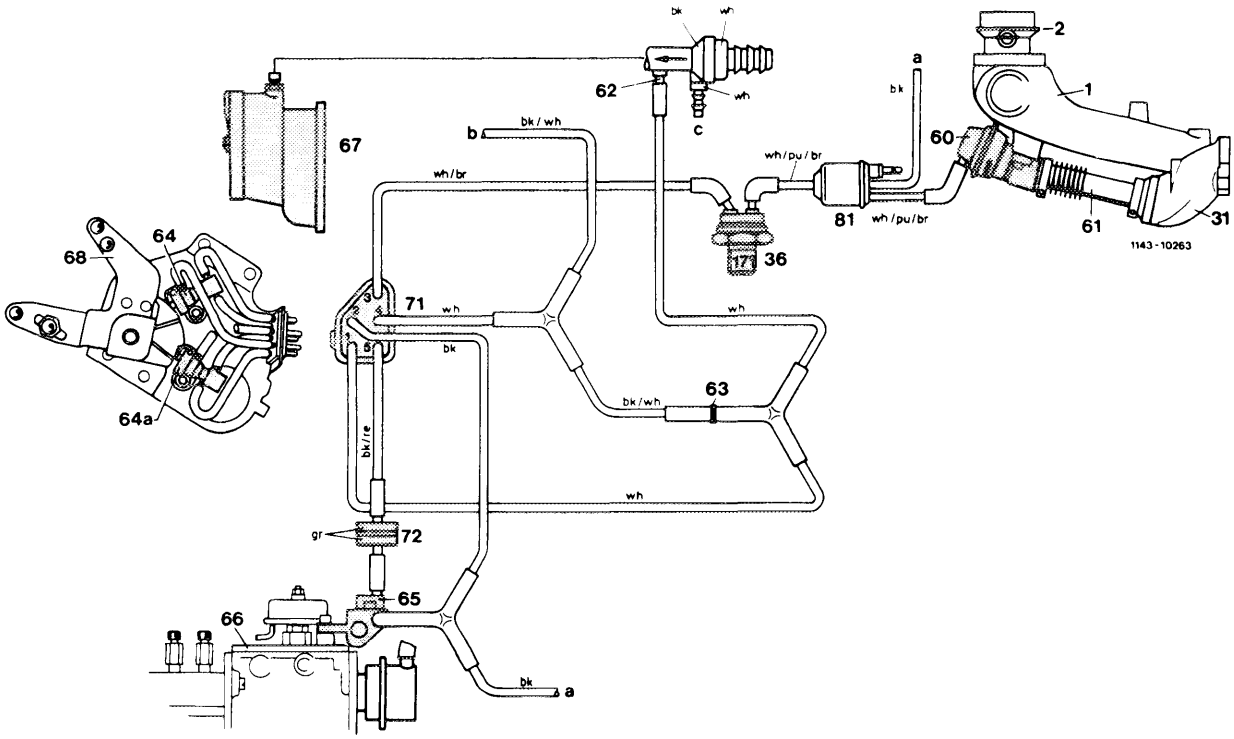


Fig. 14

1 Intake manifold
2 Throttle valve housing
31 Exhaust manifold
36 Thermo-vacuum valve 17 °C
60 EGR valve
61 Corrugated tube
62 Orifice
63 Orifice
64 Switchover valve, mechanical, EGR
64a Switchover valve, mechanical, automatic transmission
65 Vacuum control valve
66 Injection pump
67 Vacuum pump
68 Lever with cam
71 Central plug
72 Surge damper, vacuum
81 Switchover valve, electric

a Vent to passenger compartment
b To automatic transmission
c To additional vacuum consumers

Color code
bk = black
br = brown
gr = green
pu = purple
re = red
wh = white

Functional diagram with manual transmission

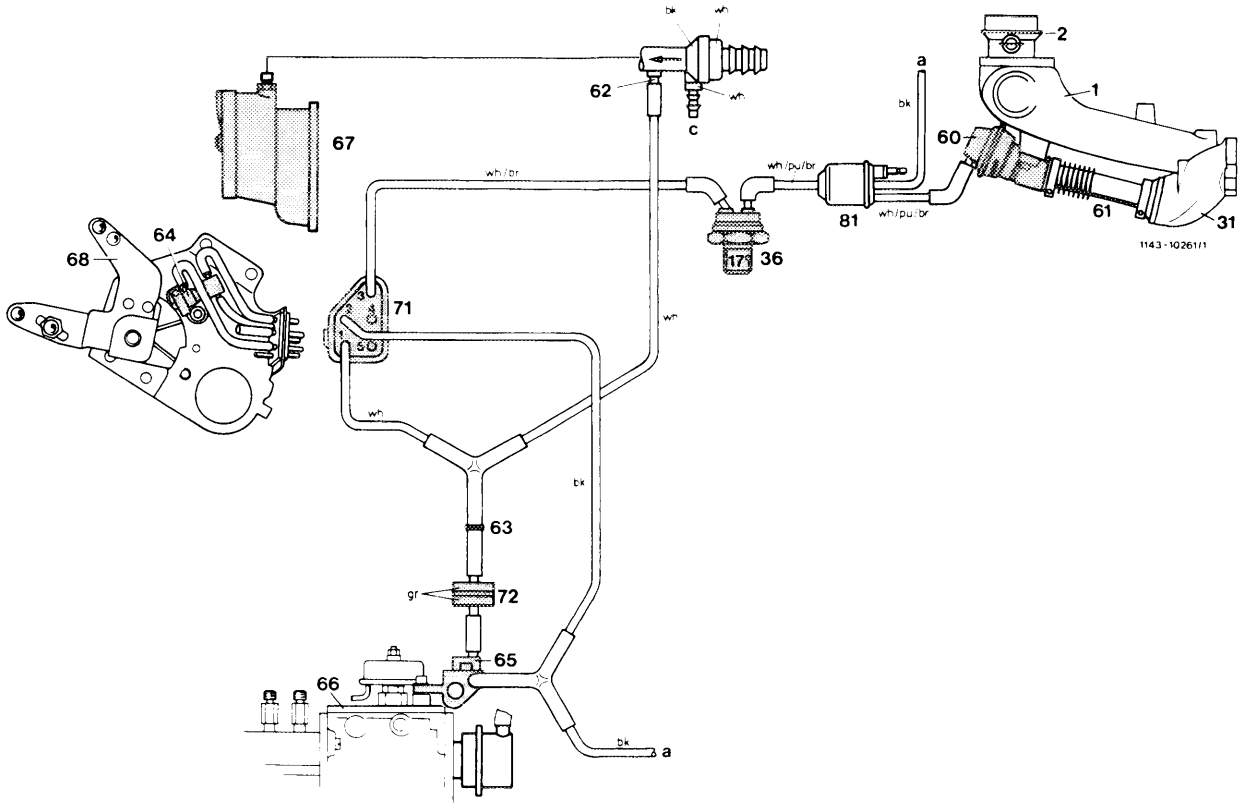


Fig. 15

1 Intake manifold
2 Throttle valve housing
31 Exhaust manifold
36 Thermo-vacuum valve 17 °C
60 EGR valve
61 Corrugated tube
62 Orifice
63 Orifice
64 Switchover valve, mechanical, EGR
65 Vacuum control valve
66 Injection pump
67 Vacuum pump
68 Lever with cam
71 Central plug
72 Surge damper, vacuum
81 Switchover valve, electric

a Vent to passenger compartment
c To additional vacuum consumers

Color code
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EGR components

The EGR valve, vacuum control valve, thermo-vacuum valve 17 °C and switchover valve, mechanical are identical with those of engine 617 of model year 1981.

Intake manifold

A spiral-shaped channel (arrows) is located around the intake opening of the intake manifold, through which the recirculated exhaust gas is routed and mixed with the intake air. The EGR valve is attached to the intake manifold as on engine 617 in model year 1981 (arrow, Fig. 17).

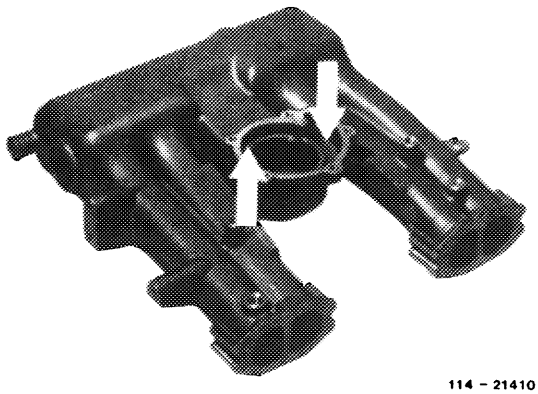


Fig. 16

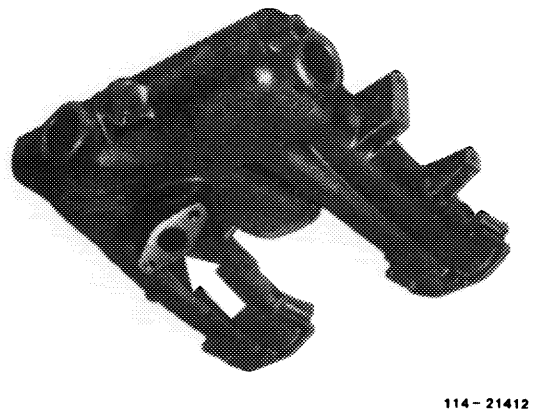


Fig. 17

Exhaust manifold

An outlet connection (arrow) is attached to the exhaust manifold to provide the exhaust gases for recirculation.

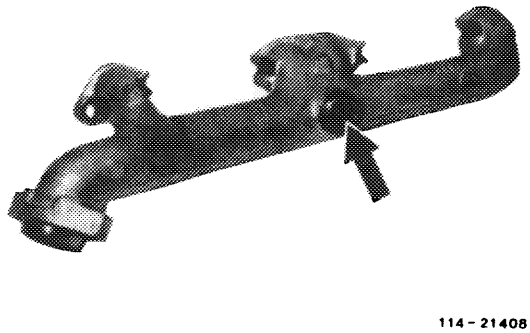


Fig. 18

Throttle valve housing

The throttle valve housing is required to increase the amount of EGR in the partial load range.

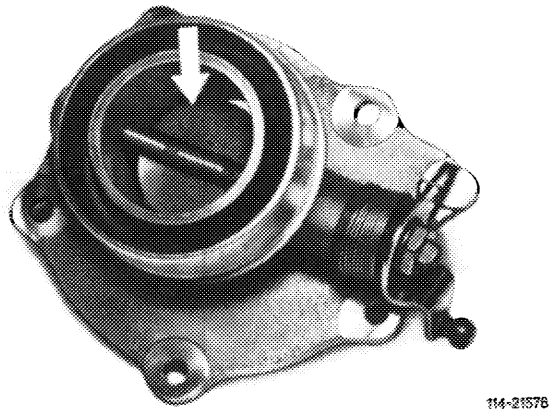


Fig. 19

Depending on the position of the regulating linkage (load condition of engine) the position of the throttle valve (arrow) and thereby the pressure difference between exhaust manifold and intake manifold are changed.

High pressure differential = high EGR

The OD of the throttle valve is designed so that in its closed position an annular cross section remains open. As a result, the engine will idle smoothly at high altitudes with the driving position engaged, the air conditioning system switched on and the power steering activated.

The lower half of the throttle valve housing is provided with guide vanes (arrows). These vanes insure complete mixing of intake air and recirculated exhaust gas, so that each cylinder is provided with the same quantity of exhaust gas.

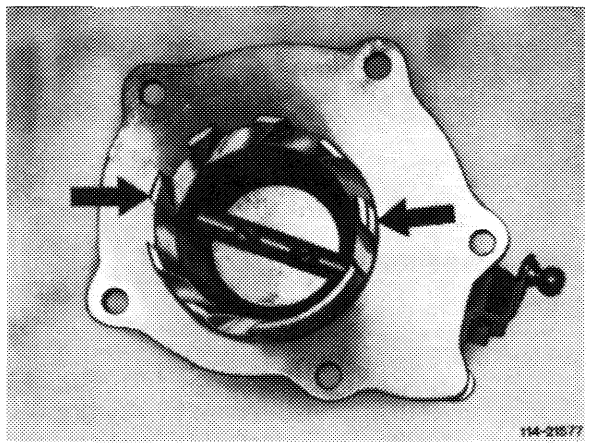
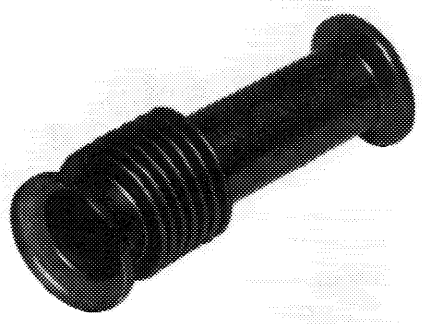


Fig. 20

Corrugated tube

Exhaust gases are returned through a corrugated tube installed between exhaust manifold and EGR valve.

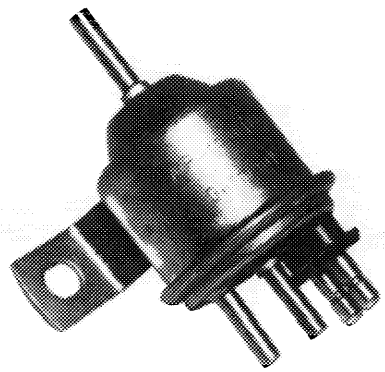


114 - 21411

Fig. 21

Electric switchover valve

The switchover valve controls the vacuum to the EGR valve. It opens or closes by way of an electronic control unit depending on engine rpm and vehicle speed.

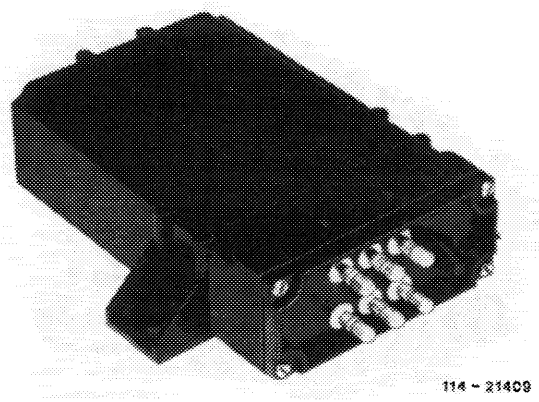


114 - 21401

Fig. 22

Control unit

The control unit processes input data such as engine rpm from the TDC transmitter and driving speed from the impulse transmitter of the speedometer (refer to electric wiring diagram).



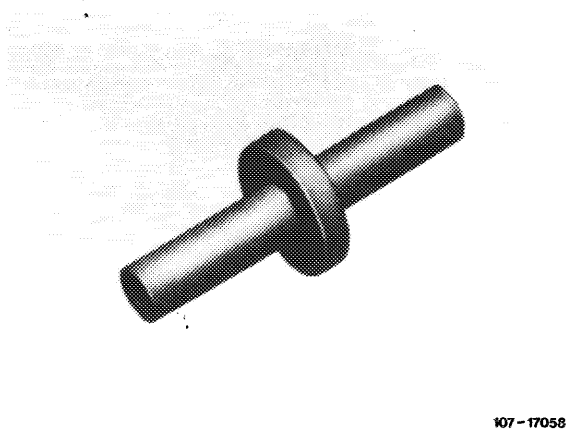
114 - 21409

Fig. 23

Orifice

To the existing orifices

green	0.7 mm	
white	0.8 mm	
blue	1.0 mm	
red	1.1 mm	
yellow	2.0 mm,	the orifice
brown	**0.9 mm**	has been added.

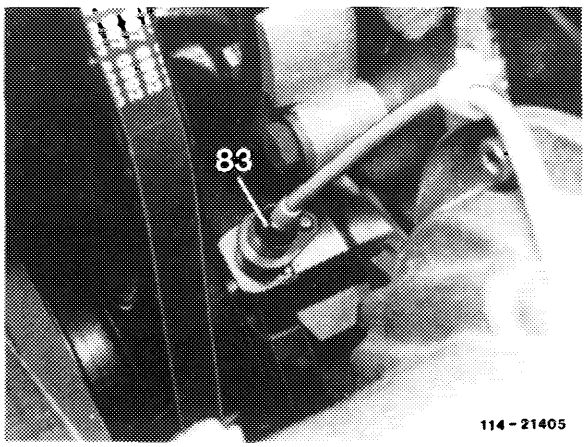


107-17058

Fig. 24

TDC transmitter

A TDC transmitter is attached to the front of the cylinder block and transmits the engine rpm to the control unit for EGR.



114-21405

Fig. 25

Description of Operation

EGR operates under the following conditions:

- Coolant temperature above 17 °C
- Engine speed above $^{+100}_{-130}$ rpm
  (+100 with increasing rpm, −130 with decreasing rpm)
- Speed below 73 ± 8 km/h
- Under partial load.

Thermo-vacuum valve (36) opens at a coolant temperature above approx. 17 °C. The vacuum can now reach the electric switchover valve (81).

Idle speed

The electric switchover valve (81) is not energized and the EGR valve is externally vented. There is no EGR.

Engine speed above 1300 rpm

Starting at an engine speed of 1300 rpm the impulses from the TDC transmitter are converted into a control signal. The switchover valve (81) is energized and opens. The vacuum arrives at the EGR valve and opens the valve against its spring force. The EGR valve opens a certain amount, depending on engine load.

Depressing the accelerator pedal will overcome the free travel on the drag lever and will start to open the throttle valve via a connecting rod. The pressure differential between the intake and exhaust manifolds is progressively reduced. As a result, less exhaust gases are drawn into the intake manifold.

The vacuum control valve (65) determines the amount of vacuum at the EGR valve depending on engine load. This amount of vacuum serves as controlling factor for EGR (position of EGR valve) and the shifting of the automatic transmission.

Shortly before full throttle, the lever with cam (68) switches the mechanical switchover valve (64) to external venting. The vacuum on the EGR valve is completely vented and there is no more EGR.

Speed above approx. 73 ± 8 km/h

At a speed above approx. 73 ± 8 km/h the impulses transmitted from impulse transmitter on the speedometer are converted into a control signal. The current to the electric switchover valve (81) is interrupted. The EGR valve is switched to external venting, there is no more EGR.

Vacuum flow at an engine speed above 1300 rpm (automatic transmission)

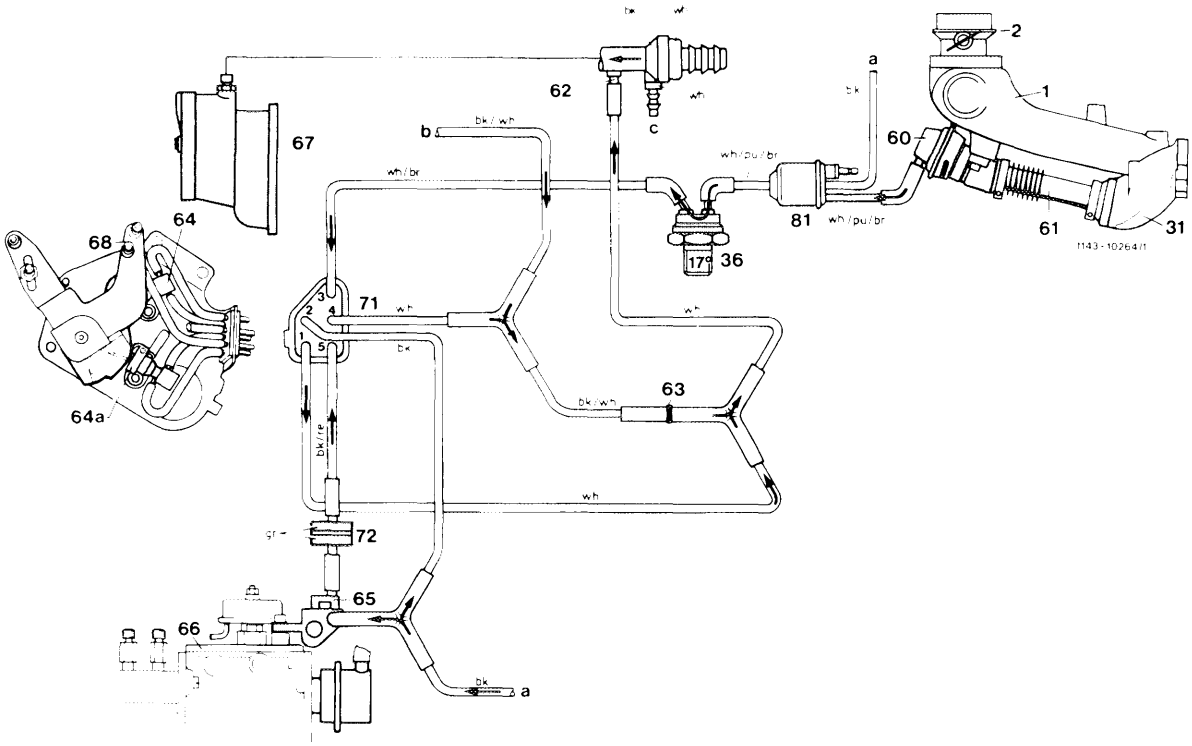


Fig. 26

1 Intake manifold
2 Throttle valve housing
31 Exhaust manifold
36 Thermo-vacuum valve 17 °C
60 EGR valve
61 Corrugated tube
62 Orifice
63 Orifice
64 Switchover valve, mechanical, EGR
64a Switchover valve, mechanical, automatic transmission
65 Vacuum control valve
66 Injection pump
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