OBD DEMONSTRATION PROCEDURE FOR MALFUNCTIONS WHICH CAUSE DEFAULT ACTION WITH INCREASED EMISSIONS

BOSCH

Malfunctions which cause default action with increased emissions
Explanation of Scenario (example)

- Some malfunctions, when detected, will and must cause some kind of default action*.
- The default action can cause a significant increase of emissions, e.g. significantly higher than OBD threshold limit.
- Example “oxygen sensor”:
  - Specific oxygen sensor malfunctions, when detected, will and must cause deactivation of lambda control.
    - Reason: malfunctioning oxygen sensor cannot deliver valid lambda value, such that lambda control is no longer possible (technical consequence, no other solution possible)
  - After deactivation of lambda control, precise adjusting of lambda to 1.0 is no longer possible, especially at change of engine operation point (i.e. at usual dynamic driving).
  - Without precise adjusting of lambda to 1.0, the catalyst conversion capability will be reduced significantly, such that emissions will exceed OBD threshold limits significantly.

* default action: roughly corresponds to EOBD term “emission default mode of operation” (not necessarily permanent)

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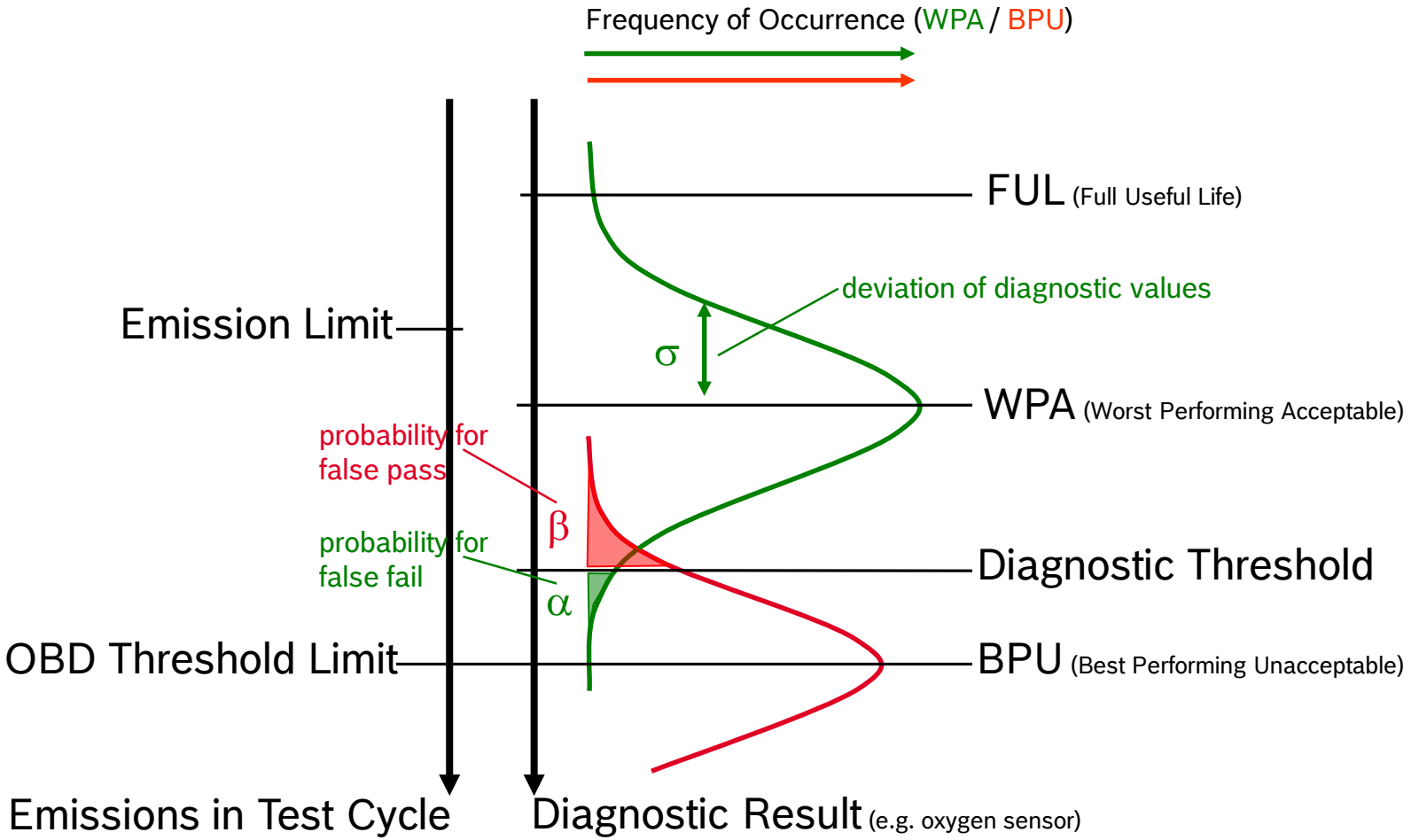
OBD certification demonstration – example oxygen sensor

- After implementation of a faulty oxygen sensor with the fault size as needed for OBD certification demonstration (i.e. to the best performing unacceptable (BPU) level for detecting the malfunction & storing a fault code & illuminating MI), the default action will cause the emissions to exceed OBD threshold limits significantly
  → not acceptable without any *countermeasure* *(possible countermeasure: see below)*
- An oxygen sensor which has deteriorated to the worst possible level, which will not cause malfunction detection & storing a fault code & illuminating MI (i.e. to the worst performing acceptable (WPA) level), would not cause emissions to exceed OBD threshold limits.
- Possible *Countermeasure* (in alignment with CARB OBD II):
  - Re-testing with reduced fault size (i.e. to the worst performing acceptable (WPA) level), such that no malfunction detection & no storing a fault code & no illuminating MI will happen
  - Remark: deteriorated oxygen sensor might (usually) be simulated by external HW tool
- Further explanation of BPU & WPA: see next slide

Malfunctions which cause default action with increased emissions
WPA & BPU & Diagnostic Threshold

CARB/OEM terminology:

- *Best Performing Unacceptable* (BPU): This term refers to a system/component that yields performance measurements (as determined by the monitoring strategy) that are failing just beyond the malfunction criteria established by the manufacturer (i.e., the diagnostic or fault threshold). Components or systems operating at this level of deterioration or worse should be detected as malfunctioning by the OBD system and illuminate the MIL.
- *Worst Performing Acceptable (WPA):* This term refers to a system/component with performance that has deteriorated to the limit of the manufacturer's criteria for acceptable performance. The MIL should not be illuminated for a component performing at this level of deterioration or better. A component or system performing worse than this level of deterioration would not be within the manufacturer's criteria for acceptable performance, but may still be good enough to pass the diagnostic (i.e. no MIL illumination).



Malfunctions which cause default action with increased emissions
CARB OBD II wording 2013

13CCR1968.2, July 31, 2013

- (h) *Monitoring System Demonstration Requirements For Certification*
- …
- (6) *Evaluation Protocol*:
- …
- (6.4) If the MIL does not illuminate when the systems or components are set at their limit(s), the criteria limit or the OBD II system is not acceptable.
- (6.4.1) Except for testing of the catalyst (i.e., components monitored under (e)(1), (f)(2) or (f)(8)) or PM filter system, if the MIL first illuminates after emissions exceed the applicable malfunction criteria specified in sections (e) and (f), the test vehicle shall be retested with the tested system or component adjusted so that the MIL will illuminate before emissions exceed the applicable malfunction criteria specified in sections (e) and (f). If the component cannot be adjusted to meet this criterion because a default fuel or emission control strategy is used when a malfunction is detected (e.g., open loop fuel control used after an O2 sensor malfunction is determined, etc.), the test vehicle shall be retested with the component adjusted to the worst acceptable limit (i.e., the applicable monitor indicates the component is performing at or slightly better than the malfunction criteria). For the OBD II system to be approved, the MIL must not illuminate during this test and the vehicle emissions must be below the applicable malfunction criteria specified in sections (e) and (f).

This older version of CARB OBD II has been chosen, because the paragraph is somewhat short and comprehensible.

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CARB OBD II wording 2016

- In the current version **13CCR1968.2, July 25, 2016**, the same paragraph (h)(6.4.1) has been further developed by CARB, thus more detailed and maybe somewhat challenging (i.e. not so easy to understand all details of the wording), while the basic sense is still the same.
- This current version can be found via the following LINK on top of the page "**Clean Versions of the Latest OAL-Approved OBD II Regulations**" --> Section 1968.2: (PDF - 1123K) (**OAL-approved on July 25, 2016**) : https://ww3.arb.ca.gov/msprog/obdprog/obdregs.htm

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