

Submitted by the Informal Working
Group on Periodical Technical Inspections

Informal document WP.29-175-07
175th WP.29, 19 - 22 June 2018
Agenda item 8.1

Tampering of Air Emission Control Systems

IWG on Periodical Technical Inspections



Tampering of Air Emission Control Systems

Methodology

- Collate available information about diesel vehicles
- Main areas of fraud
 - Exhaust Gas Recirculation (EGR)
 - Diesel Particulate Filter (DPF)
 - Selective Catalytic Reduction (SCR)

Tampering of Air Emission Control Systems

- Identify methods of tampering
- Possible methods of detection for Road Side Inspection (RSI) and Periodic Technical Inspection (PTI):
 - visual inspections
 - emission measurements
 - diagnostic functions
- Timescale for implementation
 - Short term (*next 2 years, current equipment, short training*)
 - Long term (*approx. 2 – 5 years, special regulation, new equipment and procedures*)

Recommendations – Visual Inspection

All visual inspections are short term implementations

| EGR | | RSI | PTI |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| External zapping device | <ul style="list-style-type: none">External black box plugged behind EOBD socket | X | X |
| Mechanical tampering | <ul style="list-style-type: none">Physical change in the engine compartment<ul style="list-style-type: none">blocking the gas tube with a bafflesealing the hose to the vacuum actuator | X | X |



Tube blocked

Recommendations – Visual Inspection

| DPF | | RSI | PTI |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|
| DPF removed, also with ECU set up | <ul style="list-style-type: none">• Missing part or visible alteration (e. g. welding seam) of the exhaust pipe• Soot in the exhaust of a Euro 5/6 vehicle, this may indicate DPF removal (only an indication, no proof for a manipulation) | X X | X X |
| DPF gutted, also with ECU set up | <ul style="list-style-type: none">• Soot in the exhaust of a Euro 5/6 vehicle, this may indicate DPF removal (only an indication, no proof for a manipulation) | X | X |



Recommendations – Visual Inspection



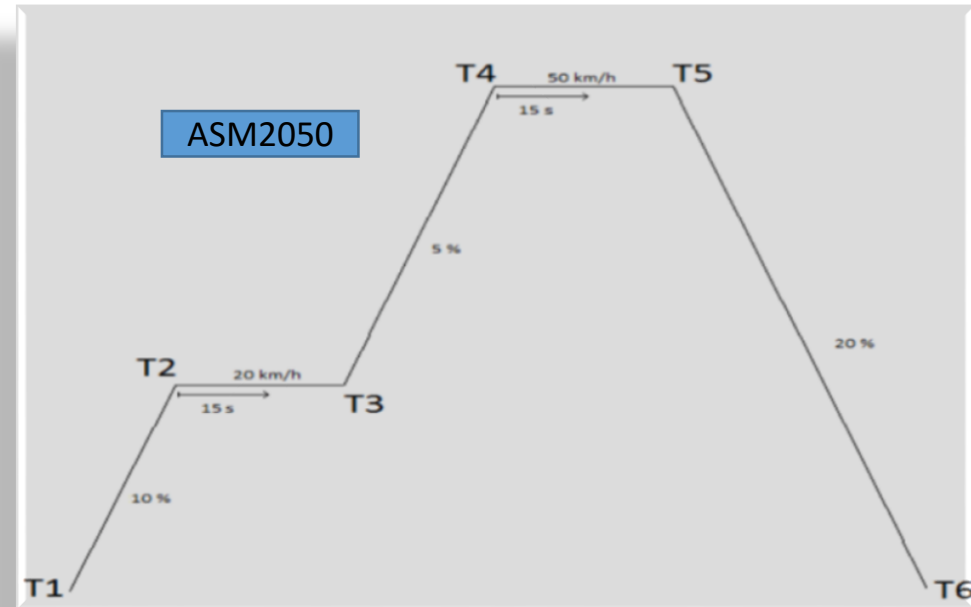
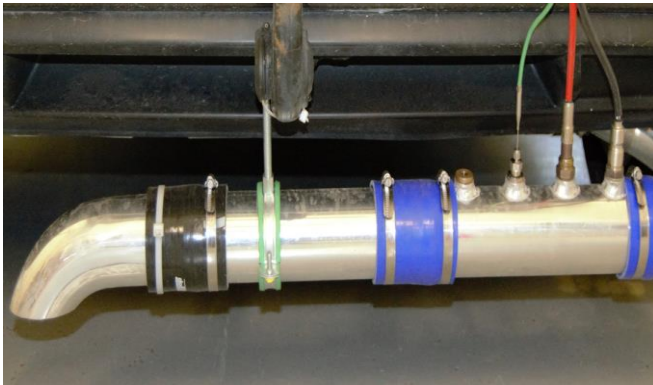
Recommendations – External Measurement

| | Short Term | RSI | PTI | Long Term | RSI | PTI |
|------------|------------|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| EGR | | | | | | |
| | | | | <ul style="list-style-type: none"> • Implementing NOx measurement: <ul style="list-style-type: none"> ➤ Without load: <ul style="list-style-type: none"> - Capelec/AVL procedure ➤ With load: <ul style="list-style-type: none"> - ASM 2050 - Mini-PEMS • Use of remote sensing equipment at roadside | (X) | X |
| | | | | | (X) | X |
| | | | | | X | |

Recommendations – External Measurement

| | Short Term | RSI | PTI | Long Term | RSI | PTI |
|------------|------------|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|
| SCR | | | | | | |
| | | | | <ul style="list-style-type: none"> • Implementing NOx measurement: <ul style="list-style-type: none"> ➤ With load: <ul style="list-style-type: none"> - ASM 2050 - Mini-PEMS • Use of remote sensing equipment at roadside | (X) X | X X |

Recommendations – External Measurement



Recommendations – External Measurement

| | Short Term | RSI | PTI | Long Term | RSI | PTI |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| DPF | | | | | | |
| | <ul style="list-style-type: none"> • Current free acceleration test: <ul style="list-style-type: none"> ➤ Euro 4: threshold is plate K-value, max. 1,0 m⁻¹ ➤ Euro 5 and 6: threshold is a generally reduced K-value, max. 0,2 m⁻¹ | | X | <ul style="list-style-type: none"> • Implementing particulate number (PN) measurement: <ul style="list-style-type: none"> ➤ Measuring at idle or high idle • Use of remote sensing equipment at roadside | (X) | X |

Remark for **long term** measures:

Beside existing first studies and experiences made, further investigations are necessary to define an applicable procedure (e. g. pollutant, equipment, calibration).

Recommendations – Diagnostic Functions

| | Short Term | RSI | PTI | Long Term | RSI | PTI |
|-----|---------------------------------------------------------------------------------------------------------------------|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| EGR | | | | | | |
| | <ul style="list-style-type: none"> Judge sensor signal for air mass by reference values (idle speed) | X | X | <ul style="list-style-type: none"> Test of valid CALID (version) and CVN (check sum) Use of EOBD tool to detect inappropriate communication sequence hiding EGR errors or overwriting EGR command Use of tolerance values to judge EGR rate Judge EGR position signal | X | X |
| | | | | | X | X |
| | | | | | X | X |

Remark:

Standard values, applicable for most vehicles (some OEM provide already values).



Recommendations – Diagnostic Functions

| | Short Term | RSI | PTI | Long Term | RSI | PTI |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| SCR | | | | | | |
| | <ul style="list-style-type: none"> Check SCR temperature value when it is cooling down (no change) Physically disconnecting the SCR temperature sensor should trigger the MIL | X | | <ul style="list-style-type: none"> Test of valid CALID (version) and CVN (checksum) Communication ("ping") with exhaust after treatment ECU via scan tool (Emulators hinder/block communication) Judge NOx-sensor value | X | X |
| | | X | | | X | X |

Remark:

Even basic information already existing, e. g. SCR-temperature or AdBlue injection rate, are not accessible via EOBD and currently not standardized.

Recommendations – Diagnostic Functions

| | Short Term | RSI | PTI | Long Term | RSI | PTI |
|----------------|------------|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| DPF/GPF | | | | | | |
| | | | | <ul style="list-style-type: none"> • Test of valid CALID (version) and CVN (check sum) • Judge differential pressure over DPF or judge tailpipe pressure (depending on the layout, not standardized) | X | X |
| | | | | | X | X |

Vehicle Information

ECU Module

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| Parameter | Value | Units |
|-------------------------------------------|-------------------|-------|
| Vehicle Identification Number | 1G1JC5444R7252367 | |
| Calibration Identifications | JMB*36761500 | |
| Calibration Identifications | JMB*47872611 | |
| Calibration Verification Numbers | 39383132 | |
| Calibration Verification Numbers | 33343736 | |
| OBD Monitor Conditions Encountered Counts | 12594 | count |
| Ignition Counter | 13108 | count |

Recommendations – Diagnostic Functions

Chart of manipulation methods and the testing diagnostic technologies

| | | Manipulation method | | | | | |
|--------------------|----------------------------|--------------------------|----------------------------|----------------------------------------|-------------------------|------------------------|----------------------------------|
| | | Modification of EGR rate | Deactivated EGR (software) | Mechanical deactivation with simulator | Mechanical deactivation | Removal of NSC/SCR/DPF | Deactivation/reduction of AdBlue |
| Testing technology | Software status | | X | | | X | X |
| | EGR calibration value | X | | | | | |
| | Differential/back pressure | | | | | X | |
| | NOx sensors | | | | | X | X |
| | Air mass | X | X | X | X | | |

Summary

- There is an urgent need for coordinated actions regarding RSI and PTI
- Many measures can be implemented on a short term perspective
- For the long term perspective are necessary
 - more meaningful real emission measurement procedures for all pollutants (petrol and Diesel engines)
 - more comprehensive diagnostic tools and extensive information via EOBD in a standardized version
- Efforts are needed against sale of tampering devices