

WLTP DTP PM-PN Subgroup Activities, Progress & Future Plans

6th DTP Meeting

Geneva

8th June 2011

Chris Parkin

Outline

- Meetings
- Closed Issues
- Open Issues
- Points to Note
- Amendments to GTR Text
- Future Plans

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Subgroup Meeting

- 9th Meeting – 3rd May
 - The following Open Issues were reviewed;
 - Dilution air filtration,
 - Background corrections,
 - Sample cooling,
 - Sample shut-off valve location,
 - Filter media specification, conditioning & handling
 - PM Microbalance precision and calibration
 - Reference filter weighing
 - PM calculations

Subgroup Meeting

- Open Issues review cont.
 - PN during regeneration
 - VPR solid particle penetration efficiency
 - PNC calibration aerosol

- The draft GTR text was reviewed. An updated text has been circulated as document PMPN-09-06 rev.3.

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Closed Issues

PM Sampling

- **A8 Dilution air filtration efficiency:** 99.95% agreed [JASIC would prefer 99.97%]
- **(partial) A9 Background correction:** Tunnel or dilution air background included as regional options. Tunnel background should be measured on day of test, following any tunnel pre-conditioning
- **A16 Sampling cooling:** text is acceptable as is, without explicit reference to sample cooling
- **A20 Data logging frequency:** 1Hz for all parameters for consistency
- **A27 proportionality of PM sample flow rate:** verify on system commissioning and then as required by technical authority

Closed Issues

PM Sampling cont.

- **A35 Shut-off valve location:** downstream of filter holder
- **A38 Filter media:** Either membrane or coated filter, collection efficiency specification corrected based on input from Pall

PM weighing

- **B2 Microbalance precision:** 1 μ g as per GTR 4 accepted

PN

- **D4 PNC Calibration frequency:** 13 month interval agreed with a requirement to either monitor PNC counting efficiency versus a reference or change PNC wick every 6 months

Closed subject to review e.g. due to Validation 2 or DHC conclusions

PM sampling

- **A2 CVS temperature during regen:** 190C maximum subject to validation experience
- **A26 Number of PM sample filters required:** one for cold start phase, one for all hot start phases combined, subject to DHC cycle design/weighting

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Open Issues

PM sampling

- **A9 background correction:** Maximum permissible PN correction. Dilution air background measurement (rolling average or on day of test).
- **A15 Tunnel pre-conditioning procedure:** review during validation whether recommended 20 mins at 120kph is sufficient, text amended to clarify that longer, hotter pre-conditioning is permissible.

PM weighing etc

- **B3 PM sample filter conditioning:** reviewing minimum filter conditioning period based on data from different labs and different vehicle technologies
- **B6 Reference filter weighing:** ≥ 2 reference filters of same size and media as test filters, replace every 30 days or more frequently. Still considering acceptance criteria
- **B7 PM calculations:** awaiting proposed text

Open Issues

Regeneration

- **C1 PN measurement during regeneration:** limited available studies suggest current VPR and PNC cut-off are suitable for regeneration measurements. Propose making additional experimental measurements during Validation 2 to confirm. Need to consider regeneration test procedure/weighting, repeat hot start cycles during regen testing will artificially depress PN.

Particle Number

- **D1 VPR minimum solid particle penetration efficiency:** 70% at 100nm proposed, plus current max ratios for $\text{pcrf}_{30\text{nm}}:\text{pcrf}_{100\text{nm}}$ and $\text{pcrf}_{50\text{nm}}:\text{pcrf}_{100\text{nm}}$. Reviewing whether ratios could be tightened based on available data.
- **D5 PNC calibration aerosol:** subgroup will develop updated calibration guidance documents in parallel to Validation 2.

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Points to Note

- DHC construction should permit use of PM single filter for all hot start phases, i.e. no phase weighting factors, to minimise measurement errors
- DPF regeneration testing procedures should permit repeat cycles to be run back to back without intermediate cold starts or hot soak.
- Want to gather data during validation on PN during DPF regeneration;
 - To confirm PN measurement system is capable of excluding worst case volatile material during DPF regenerations
 - CVS and filter face temperatures during regenerations?
- Want to gather data during validation on tunnel background levels
 - Is 20 minutes pre-conditioning at 120kph sufficient?
 - Tunnel PN background levels

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Amendments to GTR Text

Document: WLTP-DTP-PMPN-09-06 rev.3

Definitions

- Buoyancy correction
- Compression ignition engine
- Continuous regeneration
- Particle number
- Particulate matter
- Particulate matter weighing chamber
- Periodic regeneration
- Positive ignition engine

Amendments to GTR Text

- **List of Symbols & Acronyms updated**
- **Exhaust transfer tube** – heating added as an optional alternative to insulation. Connection sealing elastomers should be thermally stable and not bridge connection
- **Dilution tunnel mixing point pressure variation** – deleted. Dealt with by pressure variation requirements at tailpipe
- **PDP & CFV Dilution system schematics** – updated and made consistent
- **PM & PN background measurements** – either dilution air or tunnel background permitted at discretion of contracting party up to maxima of 1mg/km and *TBD* PN/km. Tunnel background measurements must be on day of test after any tunnel pre-conditioning
- **PM filter weighing procedures** – sample and reference filter weighing procedures added

Amendments to GTR Text

- **Calibration requirements** – microgram balance, VPR and PNC requirements inserted
- **Tunnel pre-conditioning** – text amended to explicitly permit longer and/or higher speed running if required
- **Double dilution** – text added to permit this as an option provided dilution system accuracy requirements are still met
- **PM & PN calculations** – text amended to reflect option to use double dilution and introduction on PN background correction
- **Partial flow dilution systems** – text deleted, not permitted for WLTP phase 1
- **PM & PN Measurement & weighing chamber specifications** – moved to Annex III (measurement equipment) and updated
- **Regeneration test procedures** – text amended to explicitly permit use of a single filter for PM measurement over repeat cycles required to complete regeneration

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Future Plans

June/July 2011

- Objectives
 - Reach final agreement on remaining Open Issues
 - Finalise PM-PN elements of GTR text

Post July

- Objectives
 - Update PN calibration guidance documents
 - Review data from Validation 2 on tunnel background, tunnel pre-conditioning & PN during regeneration