Welcome to the FSD Testing Laboratory Radeberg!
Who is who

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Manipulations of exhaust-gas after-treatment systems
**Manipulation B1**  
Reducing the EGR rate with a diagnostic device

- Changing the EGR rate using commercially available diagnostic devices
- Purpose: Reducing carbon deposits in the intake tract
- Modification is recommended by the OEM as repair method in exceptional cases (see example)

Translation:

*Note:* In cases of severe or repeat complaints, reducing the EGR rate can help reduce the intensity of carbon deposition. However, this method should only be used in exceptional cases!
Possibility of modifying the EGR rate in sample vehicles (in this case BMW models) with diesel engines from 9/1998 (1,453,903 vehicles)

Central Agency tests revealed a significant increase in NO\textsubscript{x} emissions

According to experts, this type of maintenance must be classified as a technical change that is not permissible and results in the termination of the operating license approval of the respective vehicle.
Manipulation B1
Modifying the EGR rate with a diagnostic device

Detecting this manipulation as part of the PTI:

- By reading out the set calibration value using the PTI adapter
  - If calibration value = 0 → Original condition
  - If calibration value > 0 → Reduction in EGR rate
  - If calibration value < 0 → Increase in EGR rate

![Image of a diagnostic device]

<table>
<thead>
<tr>
<th>Abfrage Anpassungswert AGR-Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WERT SOLL</strong></td>
</tr>
<tr>
<td>0.0</td>
</tr>
</tbody>
</table>

☐ Diese Messung als ungültig markieren
Manipulation B2/B3
Software-based deactivation of exhaust-gas recirculation (EGR)

- By modifying the hysteresis values (e.g., intake air temperature) for the activation of the exhaust-gas recirculation or by modifying the characteristic map for the target air mass, for example
- Often in combination with a performance increase (tuning) with simultaneous deactivation and removal of the diesel particulate filter (DPF)
- Modifying the activation conditions (intake air temperature or target air mass) so that no EGR occurs in the normal driving mode

**Consequence:** Deactivation of EGR

→ Significant increase in NO\textsubscript{x} emissions

According to experts, this type of technical change that is not permissible and results in the termination of the operating license approval of the respective vehicle.
Manipulation **B2/B3**

**Software-based deactivation of exhaust-gas recirculation (EGR)**

Detecting this manipulation as part of the PTI:

- By reading out the software identification parameters via standardised OBD protocols using the PTI adapter:
  - Calibration Identifier (CALID) – OBDII Mode 9 PID 0x04
  - Calibration Verification Number (CVN) – OBDII Mode 9 PID 0x06
- Comparing the values with target values of a permissible data record
- Optionally: Reading out the value of current fresh-air mass using the PTI adapter and comparing it with reference values
Simulation of an intact EGR valve by installation of an additional device

- Original EGR valve is no longer powered and remains closed
- Engine control unit does not “detect” the defect, as it continues to receive signals from the simulator

Consequence: Deactivation of exhaust-gas recirculation  
→ Significant increase in NO\textsubscript{x} emissions

According to experts, this type of technical change that is not permissible and results in the termination of the operating license approval of the respective vehicle.
Manipulation B4

Manipulation of the EGR position sensor

Detecting this manipulation as part of the PTI:

- Reading out vehicle self-diagnosis data (e.g., current fresh-air mass) using the PTI adapter and comparing it with reference values
- Optionally: Visual inspection in the area of the exhaust-gas recirculation actuator
Manipulation B5/B6
Mechanical deactivation of exhaust-gas recirculation

- By installing a mechanical baffle between the exhaust-gas and fresh-air paths of the engine
- Or by sealing the hose to the vacuum actuator in pressure-controlled systems

- **Consequence:** Deactivation of exhaust-gas recirculation
  → Significant increase in NO\textsubscript{x} emissions

According to experts, this type of maintenance must be classified as a technical change that is not permissible and results in the termination of the operating license approval of the respective vehicle.
Manipulation B5/B6

Mechanical deactivation of exhaust-gas recirculation (EGR)

Detecting this manipulation as part of the PTI:

- Reading out the value for current fresh-air mass using the PTI adapter and comparing it with reference values
- Optionally: Visual inspection of the exhaust-gas path for abnormalities
Manipulation B7
Removal of the NO\textsubscript{x} adsorber and/or SCR catalyst

- Often in combination with removal of the diesel particulate filter
- Removal of components and installation of replacement hoses or destruction of the monoliths and installation of “empty housings”
- Then: Deprogramming the corresponding functions from the engine management
- **Consequence:** Complete disabling of the exhaust-gas post-treatment functions
  \[ \rightarrow \] Significant increase in exhaust-gas emissions

According to experts, this type of maintenance must be classified as a technical change that is not permissible and results in the termination of the operating license approval of the respective vehicle.
Manipulation B7
Removal of the NO$_x$ adsorber or SCR catalyst

Detecting this manipulation as part of the PTI:

- By reading out the software identification parameters via standardised OBD protocols using the PTI adapter:
  - Calibration Identifier (CALID) – OBDII Mode 9 PID 0x04
  - Calibration Verification Number (CVN) – OBDII Mode 9 PID 0x06
- Comparing the values with target values of a permissible data set
- Reading out the differential/back pressure across/before the DPF using the PTI adapter and comparing it with reference values
- Reading out the NO$_x$ concentration in the exhaust gas using the PTI adapter and comparing it with reference values
Manipulations **B8**  
Reduction or deactivation of AdBlue injection

By

a) Making corresponding changes to characteristic maps in the engine control unit or

b) Installing special simulators (emulators)

- **Purpose:** Reducing AdBlue consumption (often in commercial vehicles)
- **Consequence:** Insufficient or no AdBlue injection  
  → Significant increase in NO\textsubscript{x} emissions

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According to experts, this type of maintenance must be classified as a technical change that is not permissible and results in the termination of the operating license approval of the respective vehicle.
Manipulations **B8**

Reduction or deactivation of AdBlue injection

Detecting manipulation case as part of the PTI:

- By reading out the software identification parameters via standardised OBD protocols using the PTI adapter:
  - Calibration Identifier (CALID) – OBDII Mode 9 PID 0x04
  - Calibration Verification Number (CVN) – OBDII Mode 9 PID 0x06
- Comparing the values with target values of a permissible data record
- Reading out the in-vehicle value for NO\textsubscript{x} concentration in the exhaust gas using the PTI adapter and comparing it with reference values
Development of testing technologies

Overview

Development of a concept for five testing technologies (P1–P5) to detect these manipulations (B1–B8):

- Testing technology **P1**: Querying the software status (CALID/CVN comparison)
- Testing technology **P2**: Querying the exhaust-gas recirculation calibration value
- Testing technology **P3**: Querying the value for differential or back pressure at the diesel particulate filter
- Testing technology **P4**: Querying the NO\(_x\) sensor signals
- Testing technology **P5**: Querying the value for air mass
### Development of testing technologies

**Overview matrix of testing technologies**

Chart of manipulation methods and the testing technologies for detecting them

<table>
<thead>
<tr>
<th>Manipulation method</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
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<tr>
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<table>
<thead>
<tr>
<th>Testing technology</th>
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<th>P3</th>
<th>P4</th>
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