Survey about functional efficiency of DPF during PTI in Zürich – 22. ETH-NPC 2018

Beat Gloor, AWEL Abteilung Luft
Contents

• definition of the project
• approach – basic points
• measuring equipment
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The project

- cars comes for the PTI
- only diesel cars
- if possible only Euro 5b → Euro 6....
- use and test different PN-measuring equipments
- communicate the measuring technique, feasibility, time required

requirements
- no disturbance during PTI
- no consequences for DPF malfunction → wording
Method

- data sheet for one week,
- 7 lanes to monitor at the same time
- to pick the relevant cars
- PN-measuring (2 instruments) during the PTI (drive to or from the control basement)
- notice the value, complete data set if necessary, identify DPF under the car
PN-measuring equipment

- P-Trak (TSI) → CPC
- Disc-mini (testo) → diffusion charging
- Partector with heating (naneos) → diffusion charging
- NPET (TSI) → metas-approved PN-measuring equipment for diesel engines with dilution, dilution rate 1:10 and heating to 350°C (CPC) power: 240V AC
Equipment

P-Trak

Disc-mini

Partector

NPET
Method by evaluation the results

List of examined cars and the measured values
→ Euro 5b or younger → always DPF present
→ Euro 5a oder older
  measured value \(\leq 300'000\) → DPF present
  measured value \(> 300'000\) → database of registration by Road Traffic Licensing Department:
  a) with COC Nr. → DPF yes/no
  b) without COC Nr. → comparison with the same cars with COC and the same year of first registration → DPF yes/no
All cars - with and without DPF

all measured cars (1090)

- Euro 5b…6: 328
- Euro 1…5a with DPF: 500
- Euro 1…5a without DPF: 262
Results

number of measured cars with/without DPF after year of first registration

- all measured cars: 1090
- with DPF: 762
- without DPF: 328

Year of first registration

with DPF ▪ without DPF

Number of cars
cars Euro 5a

Year of first registration

Number of cars

- 0
- 20
- 40
- 60
- 80
- 100
- 120
- 140
- 160
- 180

2008 2009 2010 2011 2012 2013 2014

one car without DPF

without DPF

with DPF
cars Euro 5b

Number of cars

Year of first registration

- 2010
- 2011
- 2012
- 2013
- 2014
- 2015

with DPF
Results

particle number concentration of cars Euro 5a with DPF

- upper limit of measuring range of P-Trak
- threshold value
- value as expected
Results

particle number concentration of cars Euro 5b+

upper limit of measuring range of P-Trak

threshold value

value as expected
Evaluation of all measured cars

all measured cars (1090)

- Euro 5b.. 6c DPF malfunction: 29
- Euro 5b.. 6c DPF in good condition: 233
- Euro 1...5a with DPF in good condition: 369
- Euro 1...5a with DPF malfunction: 131
- Euro 1...5a without DPF: 328
Results of the investigations relating to emission-standard and DPF-obligation

<table>
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<th>DPF-obligation</th>
<th>no DPF-obligation</th>
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<td>B5b-&gt;B6...</td>
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<tr>
<td>Total</td>
<td>100%</td>
<td>39.6%</td>
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<td>60.4%</td>
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A closer look

all cars with DPF

12.5% malfunction by first PTI?
Controlled cars with first registration 2011

190 cars with DPF

→ 159 cars Euro 5a
→ 4 cars Euro 4
→ 22 cars Euro 5b
→ 5 buses Euro 5 (public transport)
Cars Euro 5a with first registration 2011

190 cars w. DPF → 159 cars Euro 5a

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<tr>
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<td>2</td>
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</table>

total 159 16 10%

statistically verified results, no bias
Conclusions I

- the technology for PN-measurement is functional although with easier instruments
- with this equipment I can measure 95% of that cars without any doubt and I have a clearly result
- for the 5% «doubt-results», I can use the metas-aprooved equipment(s) or I inform the driver, that the DPF has to be replaced at least before next PTI or the MIL indicate an error.
- time required for measurement (~ 30 sec.)
Conclusions II

- we need a reliable battery powered PN-measuring equipment, of handy-size with a sufficient measuring range
- handy-size = like P-Trak or Partector
  battery capacity = 5 hours
  measuring ranged = 1000 – 10 million P/cm³
- we need threshold value(s) for PN, as low as possible, as high as necessary
- we need a mandatory inspection instruction, for a fast and reliable measuring
Special thanks:

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Thank you for your attention!

Are there any questions?

Beat Gloor, beat.gloor@bd.zh.ch