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1/5

SERVICE INFORMATION

PRESSURE TRANSDUCER

PRODUCT SUMMARY

PRODUCT DESCRIPTION

Pressure transducers are used in large numbers for exhaust gas recirculation systems (EGR) and VTG-superchargers ("Variable Turbo Geometry", turbochargers with variable vanes). Their function is similar to that of a "Dimmer" in an electrical circuit: From a vacuum and atmospheric pressure a mixed pressure (control pressure) is formed in the Pressure transducer that can be infinitely varied via the pneumatic actuator ("vacuum cell").

Via a pressure transducer in conjunction with a pneumatic regulator, far higher forces can be exerted than possible in an electrical system with "dimmer" and actuator – and this with smaller sizes. The necessary vacuum is present in virtually all vehicles (e.g. from the intake pipe or a vacuum pump).



Fig. 1: Product view (type variants)

VARIANTS

The pressure transducers are dimensioned according to the particular application. The following can be varied depending on the requirements (Fig. 1):

- Type of position of electrical connection (connector variants, contacting)
- Position of pipe connections
- Method of attachment (bracket)
- Characteristic
- With / without temperature compensation
- Current or pulse controlled
- Dynamic (evacuation / vent time)
- With / without filter at vent connection (ATM)

All content including pictures and diagrams is subject to change. For assignment and replacement, refer to the current catalogues or systems based on TecAlliance.



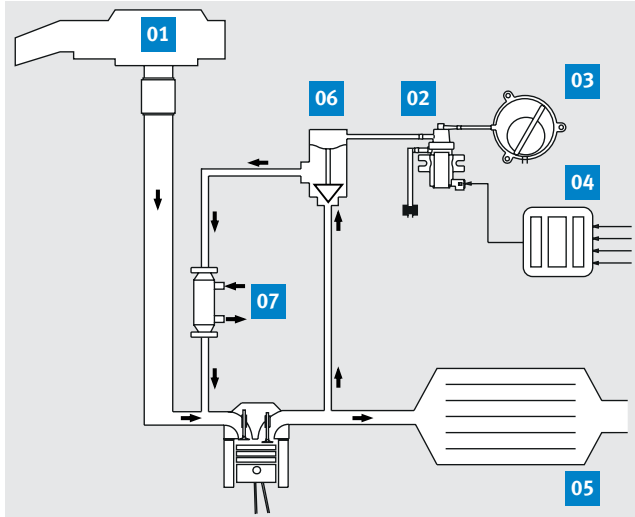
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2/5

APPLICATIONS

Exhaust gas recirculation (EGR)



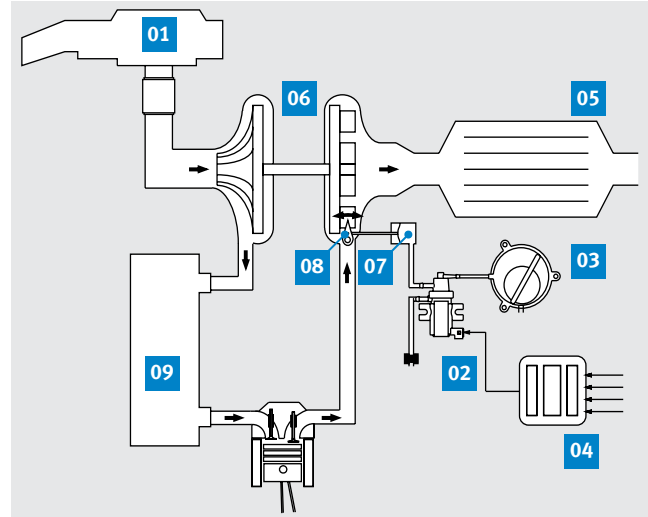
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|------------------------|---------------|
| 01 Air filter | 05 Catalyst |
| 02 Pressure transducer | 06 EGR valve |
| 03 Vacuum pump | 07 EGR cooler |
| 04 Engine control unit | |

Exhaust gas recirculation serves for the reduction of pollutants in the exhaust gas. The fresh air supplied to the engine is added to the exhaust gas. This reduces the oxygen content in the combustion chamber and in turn the combustion temperature. The lower combustion temperature reduces the emission of nitrogen oxides (NO_x).

An exhaust gas recirculation system only operates effectively when it is precisely controlled. EGR valves can be controlled either pneumatically or electrically, depending on the particular type. With pneumatic control, the necessary vacuum ("control pressure") modulation takes place via a pressure transducer.

The pressure transducer is controlled via a specific family of characteristics. The control pressure with which the EGR valve is operated is set depending on the signal mark-space ratio.

VTG-supercharger



- | | |
|------------------------|----------------------|
| 01 Air filter | 07 Vacuum cell |
| 02 Pressure transducer | 08 Variable vanes |
| 03 Vacuum pump | 09 Charge air cooler |
| 04 Engine control unit | |
| 05 Catalyst | |
| 06 VTG-supercharger | |

The achievable engine torque of a vehicle with internal combustion engine depends on the proportion of fresh gas in the cylinder charge.

Exhaust gas turbochargers utilise the energy in a turbine in order to increase the cylinder charge via a connected compressor. VTG-superchargers vary the required boost pressure by varying the turbine vanes. This variation must take place with precision.

The pressure transducer is controlled by the engine control unit via a specific family of characteristics. The control pressure with which the turbine vanes are varied via a vacuum cell is set depending on the signal mark-space ratio. This variable turbine geometry enables a particularly rapid response at low speeds and high efficiency in the upper speed range.



TYPICAL CHARACTERISTICS

Rated voltage	[V]	12
Operating voltage	[V]	10 - 16
Resistance	[Ω]	11 - 16
Inductivity	[mH]	40
Pulse duty factor	[%]	20 ... 95
Frequency	[Hz]	250 ... 300
Ambient temperature	[°C]	-30 - 120

BASIC DESIGN

The pressure transducer accordingly forms from the vacuum (e.g. produced by a vacuum pump) and the ambient pressure a mixed pressure ("control pressure").

With this control pressure

- the pneumatic EGR valve of the exhaust gas recirculation can be controlled or
- the vanes in the VTG-supercharger can be varied via a vacuum cell

For controlling the pressure transducer via the engine control unit, a control current is necessary. This is not a direct current however, but a current pulsed at a constant frequency ("pulse width modulation"). The pulse duration is termed "pulse duty factor". Depending on whether the current or the pulse duty factor acts as a reference variable for the control circuit, a pressure transducer is referred to as "current controlled" or "pulse duty factor controlled".

The magnetic force that operates the regulator reduces at high temperatures, as they occur in an operational vehicle. With the temperature-compensated pressure transducer, the magnetic force is maintained over a wide range independent of temperature. This makes sophisticated current control circuitry in the control unit unnecessary.

Control then only takes place via an appropriate pulse duty factor. The majority of employed pressure transducers are pulse duty factor controlled.

CONNECTIONS



Fig. 2: Connections

- 01** Vacuum supply (VAC)
- 02** Variable control pressure (OUT)
- 03** Vent connection (ATM)
- 04** Electrical connection



NOTE

The position of the connections can vary depending on the particular type.

FAULTS

A faulty pressure transducer is noticeable by:

EGR-system

- Change to an emergency condition
- Reduction in engine output
- EGR no longer ensured
- Vehicle shakes
- Black smoke

VTG-supercharger

- Reduction in engine output
- Low torque when accelerating from low speeds ("turbohole")

**TESTING****Pressure transducer and EOBD**

Pressure transducers are electrically monitored on vehicles with OBD systems.

Possible EOBD fault codes can be			
P0033	Boost pressure control valve - Circuit malfunction	P0245	Boost pressure control valve A - Signal too low
P0034	Boost pressure control valve - Signal too low	P0246	Boost pressure control valve A - Signal too high
P0035	Boost pressure control valve - Signal too high	P0247	Boost pressure control valve B - Circuit malfunction
P0234	Engine supercharging - Limit exceeded	P0248	Boost pressure control valve B - Range / malfunction
P0235	Engine supercharging - Limit not reached	P0249	Boost pressure control valve B - Signal too low
P0243	Boost pressure control valve A - Circuit malfunction	P0250	Boost pressure control valve B - Signal too high
P0244	Boost pressure control valve A - Range / malfunction		

Indirect monitoring of the Pressure transducer takes place by monitoring the function of the EGR valve			
P0400	Exhaust gas recirculation - Flow rate malfunction	P0405	EGR valve - Sensor A - Input signal too low
P0401	Exhaust gas recirculation - Insufficient flow rate detected	P0406	EGR valve - Sensor A - Input signal too high
P0402	Exhaust gas recirculation - Excessive flow rate detected	P0407	EGR valve - Sensor B - Input signal too low
P0403	Exhaust gas recirculation - Circuit malfunction	P0408	EGR valve - Sensor B - Input signal too high
P0404	Exhaust gas recirculation - Range / malfunction		

A faulty air flow sensor can supply the engine control unit with incorrect inputs signals, which then control the pressure transducer incorrectly			
P0100	Air flow sensor - Circuit malfunction	P0103	Air flow sensor - Input signal too high
P0101	Air flow sensor - Range / malfunction	P0104	Air flow sensor - Intermittent circuit interruptions
P0102	Air flow sensor - Input signal too low		

**ATTENTION**

- When the ignition is switched on, no connectors must be disconnected or connected. The voltage surges occurring as a result can damage the electronic components.
- Resistance measurements on the pressure transducer must only be carried out with the connector disconnected as internal control unit circuitry can be damaged.

When searching for the fault, attention should be paid to:

- Leaks in the hoses
- Poor contact at connectors
- Smooth operation of the actuators (pressure cell or EGR valve)
- Faultless function of the air flow sensors

**NOTE**

- Depending on the vehicle manufacturer and scan tool, the pressure transducers can be activated as part of actuator diagnostics. It is recommended to initially read out the fault memory according to the instructions of the diagnostic unit manufacturer.
- A pressure transducer activated through actuator diagnostics is controlled at intervals, so that it switches audibly or noticeably. When it switches audibly or noticeably, the voltage supply and the pressure transducer are electrically okay. Leaks or internal fouling is not detected.
- On completion of the test and possible replacement, the fault memory must be deleted. Electrical faults in the cable harness or in the pressure transducer itself are stored as faults in the majority of applications and must be located, in the same way as for mechanical faults, such as leaks, sticking of the valve, etc., using conventional test equipment.



Testing voltage supply

- Disconnect connector from pressure transducer.
- Switch on vehicle ignition.
- Measure the voltage between the contacts and engine ground (see Fig. 5).
One of the contacts must give a battery voltage reading.



NOTE

The connector polarity varies from vehicle to vehicle.
The supply voltage is present on contact 1 or 2.

- Switch off the ignition again.

Electrical resistance measurement on pressure transducer

- Measure the resistance between the contacts of the pressure transducer (see Fig. 6).
Required value: 11 - 18 Ω
- Reconnect the connector.

Functional test

- Connect pressure gauge / vacuum hand pump to connection (02) as shown in Fig. 2.
The other hose connections can remain as they are.
- Allow the engine to idle and measure the pressure.
Required value: Minimum 480 mbar
- Disconnect supply voltage connector from the pressure transducer and measure the pressure.
Required value: 0 - max. 60 mbar

Testing control signal

If necessary, the signal from the engine control unit to the pressure transducer can additionally be tested with an oscilloscope.
This is a mass-controlled square-wave signal.

- As the pin assignments of the connector on the pressure transducer vary, it must first be determined on which contact the supply voltage is present (see Fig. 5).
- The ground signal for the oscilloscope input can be tapped off from the other contact.
- Allow the engine to idle at operating temperature.
- On acting on the accelerator, the square-wave signal must change in width.

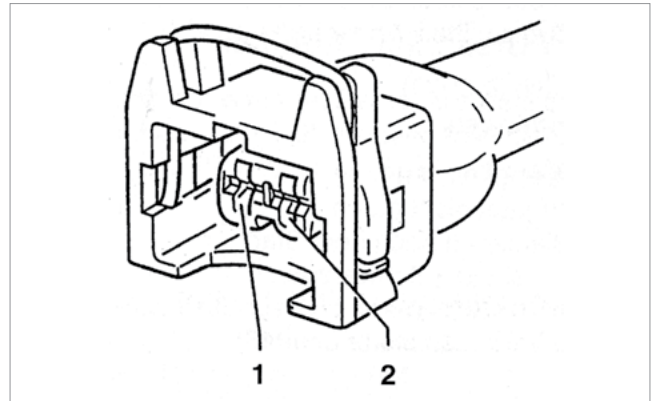


Fig. 5: Contact 1 or 2

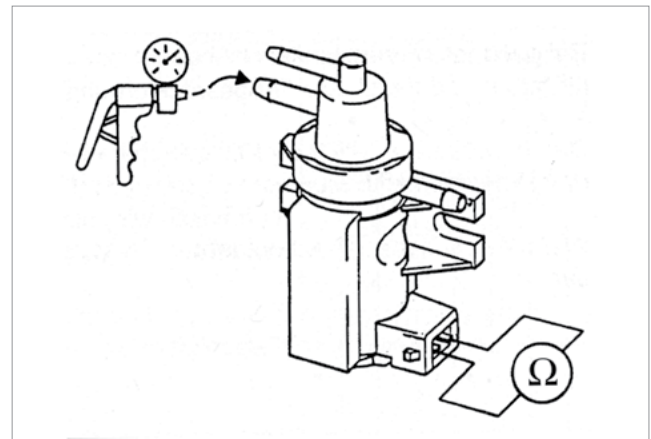


Fig. 6: Electrical resistance measurement on pressure transducer

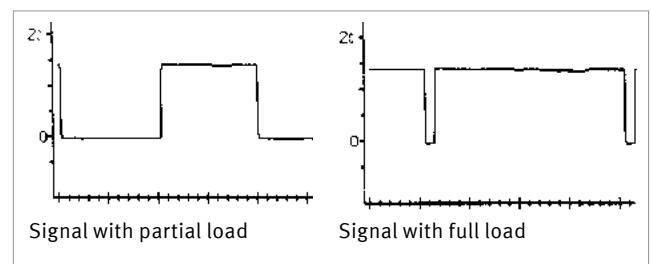


Fig. 7: Signal



Required equipment

- Multimeter
- Pressure gauge or Pierburg pressure / vacuum handpump 12 00001 11 900
- Oscilloscope if required