PMP – Particle Measurement Program Informal Working Group
Task Force 2– Brake Dust Sampling and Measurement

Meeting #32 – Thursday 27 MAY 2021 15:00 – 16:00 CEST

Minutes of Meeting – Final Version

1. Participants: As in the file ***"32nd TF2 Meeting Attendance"*** uploaded in TEAMS.

2. Background: This is the 1st meeting related to the PN measurement approach followed by the TF2 members. TG introduced the meeting and provided a summary of the scheduling of the upcoming meetings. Two more meetings have been confirmed. A quick summary of the PM discussion and the circulated document related to the proposed minimum specifications for the PM measurement was given. TG asked for the final comments on the PM measurement to be submitted by the end of May. Afterwards, the final version of the document will be submitted.

3. PN measurement Discussion: AM presented AVL's experience with brake PN measurement. AVL discussed PN measurement efficiency identifying four areas of interest: ***transport and extraction, pre-classification, dilution, and detection***. Initially, AM focused on AVL's setup and discussed their recent experience in brake PN measurements with two different experimental setups (brake dynos). Overall, there seems to be no significant difference between total and solid particle concentrations over the WLTP-Brake cycle. In some cases, a thermally stable nucleation mode was noted indicating very small particles of solid nature. These particles can increase PN emission rates by an order of magnitude. The importance of background concentrations was highlighted along with the need to consider it as a function of the brake particle emission concentration levels. A level of 10^9 particles/km was suggested. Dilution requirements were also discussed because of possible instrument saturation. AM highlighted the need for real-time monitoring of the dilution ratio of the particle number system with regular checks over time. Flow changes due to clogging have been proved to be a significant source of error; therefore, AVL strongly recommends the use of full-flow CPCs for regular monitoring of the sample flow. AM discussed the issue of volatile particles and the "difficulties" linked to their presence when measuring PN concentrations. While a change in the tunnel flow might slightly affect brake temperature, there is a risk to hugely affect volatile formation due to change in the dilution precursors and the saturation ratios. AVL has not detected yet this phenomenon with the application of the WLTP-Brake cycle. However, Slide 15 of the attached presentation shows its importance over the LACT-Short Cycle, where 220% differences of total particles were measured versus 5% of solid particles. Overall, AVL would consider a dedicated setup for the correct measurement of the total PN concentrations. Regarding the pre-classification, AVL suggested that a 2.5 μm (or smaller) pre-classifier would be justifiable to protect the instrumentation from clogging or other phenomena. The pre-classifier could introduce 10-25% underestimation of concentrations <10^10 particles/km, but <2% for concentrations >10^10 p/km (with nucleation mode). The calibration topic was also introduced. AVL highly recommends aligning with the ongoing discussions at the exhaust PMP level to harmonize calibration procedures for the dilutor and the CPC as a whole. The PCRF (Particle Concentration Reduction Factor) approach for particle losses was very briefly introduced. Slides 22 and 23 of the attached presentation summarize AVL's overall recommendations regarding the PN measurement. Some additional items for the upcoming Interlaboratory Study were also introduced.

BA asked for some clarifications related to the dilution based on the 3000:1 requirement introduced by AM. BA added that the application of a CA (Catalytic Stripper) might be the best option to avoid phenomena related to volatile formation.

4. Next Meetings: The next meeting will take place on Thursday 03.06.2021. Link-US and Link-EU will provide a common presentation on the PN measurement.