

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

Meeting #29 – Thursday 29 APRIL 2021 15:00 – 16:00 CEST

Minutes of Meeting – Final Version

1. Participants: As in the file “*29th TF2 Meeting Attendance*” uploaded in TEAMS.

2. Background: This is the third meeting discussing the mass measurement approach. TG introduced the meeting and provided a brief update on the scheduling of the upcoming meetings. The PM discussion is expected to be finalized by the 20th of May.

3. Mass Discussion: GF presented Horiba-Audi’s experience with PM measurement. The presentation included some background information as well as details regarding the testing setup, provided measurement results from different testing campaigns, and focused on recommendations and points for discussion within the TF2.

GF provided an introductory note related to PM and PN definitions. Then, GF discussed a slide from an older Horiba presentation (50th PMP Meeting), which demonstrates a decrease in the measured PM mass with decreasing air velocity. The sampling point (7D vs. 14D) did not seem to significantly affect the PM measurement. Afterwards, the basic characteristics of the Horiba setup were discussed. GF clarified that the setup features two 90° bends between the brake enclosure and the sampling system. The importance of installing a HEPA filter prior to the system was demonstrated. Then, the Horiba DLS-ONE system for PM measurement was presented. The system features two cyclones – one for each PM fraction – while it allows for bypassing the airflow during the soak parts of the cycle. Isokinetic sampling is realized by means of different sampling probes. Finally, the challenges related to the mass determination and the error factors were analyzed.

PM₁₀ and PM_{2.5} results from a VW brake at different loads were presented. PM₁₀ and PM_{2.5} were found to be approximately 4.5 mg/km and 2.6 mg/km per brake, respectively, while values were somewhat higher when fully loaded testing conditions were applied. These values are in line with recently presented data from other labs. All tests were performed at a relatively high air flow rate of 3000 m³/h.

The presentation concluded with high-level recommendations on points that need to be clarified. These include the effect of flow drift, the definition of proper flow control and adjustment, the particle bounce related to the shifting of the cut-off point, and the selection of the proper filter material.

The discussion touched upon several topics. GF clarified that the setup design was based on the exhaust experience. The air flow rate of 3000 m³/h was selected to match the WLTP-Brake cycle average velocity. Most of Horiba’s initial brake tests were performed with this air flow rate (3000 m³/h). A discussion related to the possibility of introducing additional uncertainty due to the 90° bends as well as due to the additional transition bend to the cyclones took place. GF clarified that different nozzles are employed to adjust the sampling flowrate. A discussion regarding the filter face velocity followed. AM stated that filter face velocity is not so relevant for brake measurements due to low gas concentration. It was proposed to introduce a check in the velocity before the filter to

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make sure that it remains constant. Concerns related to high Stokes number and big particle losses were raised. RV asked more information about the use of TX40 and PTFE membrane filters – a suggestion for some labs to run some tests during the interlaboratory study.

4. Next Meetings: The next meeting will take place on 06.05.2021. LINK-EU and BMW will present their point of view on the topic of PM measurements.