

Exhaust gas recirculation system with air mass sensor

si 0017/A GB

replace si 0017
VHH 06.99

Vehicle: Audi / Ford / Seat / Skoda / VW

Type	Engine	Power (kW)	Engine-code	Model year
Diverse	1,9 SDI / 1,9 TDI	47 / 66 / 81	1Z/AEF/AEY/AFN/AGD/AGR AHF/AHU/ALE/ALH/ALU	06.93-

Product:	Pierburg-No.	Replacem.-No.	O.E.-No. *)
Air mass sensor (LMS)	7.18221.01.0	7.18221.51.0	074 906 461 / 95 VW12B529 BA
Electropneumatic pressure converter (EPW)	7.21903.20.0	7.21903.70.0	1H0 906 627 / 95 VW12B573 CA
Exhaust gas recirculation valve (EGRV)	Diverse, see si 0043 Example in Fig.: 7.21723.02.0/03.0/52.0	7.21723.53.0	028 131 501 E

1. Overview

Exhaust gas recirculation (EGR) is a way of reducing pollutants in the exhaust gas.

Due to high combustion temperatures and an air surplus, direct-injection generates more nitric oxygen (NO_x) than other diesel methods do.

The EGR system reduces the generation of NO_x considerably by adding exhaust gas to the fresh air delivered to the engine.

The exhaust gas recirculation rate, however, is limited due to a rise of HC and CO levels and soot particle emission.

An exhaust gas recirculation system works ideally only if it is controlled precisely.

2. Design

In the present case, an EGR system is used consisting of EGR valve, pressure converter and air mass sensor.

The system is controlled by the control unit according to a specific EGR map depending on air mass, engine speed, engine temperature and injection quantity.

3. System function

The air supplied to the engine flows through the air mass sensor. At the same time, a signal is created that is processed by the control unit, apart from other input signals.

Depending on the operating conditions, current is sent to the pressure converter (EPW) which sends vacuum to the diaphragm of the EGR valve. The valve opens and exhaust gas flows into the intake manifold. A vacuum pump driven by the engine generates the required vacuum.

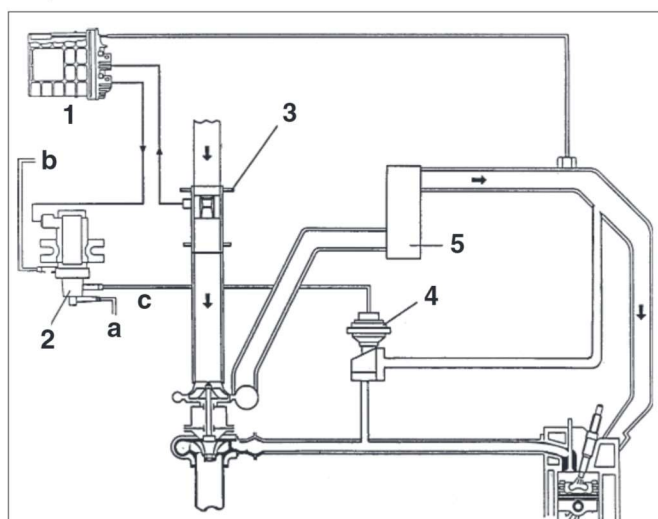


Fig. 1 Connecting plan TDi-engine

- | | |
|--------------------------|---|
| a - Vacuum | 2 - Electropneumatic pressure converter (EPW) |
| b - Atmospheric pressure | 3 - Air mass sensor (LMS) |
| c - Control pressure | 4 - EGR valve |
| 1 - Control unit | 5 - Intercooler |

*) The listed reference numbers should be listed for comparison only. They may not be used on invoices sent to final users.

Subject to change of illustrations and text.

For changes with regard to respective matching and replacements, refer to the catalogs, TECDOC-CD or systems basing on TECDOC-data, which are currently in effect.

4. Component function

4.1 Air mass sensor (LMS), fig. 2

The air mass sensor measures the air mass supplied to the engine with a high degree of precision.

The unit uses 2 resistors in the air flow. The resistor in the front area of the air flow is used to measure the temperature (temperature sensor). It measures the temperature of the passing air continuously. An electronic control system processes this value and controls the heating flow for the second resistor (hot film sensor) that is continuously heated.

The heat flow is metered so that a constant hot film temperature exists which is approximately 130°C above the air temperature.

The required heating power is the measure for the air mass flow quantity. The output signal is an electric voltage.

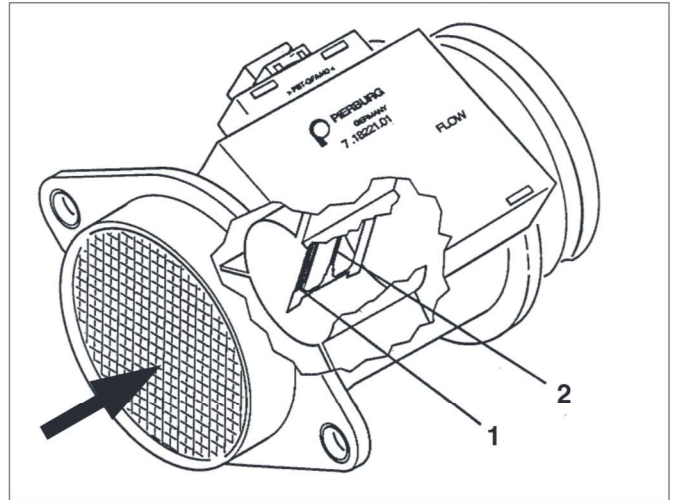


Fig. 2
1 - Temperature sensor
2 - Hot film sensor

4.2 Electropneumatic pressure converter (EPW), fig. 3

The pressure converter is used to form a mixed pressure (control pressure) from the vacuum and the atmospheric pressure.

The variable control pressure that is generated by the pressure converter permits to operate the EGR valve exactly according to the operating conditions.

The pressure converter is equipped with a dual seat valve which is controlled both by a diaphragm via vacuum and via a magnetic circuit with a rotor.

Without power, a pressure difference of approximately 30 mbar exists. Under full power, the pressure difference (control pressure) is so large that the EGR valve is fully open.

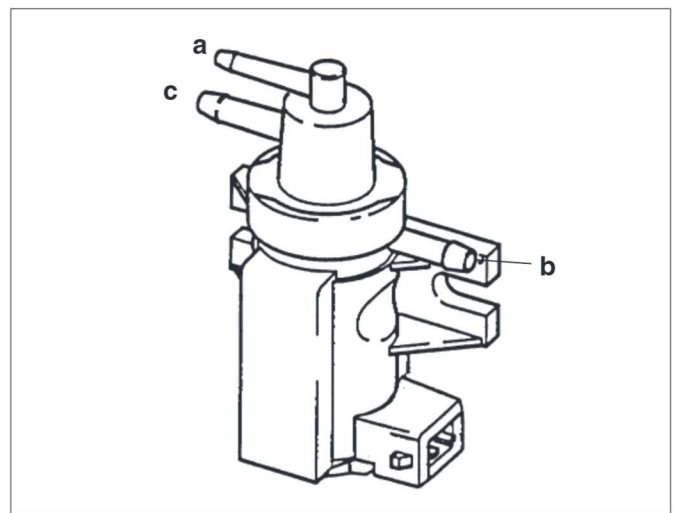


Fig. 3
a - Vacuum
b - Atmospheric pressure
c - Control pressure

4.3 Exhaust gas recirculation valve (EGR valve), fig. 4

(Further variants see Si 0043)

The EGR valve is located in a connecting passage between the exhaust gas manifold and the intake manifold.

When the valve is open, exhaust gas can flow into the intake manifold and from there to the engine.

The valve is equipped with a pusher that is controlled via a diaphragm that is exposed to vacuum.

When no vacuum exists, the valve is closed.

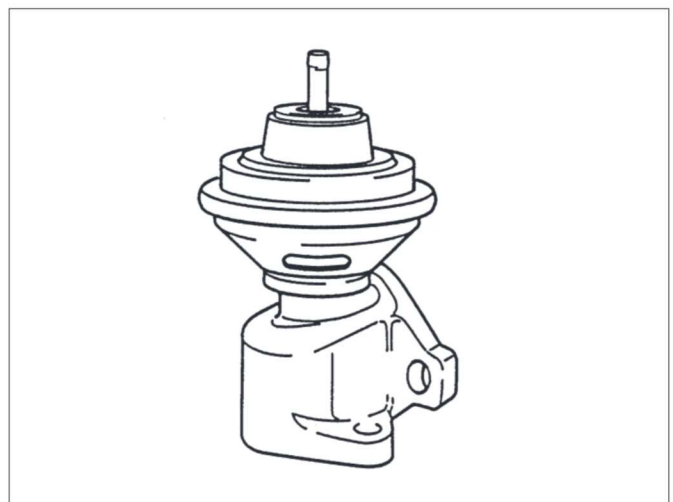


Fig. 4

5. Tests

5.1 Air mass sensor

Checking the voltage supply, fig. 5

- Remove connector from the air mass sensor.
- Switch the ignition on.
- Measure the voltage as follows:
Required: 3Ø vehicle mass = approx. battery voltage
3Ø 5 = approx. battery voltage
1Ø vehicle mass = approximately 5 V
1Ø 5 = approximately 5 V

- Switch the ignition off.

Function check

Preconditions:

EGR valve operates perfectly, see Chapter 5.3
Cutoff speed is reached (according to AU data)

Note: Use test cable
Pierburg No. 4.07360.42.0

- Insert test cable between LMS and cable connector for LMS
- Insert multimeter leads in test sockets of test cable (2 and 6 of the LMS) and read voltage values as follows:

Ignition switched on:

Required: 0.24 - 0.33 V

Engine at operating temperature and idling:

Required: 0.9 - 1.5 V

Increase speed (act on throttle) up to cutoff speed:

Required: Voltage rise to minimum 4.3 V

5.2 Electropneumatic pressure converter (EPW)

Check voltage supply, Fig. 7

Note: The connector polarity differs according to vehicle. The voltage supply is applied to contact 1 or 2.

- Remove connector from EPW
- Switch on ignition
- Measure voltage, e.g. for Audi, between contact 2 and engine ground.
Required: Battery voltage
- Switch off ignition

Check EPW resistance, Fig. 8

- Measure resistance according to Fig. 8
Required: 14 - 18 Ω
- Reconnect connector

Checking the function, fig. 8

- Connect manual vacuum pump according to fig. 8. It is used as a manometer. The other hose connections remain in place.
- Leave the engine idling and measure the pressure difference.

Required: min 480 mbar

- Remove connector from the EPW and measure the pressure difference.

Required: 0 - max. 60 mbar

- Reconnect the connector.

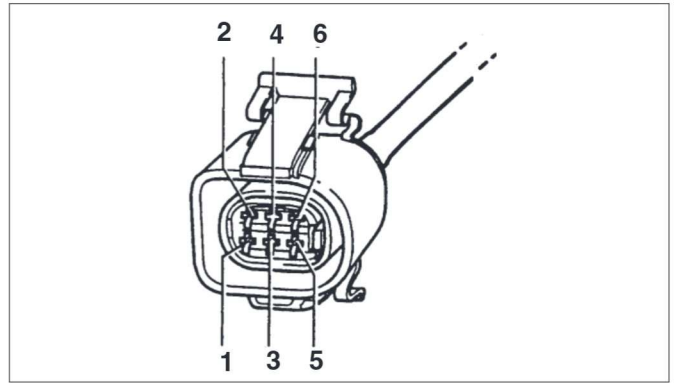


Fig. 5

Cable connector for air mass sensor

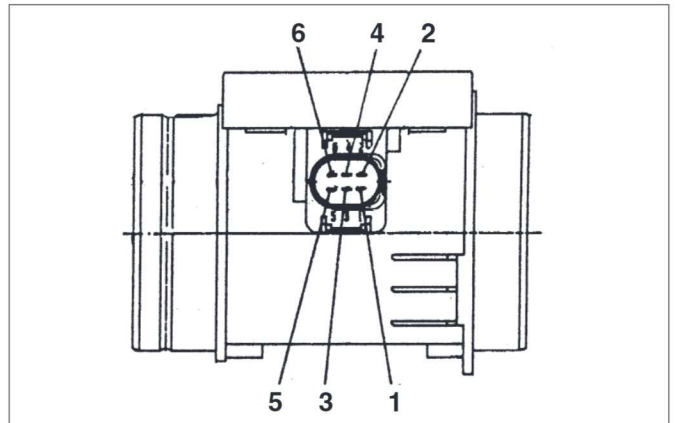


Fig. 6

Air mass sensor (LMS)

- | | |
|--------------------------------------|-------------------|
| 1 - Reference voltage | 4 - not used |
| 2 - Sensor mass | 5 - Ground |
| 3 - Supply voltage (battery voltage) | 6 - Output signal |

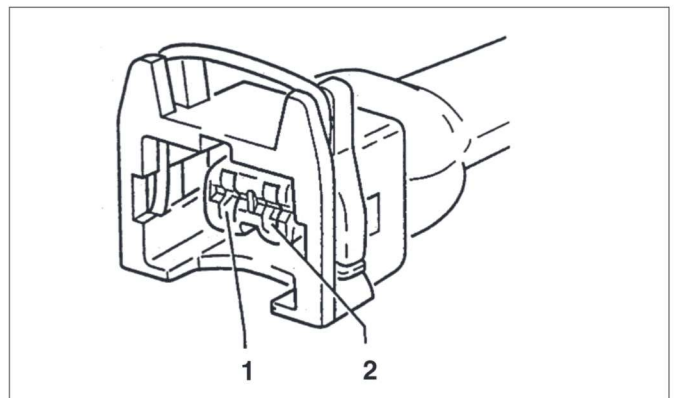


Fig. 7

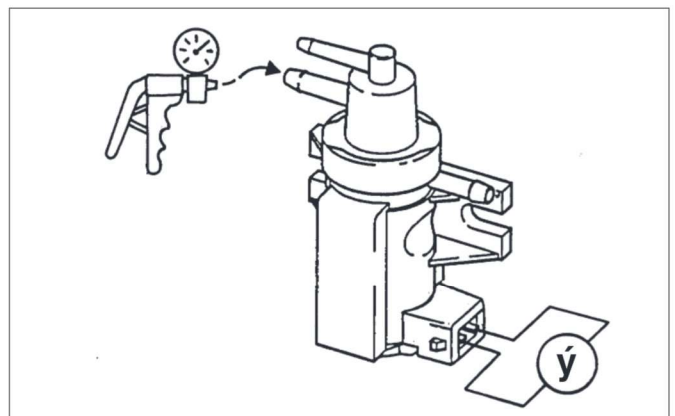


Fig. 8

(further variants, see si 0043)

(with engine switched off)

- Connect manual vacuum pump according to fig. 9 and create a pressure difference of approximately 300 mbar.

Required: The pressure difference should not drop

Note: A tightness test of the valve seat is only possible with the EGR valve removed.

- Connect manual vacuum pump according to fig. 9 and operate the pump; the valve should open, the pusher moves in the direction of the vacuum connection; this can be seen on the window (arrow, fig. 9) of the valve.
- Bleed the manual vacuum pump; the valve should close audibly.
- Reconnect the vacuum connection of the vehicle.

- Check for leakage.
- Check for correct connection.

- Manual vacuum pump, No.: 4.07370.01.0, or
- Manual pressure/vacuum pump,
No.: 4.07370.02.0 or 4.07370.07.0
- Test cable, No.: 4.07360.42.0

(see also si 0039)

- Engine does not start
- Engine does not stabilise
- Blue smoke after start
- Continuous black smoke
- Black smoke during acceleration
- Rough idling
- Does not accelerate at certain times
- Performance too low

									Possible causes	Remedies	Chapter
•	•	•	•	•	•	•	•	•	Exhaust gas recirculation	- Check EPW - Check EGR valve - Check vacuum hoses	5.2 5.3 5.4
								•	Air mass not detected reliably	- Check air mass sensor - Check air filter (dirt) - Check intake hose	5.1 - -
			•					•	Wrong air	- Check leakage on the pressure side between the turbocharger and the engine	-

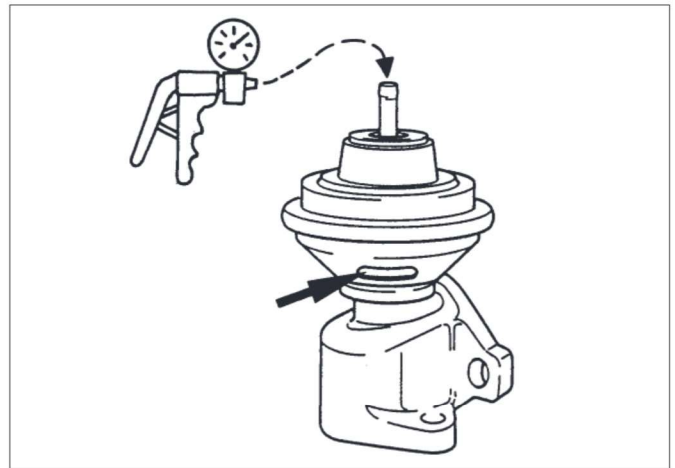


Fig. 9

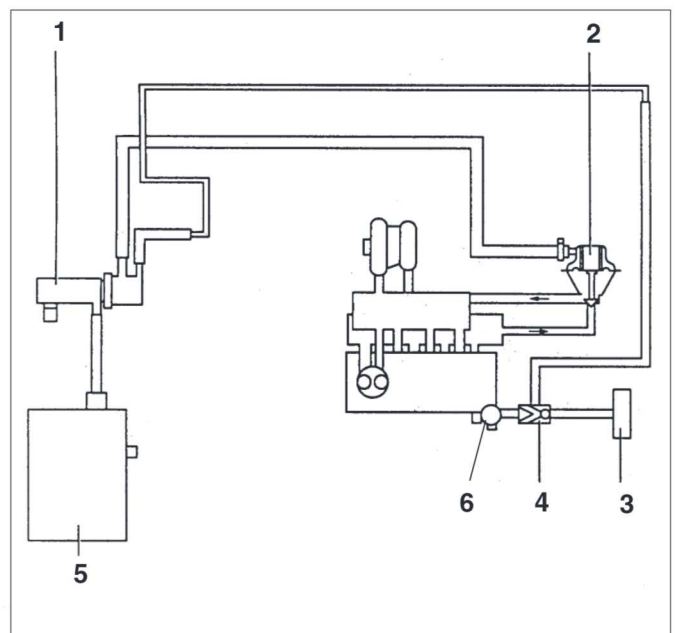


Fig. 10

- 1 - Electropneumatic pressure converter (EPW)
- 2 - EGR valve
- 3 - Brake booster
- 4 - Check valve
- 5 - Air filter
- 6 - Vacuum pump