157 Firewall catalytic converter
157/1 Catalytic converter insert

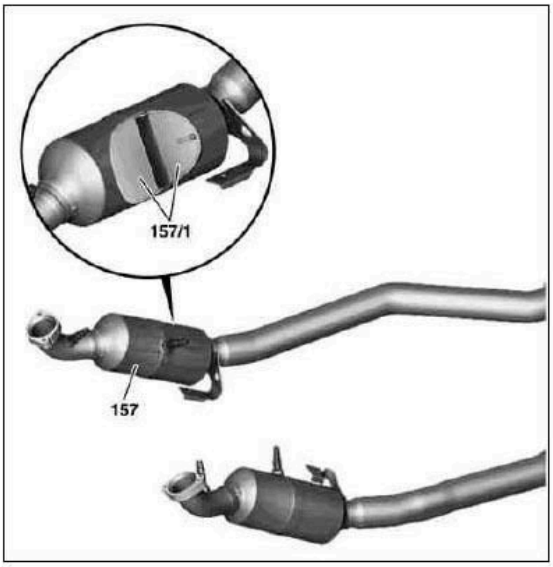


Fig. 11: Identifying Firewall Catalytic Converter And Catalytic Converter Insert
Courtesy of MERCEDES-BENZ USA

Two types of catalytic converter inserts are used respectively in near-engine mounted firewall catalytic converters.

Task

Reducing the exhaust gas emissions:

- Nitrogen oxides (NO_X)
- Hydrocarbon (HC)
- Carbon monoxide (CO)

Body (schematic)

1 Ceramic monolith
2 Wire mesh (embedded)
3 Double-walled housing (insulation)
4 Substrate (washcoat) with a coating of platinum and rhodium

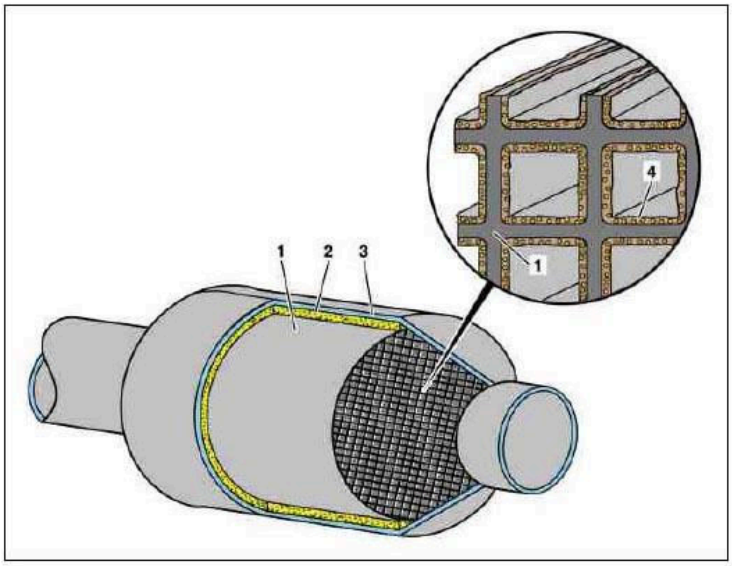


Fig. 12: Three-Way Catalytic Converter Body (Schematic)
Courtesy of MERCEDES-BENZ USA

There are two ceramic monoliths (ceramic body) in each firewall catalytic converter which are penetrated by 600 channels each. The exhaust gas flows through these passages. The ceramic consists of high temperature-resistant magnesium aluminum silicate.

The monolith, which is extremely sensitive to voltages, is embedded in an elastic wire mesh made of high-alloy steel wires and fitted in a double-walled stainless steel housing.

Ceramic monoliths require a substrate (washcoat) of aluminum oxide ($Al_2 O_3$) that increases the active surface of the catalytic converter by an approximate factor of 7000.

The active catalytic layer coated on the substrate is available in three-way catalysts primarily out of platinum and rhodium. Platinum accelerates oxidation of hydrocarbons (HC) and carbon monoxide (CO), whereas rhodium accelerates the reduction of nitrogen oxide (NO_x).

The O_2 sensors on the left or right downstream of TWC (G3/5, G3/6) are located on the side on the firewall catalytic converters and jut into the space between both monoliths.

Function (schematic)

A	Unpurified exhaust
B	Purified exhaust
F	Rich mixture
M	Lean mixture
λ	Lambda (air/fuel ratio)
CO	Carbon monoxide
CO_2	Carbon dioxide
HC	Hydrocarbon
H_2O	Water
N_2	nitrogen
NO_X	Nitrogen oxides

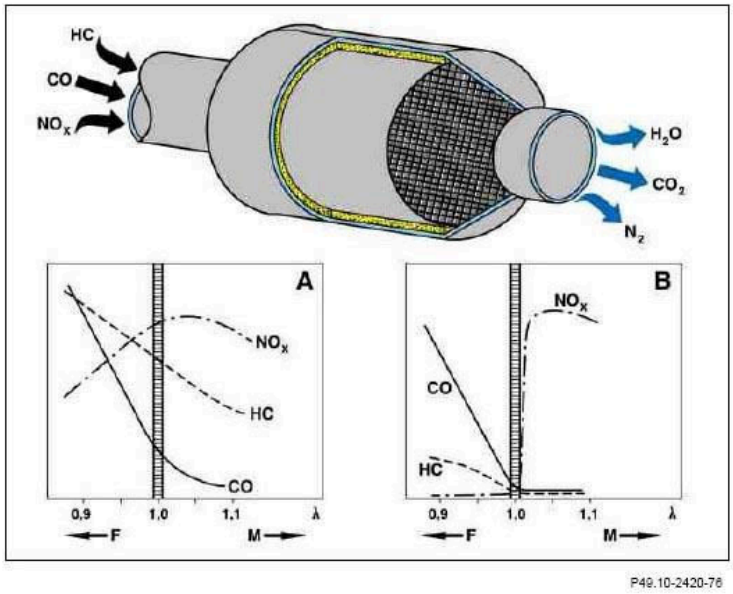


Fig. 13: Three-Way Catalytic Converter Function (Schematic)
Courtesy of MERCEDES-BENZ USA

Exhaust gases flow through the three way catalytic converter and hence come into contact with the rare metals, platinum and rhodium.

- Through oxidation, carbon monoxide (CO) is converted into carbon dioxide (CO_2) and hydrocarbons (HC) into water (H_2O) + carbon dioxide (CO_2).
- Through reduction, nitrogen oxides (NO_x) are converted into nitrogen (N_2) + carbon dioxide (CO_2).

The remaining oxygen content in the exhaust is a crucial factor in the conversion of pollutants. The best pollutant conversion is obtained at gamma=1.

Operating conditions

As is the case for the O_2 sensor, the operating temperature also plays a very important role in the case of the catalytic converter. Appreciable conversion of the pollutants does not commence until an operating temperature of approx. 250°C.

Ideal operating conditions for high conversion rates and a long life prevail at temperatures between around 450 to 800°C.

The temperature of the three way catalytic converter can increase beyond 1400°C due to malfunctioning of the engine such as misfiring etc. These high temperatures can lead to destruction of the catalytic converter, by melting the ceramic monoliths.

Another requirement for reliable long-term operation is that only unleaded fuel be used. Lead compounds form a deposit on the active surface and as a result prevent the exhaust gases from coming into contact with the

catalytic layer.

Owing to its property of being able to reduce three polluting components simultaneously, it is called a three-way catalytic converter.

THREE-WAY CATALYST - DESCRIPTION OF COMPONENTS - GF49.10-P-2010BK

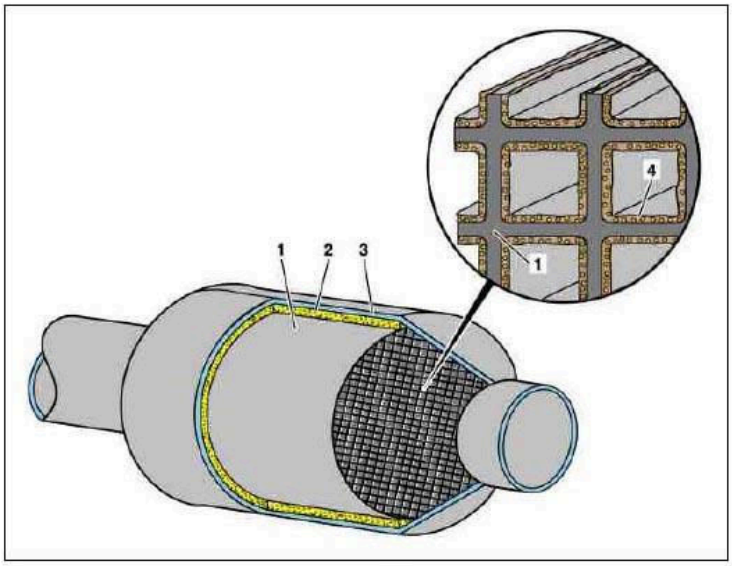
ENGINE 113.967 in MODEL 219

ENGINE 113.964 in MODEL 164.1 up to Model Year 8

ENGINE 113.971 in MODEL 251 up to Model Year 8

Catalytic converter design (schematic)

1 ceramic monolith
2 Wire mesh (embedded)
3 Double-walled housing (insulation)
4 Substrate (washcoat) with a coating of platinum and rhodium



P49.10-2419-76

Fig. 14: Catalytic Converter Design (Schematic)
Courtesy of MERCEDES-BENZ USA

Location

A catalytic convertor is located in the front part of the exhaust system for each cylinder bank, model 219 also has an underfloor catalytic convertor.

Ceramic monoliths are ceramic bodies through which pass several thousand small passages. The exhaust gas flows through these passages. The ceramic consists of high temperature-resistant magnesium aluminum silicate.

The monolith, which is extremely sensitive to voltages, is embedded in an elastic wire mesh made of high-alloy steel wires and fitted in a double-walled stainless steel housing.

Ceramic monoliths require a substrate (washcoat) of aluminum oxide ($Al_2 O_3$) that expands the active surface of the catalytic converter by an approximate factor of 7000.

The active catalytic layer coated on the substrate is available in three-way catalysts primarily out of platinum and rhodium. Platinum accelerates the oxidation of hydrocarbons (HC) and carbon monoxide (CO), whereas rhodium accelerates the reduction of nitrogen oxide (NO_x).

The stainless steel content in a three way catalytic converter is approximately 3 g.

A	Unpurified exhaust
B	Cleaned exhaust gas
F	Rich mixture
M	Lean mixture
λ	Lambda (air/fuel ratio)

CO	Carbon monoxide
CO_2	Carbon dioxide
H_2O	Water
HC	Hydrocarbon
N_2	nitrogen
NO_X	Nitrogen oxides

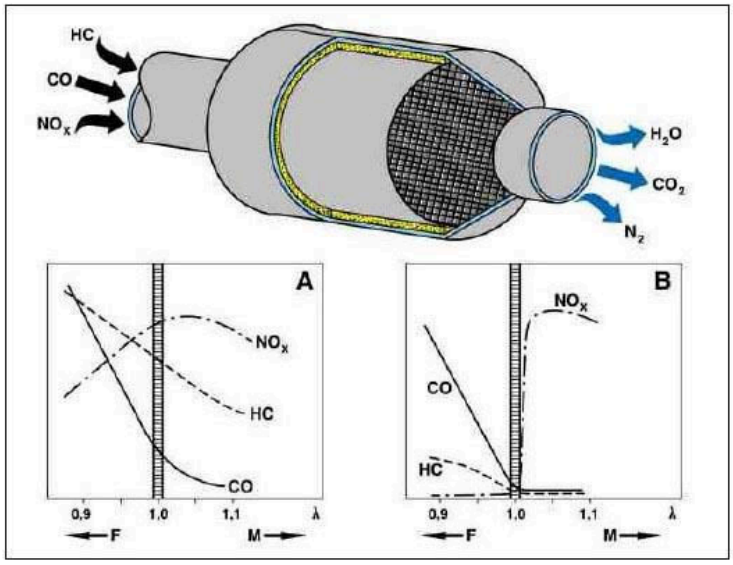


Fig. 15: Three-Way Catalyst Function Diagram
Courtesy of MERCEDES-BENZ USA

Exhaust gas components:

Function

The exhaust gases flow through the three way catalytic converter and hence come into contact with the rare metals, platinum and rhodium.

- Due to oxidation, carbon monoxide (CO) is converted into carbon dioxide (CO_2) and hydrocarbons (HC) into water ($H_2 O$) + carbon dioxide (CO_2).
- Due to reduction, nitrogen oxides (NO x) are converted into nitrogen (N_2) + carbon dioxide (CO_2).

The critical factors for the conversion of the pollutants is the residual oxygen content in the exhaust. It is determined through lambda control and maintained at lambda=1 in normal operation.

Operating conditions

As is the case for the O_2 sensor, the operating temperature also plays a very important role in the case of the catalytic converter. Appreciable conversion of the pollutants does not commence until an operating temperature of approx. 250°C.

Ideal operating conditions for high conversion rates and a long life prevail at temperatures between around 400 to 800°C.

The temperature of the three way catalytic converter can increase beyond 1400°C due to a malfunctioning of the engine such as misfiring etc. Such temperatures destroy the catalytic converter by melting the ceramic monolith.

Another requirement for reliable long-term operation is that only unleaded fuel be used. Lead compounds form a deposit on the active surface and as a result prevent the exhaust gases from coming into contact with the catalytic layer.

Owing to its property of simultaneously reducing three pollutant components, it is called a "three-way catalyst".

CATALYTIC CONVERTER EFFICIENCY MONITORING FUNCTION - GF49.10-P-3033AMG

ENGINE 156.980 in MODEL 164, 251

ENGINE 156.982 in MODEL 209

ENGINE 156.983 in MODEL 211, 219

ENGINE 156.984 in MODEL 216, 221

1	Amplitude O_2 sensor signal upstream of TWC
2	Amplitude O_2 sensor signal downstream of TWC
157	Firewall catalytic converter
A1	Instrument cluster
A1e26	CHECK ENGINE indicator lamp (for USA model 164, 209, 211, 219, 251)
A1e58	Engine diagnosis indicator lamp (except USA model 164, 209, 211, 219, 251)
A1e58	Engine diagnosis indicator lamp (for model 216, 221)
G3/3	Left O_2 sensor upstream of TWC
G3/4	Right O_2 sensor upstream of TWC
G3/5	Left O_2 sensor downstream of TWC
G3/6	Right O_2 sensor downstream of TWC
N3/10	ME control unit
X11/4	Data link connector
CAN	Data bus (Controller Area Network)

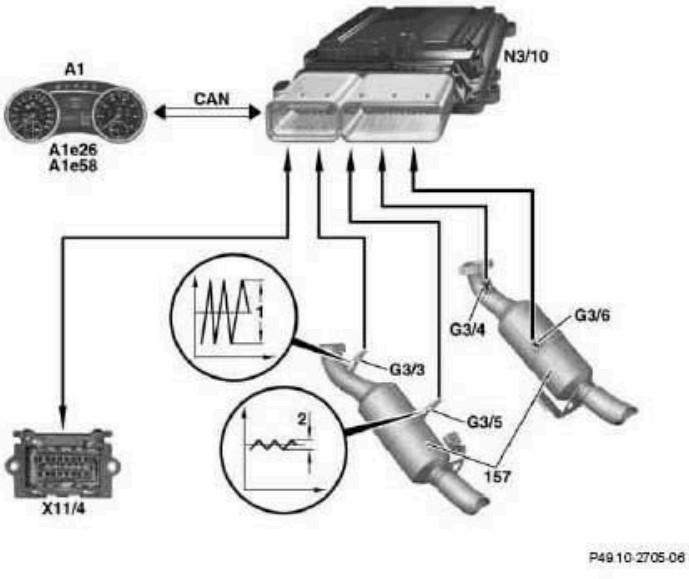


Fig. 16: Identifying Catalytic Converter Efficiency Monitoring Function Diagram

By law, HC emissions must not go above certain limits. The task of monitoring catalytic converter effectiveness to obtain insights from the oxygen storage capacity of catalytic converters about their aging and therefore their HC conversion. The oxygen stored during the "lean phase" is then reduced totally or partially during the "rich phase". Aging leads to reduction in the storage capacity of catalytic converters whereby the HC conversion is removed.

When the firewall catalytic converter is operationally warm and lambda control enabled, the amplitude sizes of the O_2 sensor signals downstream and upstream of the firewall catalytic converters are compared. Changes in the oxygen content downstream of the firewall catalytic converters are almost completely dampened by the high oxygen storage capacity of the firewall catalytic converters.

This results in the O_2 sensor signal downstream of the firewall catalytic converters being virtually constant with a small amplitude. If the firewall catalytic converter is no longer operational, the O_2 sensor signal upstream and downstream of the firewall catalytic converters will be equal.

Wideband oxygen sensors are installed upstream of the firewall catalytic converter which can exactly measure the mixture composition. Downstream of the firewall catalytic converters or after the first catalytic converter inserts (for model 164, 216, 221, 251) there are voltage-jump oxygen sensors with which at 450 mV a sensor voltage lambda=1 is recognized.

During the first stage, the oxygen stored when the mixture is rich (lambda =0.95) is reduced until the sensor voltages downstream of the TWC are >650 mV.

In the next operation step, a lean mixture (lambda=1.05) is set and the system waits until sensor voltages downstream of the TWC are <200 mV.

If the times so measured are under a stored characteristic the oxygen storage capacity is inadequate and the firewall catalytic converters must be replaced.

If a fault is detected, the engine diagnosis indicator lamp or CHECK-ENGINE in the instrument cluster lights up. The stored faults can be read out and deleted with STAR DIAGNOSIS.

	Component description for O_2 sensors	G3/3, G3/4	O_2 sensors upstream of TWC	**GF07.04-P-6100AMG**
		G3/5, G3/6	O_2 sensors downstream of TWC	**GF07.04-P-6100AMH**
	Component description for the ME-SFI [ME] control unit	N3/10		**GF07.61-P-6000AMG**
	Component description for the three-way catalytic converter	157, 158		**GF49.10-P-2010AMG**
	Component description for the engine diagnosis indicator lamp	A1e58	for model 164, 209, 211, 216, 219, 221, 251 and model 216, 221 with code 494, USA version	**GF54.30-P-5010AMG**
	Component description for the "CHECK ENGINE" indicator	A1e26	except model 216, 221 for code 494 USA version	**GF54.30-P-5011AMG**

lamp		

MONITORING CATALYTIC CONVERTER EFFICIENCY, FUNCTION - GF49.10-P-3033BK

ENGINES 113.967 in MODEL 219

ENGINES 113.964 in MODEL 164.1 up to Model Year 08/Modification Year 07

ENGINES 113.971 in MODEL 251 up to Model Year 08/Modification Year 07

Shown on model 219

157	*Firewall catalytic converter*
158	*Underfloor catalytic converter*
A1e58	*Engine diagnosis indicator lamp (USA Indicator lamp CHECK ENGINE)*
G3/3	*Left O_2 sensor upstream of TWC*
G3/4	*Right O_2 sensor upstream of TWC*
G3/5	*Left O_2 sensor downstream of TWC*
G3/6	*Right O_2 sensor downstream of TWC*
N3/10	*ME-SFI [ME] control unit*
X11/4	*Data link connector*
CAN	*Data bus*

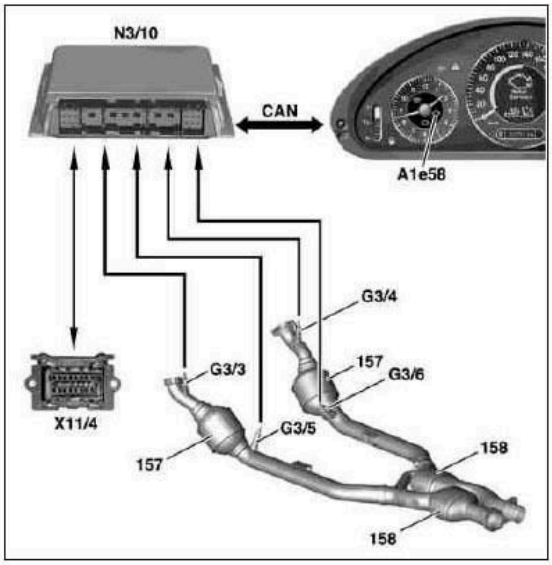


Fig. 17: Monitoring Catalytic Converter Efficiency Function Diagram
Courtesy of MERCEDES-BENZ USA

Each firewall catalytic converter is evaluated via its oxygen storage capability. A property of catalytic converters is that they are able to store oxygen. The oxygen stored during the lean phase is then reduced totally or partially during the rich phases. Aging reduces the ability of catalytic converters to store oxygen. It also reduces the ability to convert HCs.

By law, HC emissions must not go above certain limits. The task of the catalytic converter monitoring is to evaluate aging through the ability to store oxygen and therefore to convert hydrocarbons.

On catalytic converters at operating temperature and with enabled lambda control the O_2 sensor signals downstream of catalytic converter are compared with the O_2 sensor signals upstream of catalytic converter. The amplitude of the O_2 sensor voltage downstream of catalytic converter must the smaller than the amplitude of the O_2 sensor voltage upstream of catalytic converter

NOTE: (If no monolith were installed in the catalytic converter for example, the O2 sensor signals upstream or downstream of catalytic converter would be identical).

Several measurements must be performed in the specified engine speed and load range. The results are compared with a performance map from the ME control unit and detected faults placed in the fault memory.

If a fault is detected, the engine diagnosis indicator lamp or the "CHECK ENGINE" indicator lamp is lit on the instrument cluster.

The stored faults can be read out and erased with the STAR DIAGNOSIS.

	Component description for O_2 sensors		**GF07.04-P-6100BK**
	ME-SFI [ME] control unit, component description		**GF07.61-P-6000BK**
	Three-way catalytic converter, component description		**GF49.10-P-2010BK**
	Component description for the engine diagnosis indicator lamp	Except	**GF54.30-P-5010BK**
	Component description for the "CHECK ENGINE" indicator lamp		**GF54.30-P-5011BK**

MISCELLANEOUS NOTES

NOTES ON DISPOSING OF CATALYTIC CONVERTERS - OS49.10-P-1000-01A

ENGINE all with CODE (620) Vehicles with catalytic converters

Catalytic converters must not be disposed of as regular scrap. The catalytic converter contains valuable rare metals, which can be recycled in the production process.

Since 2.1.1989, DaimlerChrysler has offered a return facility with a refund payment for old catalytic converters.

Catalytic converters have been included in the exchange price list (valid as of 2.1.1989) and provided with the footnote "Order new parts - delivery of exchange parts not possible".

Details about returns addresses and final change prices can be taken from "Information about parts and accessories".

SPECIAL TOOLS

SPECIAL TOOLS: PASSENGER CARS: EXHAUST SYSTEM - WS49.00-Z-9999AZ

MODEL all

	000 589 52 43 00 Resetting device	FG 49/Set B	WS49.00-P-0004B
	103 589 01 39 00 Caulking bolt	FG 14/49/Set B	**WS14.00-P-0001B**
	211 589 04 63 00 Assembly device	FG 49/Set B	WS49.00-P-0002B
	642 589 01 63 00 Assembly tool	FG 49/Set B	WS49.00-P-0005B
	651 589 06 63 00 Assembly tool	FG 49/Set B	WS49.00-P-0006B