

ENGINE 457.9, 541.9, 542.9, 900.9, 902.9, 924.9, 926.9

Introduction

What is understood by OBD NOx control?

OBD NOx control is the technical implementation of EC directive 2005/55/EC.

It is based on on-board diagnosis (OBD) which has been specified for years for almost all vehicles

OBD NOx control includes all the functionalities of OBD and primarily serves the monitoring and diagnosis of all systems influencing the exhaust gas.

As an innovation OBD NOx control monitors the adherence to the nitrogen oxide (NOx) limits specified by the legislator.

Apart from the OBD-software and the Malfunction Indicator Lamp (MIL) familiar from it, OBD NOx control also has a NOx sensor integrated in the muffler and a function for limiting the torque stored in the engine control (MR) control unit.

In series production the EC guideline is met by controlling the code (KE8) OBD NOx control .

How and when does OBD NOx control draw attention to malfunctions or faults?

As in the case of OBD, faults occurring in the case of OBD NOx control are displayed via the MIL lamp and stored in the fault memory. In the event of serious faults the OBD NOx control can however also limit the torque.

Warning messages are also shown in the driver information display, if for example the AdBlue tank was empty or inferior AdBlue was refueled, faults exist in the AdBlue fuel metering system, the NOx sensor is defective electrically or the NOx output exceeds 7 g/kWh.

If the OBD NOx limit value specified by law (on Euro 4: 3.5 g/kWh, on Euro 5: 2 g/kWh) is exceeded by more than 1.5 g/kWh, this is displayed by the yellow flashing MIL lamp.

Torque reduction is activated when the Ad-Blue tank is empty and the nitrogen oxide emissions are >7 g/kWh.

How can faults be reset?

In the event of problems in the SCR (Selective Catalytic Reduction)-In the exhaust aftertreatment system fault codes are stored in the engine control (MR) control unit, for which guided troubleshooting is stored in the STAR DIAGNOSIS.

The functions and their resultant fault codes which can only be monitored under particular operating conditions, can only be reset after the repair without a long test drive by means of STAR DIAGNOSIS and FDOK [vehicle documentation system] analog to the process "Teach-in code".

A direct erasure of these faults is not permitted by the engine control (MR) control unit as without a repair being carried out erasure is prohibited by the EC directive.

Under which boundary conditions must OBD NOx control be active?

OBD NOx control must be active:

1. At ambient temperatures between -7 °C and +35 °C
2. In all altitudes below 1600 m
3. At engine coolant temperatures above 70 °C

The AdBlue fill level must be monitored at all times, for the OBD NOx control is also active when the AdBlue tank is empty. The NOx sensor is activated as of a catalytic converter temperature above approx. 200 °C. This ensures that the heated sensor element is not damaged by condensation water.

The BlueTec system functions in a temperature range between -40 °C and +70 °C. This means the legally specified exhaust emissions standards are always met.

For which vehicles is OBD NOx control obligatory?

OBD NOx control is obligatory for all vehicles over 3.5 t. In the case of Mercedes-Benz Trucks therefore for all Actros, Axor and Atego. Vehicles with special entitlement because they are in public service (army, police, fire brigade, rescue service, catastrophe avoidance, customs etc.) are likewise equipped with OBD NOx control - but without active torque limiter.

When will OBD NOx control become obligatory?

As of 1.10.2007 all newly registered vehicles in the scope of the EU must be equipped with OBD NOx control. The EU commission permits national transition regulations for vehicles without OBD NOx control analog to the Euro 3/4 transition. For Germany this means that all vehicles with production date up to 30.06.2007 without restrictions can also be registered after 01.10.2007 without OBD NOx control. For vehicles with build date between 01.07.2007 and 30.09.2007 the transition regulation permits a quota of 30 % of the annual production (basis of annual quantity, Euro 4/5). These vehicles may still also be registered after 01.10.2007 without OBD NOx control.

Does the OBD NOx directive only apply to vehicles with SCR (Selective Catalytic Reduction) technology or also to vehicles with AGR (exhaust gas recirculation) technology?

OBD NOx control is specified both for vehicles with SCR and for vehicles with AGR technology.

What is the function of the torque limiter?

The torque limiter ensures that the maximum torque is reduced when the OBD NOx threshold value of 7 g/kWh is exceeded. This ensures a rapid repair of the exhaust aftertreatment system. Furthermore the system should be protected against manipulation, like for example, driving without AdBlue, removal of the reduction catalytic converter, the removal of the NOx sensor etc.

When is the torque limiter active?

In general torque limitation is never active while driving but only after the vehicle has reached a standstill (v=0 km/h). Depending on the cause the activation of torque limitation can last for different periods of time:

1. Empty AdBlue tank: If the MR control unit detects an empty AdBlue tank the torque is reduced after the next time the engine is started, provided no AdBlue has been refueled.
2. Nitrogen oxide exceeding 7 g/kWh: A monitoring function runs in the background while driving. If over a longer period of time which can cover several journeys depending on the driving profile, exceeding the emission threshold of 7 g/kWh is detected, the driver receives a message "exhaust emissions standard" or "emissions stage 2" exceeded.

When is the torque limiter deactivated?

After eliminating the cause for torque limitation the self-repair or deactivation lasts for a different length of time.

Cause 1: Empty AdBlue tank

If a full AdBlue tank is detected after the engine has started, the fault readout display disappears and the flashing MIL lamp goes out. The torque reduction and the associated warning is deactivated once the engine has reached idle speed for the first time.

Cause 2: Nitrogen oxide exceeding 7 g/kWh

If the system detects that the emission limits are no longer exceeded, the fault message disappears, the MIL lamp does not flash anymore but lights up permanently. Torque reduction is canceled after reaching the idle speed for the first time. After a repair this detection can take a different length of time depending on the

Who monitors compliance with the OBD NOx directive?

The information recorded in the fault memory on NOx output can be read out by the responsible checking authority. In Germany, for example, the data is read out by the federal office for goods transport (BAG).

Are vehicles with SCR technology at a disadvantage compared to vehicles with AGR technology as a result of OBD NOx control?

No, on the contrary - in numerous tests and durability test runs vehicles with SCR technology were checked on freeway/city and distributor operation. Up to now no faults occurred which lead to a torque reduction.

AGR on the other hand is a thermally loaded system in which particles can deposit and as a result NOx reduction is impaired.

The torque is reduced as follows depending on the permissible gross vehicle weight:

- | | |
|------|--|
| 25 % | Vehicles between 3.5 - 16 t (vehicle categories N1, N2, N3) - this means for all Atego |
| 40 % | Vehicles over 16 t (vehicle category N3) - this means for all Axor and Actros |

If the fault persists for a prolonged period which can continue depending on the driving profile, the MIL lamp starts to flash. Torque limitation is activated after the next time the vehicle comes to a standstill. The activation of torque limitation is conveyed to the driver in the display.

3. Defect in NOx sensor: If the electronics detects a defect in the NOx sensor this is shown in the driver information display. From this point in time it takes another 50 operating hours for torque reduction to be active.

i The failure of a metering device or a pump module does not lead to torque limitation.

driving profile. The MIL lamp goes out completely, if on additional journeys no exceeding of the emission limits is detected.

Cause 3: Defect in NOx sensor

As soon as the motor electronics detects that the NOx sensor is functioning again, the fault message disappears, the MIL lamp does not flash anymore but lights up permanently. Torque reduction is canceled after reaching the idle speed for the first time. The MIL lamp goes out completely when no further fault is detected on subsequent journeys.

After a repair in the workshop the fault code and the torque limiter is reset by means of STAR DIAGNOSIS and password generation via the FDOK analog to the process "Teach-in code".

Can the torque limiter be active while driving?

No, the torque limiter is only activated once the vehicle is at a standstill. As the torque is reduced by a maximum of 40% depending on the permissible gross vehicle weight, it is possible to continue driving despite the active torque limiter.

Automated transmissions go into manual mode during the torque reduction.

How does the function of the active torque limiter behave when the power take-off is active when at a standstill or when starting off?

Torque reduction is only effective in power take-off mode if the power take-off requires a higher torque than 60 % (vehicles > 16 t) of the maximum possible torque (Example: Actros 410 BHP, 2050 Nm --> max. torque 1200 Nm).

Starting off does not present a problem, provided the legally permitted gross weight of the tractor vehicle is not exceeded as a mass.

How is the warning message or MIL lamp deactivated in the vehicle?

The warning message or the MIL lamp which is activated in the cockpit of the vehicle when the legally specified NOx control limit value is exceeded, is automatically deactivated, if depending on the type of fault, no malfunction exists anymore up to three complete driving cycles. A driving cycle begins when the engine starts and finishes when the engine stops, provided while the engine is operated, it is detected by the diagnostic system that the fault no longer exists. Which operating conditions are required for this depends on the respective type of fault.

The fault message and MIL lamp can be reset after a repair carried out in the workshop by means of STAR DIAGNOSIS and FDOK [vehicle documentation system] access.

This subject is included in the following training sessions offered by Global Training:

2007: NANE-MM284 Truck innovations/changes, drivetrain, 2-day course

2008: NSCR-MM285 Truck SCR exhaust aftertreatment system and NOx control, 2-day course

See also: <http://global-training.daimlerchrysler.com/>

When and for how long is a fault stored?

If the NOx output exceeds the NOx limit (Euro 4: 3.5 g/kWh, Euro 5: 2 g/kWh) by more than 1.5 g/kWh or if there is a fault in the NOx control system, there is an entry in the fault memory and an additional entry of a sumcheck error. The sumcheck error is stored as a non-erasable fault code over a minimum of 400 days or 9600 engine operating hours.

Is it possible to also reset current faults relevant to exhaust emissions with the FDOK [vehicle documentation system] web?

It is possible to reset current fault codes relevant to exhaust emissions with the FDOK [vehicle documentation system] web. For this purpose an additional enable of the "X-functions" is necessary. This can be obtained via the FDOK [vehicle documentation system] hotline.

Can vehicles which have the OBD NOx control be operated with vegetable oil?

Vegetable oil is not approved for Euro 3/4/5 at the plant, as the risk of a reduced engine service life is very high. In addition the use of vegetable oil increases the NOx output considerably as a result of which the torque limiter can be permanently active.
