

EGR Troubleshooting basics

Exhaust gas recirculation (EGR) is a reliable and practice-proven method of emission control. As a result of exhaust gas, the oxygen content in the air-fuel mixture is reduced and the combustion temperature in the cylinders are lowered. Pierburg explains the basics of EGR systems and some basic troubleshooting.

Since harmful nitrogen oxides (NOx) are mainly produced at high temperatures and pressures, it is possible to reduce the NOx concentrates emitted to the environment by up to 50% by lowering air intake temperature. On diesel engines, the formation of soot particulates is lowered by approximately 10%.

Exhaust gas recirculation is only activated at defined operating points. On petrol engines this is normally the case above idle, up to upper partial loads. On diesel engines the EGR is active up to approximately 3000 rpm and medium load.

EGR Components

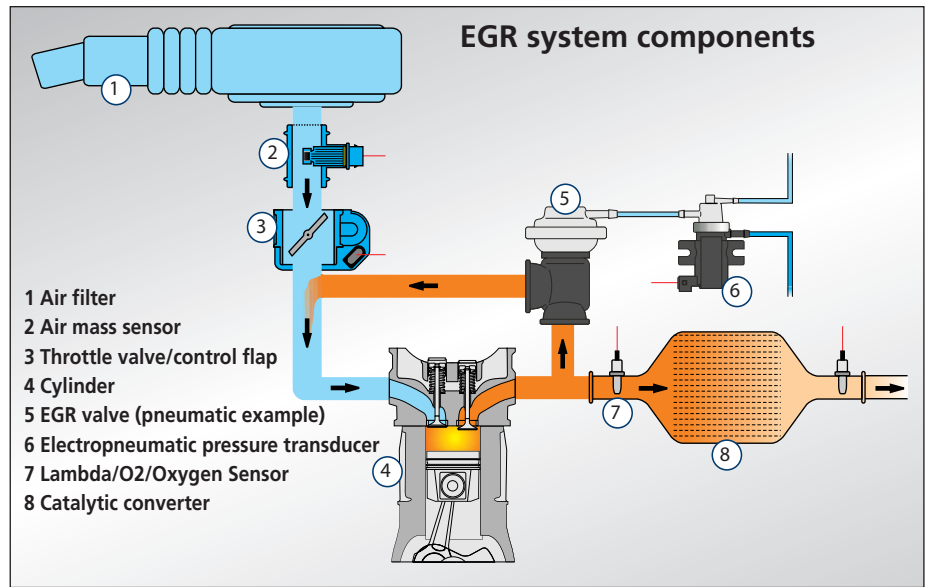
The EGR valve meters the amount of recirculated exhaust gas. It is added either at the exhaust manifold or at the intake air system, or it is located in a heat resistant exhaust-gas pipe, which connects the exhaust manifold to the intake air system.

Pneumatic EGR valves are actuated by way of vacuum via electromagnetic valves. On basic systems with an electric switchover valve, the EGR valve only has an open-close function. On systems provided with an electro-pneumatic pressure transducer (EPW), the EGR valve is infinitely adjustable. The vacuum is taken from the intake manifold or generated by a vacuum pump. Electric or electromotive EGR valves are actuated directly by the control unit and no longer need any vacuum or solenoid valve.

Tips for troubleshooting

The most common cause for malfunctions in the EGR system are stuck or carbonised EGR valves. Besides gaseous pollutants, recirculated exhaust gas also contains soot particulates, particularly in diesel vehicles. Due to oil in the intake air, carbon deposits or carbon fouling are caused, which foul the valve until it can no longer open, or it remains in its open position. This results in jerking, irregular idling or insufficient engine power.

The causes of a high portion of oil in the intake or charge air may be malfunctions in the crankcase ventilation, worn bearings, a clogged oil return line on the turbocharger,



worn valve stem seals or guides, the use of unsuitable engine oil qualities or an excessive engine oil level. Exceptionally intense deposits may also be caused by faults in the injection system.

Though EGR valves are designed for the high temperatures in the exhaust branch system, heat damage to the valve may occasionally occur. Such damage can be

caused by incorrect actuation, excessively high exhaust gas back pressure or a blow-off/waste gate valve of the turbocharger which does not open. There may even be some manipulation to increase the boost pressure.

vacuum controls (vacuum pump, vacuum lines or solenoid valves). Electric EGR valves and solenoid valves can mostly be actuated by way of an actuator diagnosis by the engine tester. The switching of a functioning valve can easily be heard when the engine is at a standstill.

Whenever a new EGR valve is installed, and the vehicle behaves as if the valve had not have been replaced at all, the map data required for operation must first be "re-learned". This is achieved either in the course of a longer test drive or by using a specific programme option in the engine tester, e.g. "Basic settings".

We strongly advise against cleaning EGR components. If a component is already defective, no improvement will be achieved by cleaning it. And if functioning components are treated in this way, they may be damaged as a

result of cleaning. A defective component should always be replaced by a new one.

See page 54 for a more detailed EGR troubleshooting guide



Diesel EGR valves have large cross-sections because of their high return rates. LtoR: Pneumatic, Pneumatic EGR valve with position detection and an Electric EGR double-seat valve

caused by incorrect actuation, excessively high exhaust gas back pressure or a blow-off/waste gate valve of the turbocharger which does not open. There may even be some manipulation to increase the boost pressure.

On pneumatic EGR valves, one potential cause of malfunctions can be found within the

EGR Troubleshooting Table

Continued from page 52.



Troubleshooting in exhaust gas recirculation system

Complaint	Potential causes	Remedies
Caused by EGR valve		
<ul style="list-style-type: none"> Irregular idling Jerking Insufficient engine power Limp-home operation MIL lights up/error code set Insufficient engine power in lower rpm range or in cold run (Petrol) Insufficient engine power in upper rpm range (diesel) 	<ul style="list-style-type: none"> General: Coked/stuck EGR valve <ul style="list-style-type: none"> Poor, inadequate combustion Engine management fault Frequent short-distance drives Leaks in vacuum system 	<ul style="list-style-type: none"> Check engine controls Check software update of engine control unit Avoid frequent short-distance drives Replace valve
	<ul style="list-style-type: none"> Defective solenoid valves Malfunctions in vacuum system 	<ul style="list-style-type: none"> Check function, electrical actuation and tightness of vacuum system See below: "Vacuum system"
	<ul style="list-style-type: none"> High oil content in intake or charge air: <ul style="list-style-type: none"> Malfunctions in crankcase ventilation Engine oil level too high Low-quality engine oil Worn valve stem seal or guides 	<ul style="list-style-type: none"> Check oil separator, engine exhaust valve Check pistons, piston rings, cylinders, valve stem seals and/or guides for wear Check turbochargers for clogged oil return line Change of oil and oil filter replacement (by professional)
	<ul style="list-style-type: none"> Air mass sensor signal/other sensor signal defective 	<ul style="list-style-type: none"> Check sensors for set-point values, replace if necessary
<ul style="list-style-type: none"> P0401 "Flow rate too low" P0103 "Air mass too high" 	<ul style="list-style-type: none"> EGR valve does not open or is not actuated EGR system has been blanked/defeated 	<ul style="list-style-type: none"> Check connectors and actuation
<ul style="list-style-type: none"> P0402 "Flow rate too high" P0102 "Air mass too low" 	<ul style="list-style-type: none"> EGR valve does not close/remains permanently open Uncontrolled, permanent exhaust gas recirculation 	<ul style="list-style-type: none"> Replace EGR valve Check connectors and actuation
<ul style="list-style-type: none"> EGR valve has temperature damage, visible discolouration, initial fusing (Petrol) 	<ul style="list-style-type: none"> Incorrect actuation Exhaust gas back pressure too high Blow-off valve of turbocharger does not open 	<ul style="list-style-type: none"> Replace EGR valve Check actuator of EGR valve Check exhaust gas back pressure Check blow-off valve of turbocharger ("waste-gate") and its actuation
<ul style="list-style-type: none"> New EGR valve, inoperative High idling after installation 	<ul style="list-style-type: none"> New EGR valve has not been adapted 	<ul style="list-style-type: none"> Conduct a basic setting of EGR valve using the engine tester
Caused by vacuum system/solenoid valves		
<ul style="list-style-type: none"> Engine "chattering" Engine misfires Limp-home operation Decreasing braking performance 	<ul style="list-style-type: none"> Defective hoses (porous, damaged by rodent bites) Leaking connectors on pneumatic valves Leaking non-return valves/vacuum reservoir Defective/porous diaphragms or seals on pneumatic actuators Leaks in intake manifold 	<ul style="list-style-type: none"> In the event of damage, check the tightness of all components in the vacuum system and replace defective part(s)
Caused by air mass sensor		
<ul style="list-style-type: none"> P0401 "Flow rate too low" Black smoke Inadequate engine performance Limp-home operation 	<ul style="list-style-type: none"> Air mass sensor damaged/dirty due to <ul style="list-style-type: none"> Dirt particles in intake air Leaks in intake air system, splash water Contamination during air filter replacement Clogged air filters Oil-moistened sports air filters 	<ul style="list-style-type: none"> Avoid any intake of water and particles into intake air system
	<ul style="list-style-type: none"> Damage to turbocharger 	<ul style="list-style-type: none"> Check turbocharger

EGR = Exhaust gas recirculation; MIL = Malfunction Indicator Lamp