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

**Meeting #10 – Thursday 22 February, 2018, 14:00 – 15:00**

**Minutes of Meeting – Final Version**

**1. Tour de table:** Participants: AUDI-(SG) Sebastian Gramstat; AVL-(MA) Michael Arndt; AVL-(TM) Thanasis Mamakos; BMW-(KL) Katharina Lammel; BREMBO-(FR) Francesco Riccobono; CARB-(SC) Sonya Collier; DEKATI-(MMD) Mikko Moisio; FORD-(JG) Jarek Grochowicz; FORD-(MM) Marcel Mathissen; FEDERAL MOGUL-(MM) Marcus Morbach; GM-(MR) Matt Robere; Horiba-(DL) Dmytro Lugovyy; JARI-(HH) Hiro Hagino; JRC-(TG) Theodoros Grigoratos; LINK-(CA) Carlos Agudelo; LINK-(RM) Radek Markiewicz; TSI-(JS); Opel-(TN) Thomas Neff; TSI-(RA) Bob Anderson; TU Ilmenau-(TF) Toni Feissel.

**2. Introduction:** TG briefly presented the final version of the mandate definition document. Input has also been provided by FM, JARI and TU Ostrava. The final version of the document is attached to the MoM.

**3. Finalization on the definition of the scope:** Overall, there is a consensus regarding the scope of the TF2. The main goal is to propose a methodology for measuring brake wear $PM_{10}$, $PM_{2.5}$ and PN concentration. Mass and number size distributions of brake wear particles will be investigated since these parameters are necessary for subsequent R&D work but will not be a part of the scope as the task is already too complicated. It was agreed that PM measurements will be conducted gravimetrically, therefore the use of filters will be a part of the procedure. Finally, for the time being no other parameter will be considered in the scope.

RA proposed to create a sub-group which could start looking mainly into particle size distributions with the aim of better defining the losses. This proposal was supported by several TF2 members, while others expressed their doubts. It was decided to start with the main elements of the scope and come back to this proposal later when some progress will have been achieved.

There were also some questions regarding the brake cycle and other elements related to the work of TF1. TF1 will again meet in mid-March and a briefing will follow most probably at the 12th Meeting of the TF2 (end of March).

**4. Discussion on the structure of the work:** CA briefly presented Link's initial proposal on how the work should be structured. Comments from SG and MM have been included and the Group is invited to comment and provide feedback on the proposed outline. The proposal now looks as follows:

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**Proposed Outline**

1. Introduction, rationale, and scope

2. Nomenclature, definitions, and terminology

3. Dyno capabilities

    3.1. Controls and data collection per WLTP-brake schedule and similar

    3.2. Data output to ensure availability of test measurements for standard metrics

    3.3. Torque, speed, and acceleration rates

    3.4. Fixture design and orientation

    3.5. Ventilation system (air conditioning, pre-filtering)

4. Sampling system

    4.1. Cooling air speed/airflow and climatic conditioning for air temperature and relative humidity

    4.2. Enclosure and duct size, shape, and material (including surface finish in wet areas)

    4.3. Layout and losses (acceptable levels for PN, PM metrics)

5. Brake emissions mass measurement system

    5.1. Minimum size steps for data output and sampling rates

    5.2. Required PM sizes for gravimetric sampling devices

6. Brake emissions number measurement system

    6.1. Minimum/required particle size ranges (23 nm to 10 μm?)

    6.2. Minimum size steps for data output and sampling rates

7. System calibration, validation, and sign-off

    7.1. Cooling air settings and temperature regimes using WLTP-brake and reference brakes

    7.2. Standard losses estimation numerical tools (spreadsheets or calculators)

    7.3. Standard calibration process for particle measurement with reference aerosols, filters, and use of approved reference brakes

    7.4. Checklists for installation, validation, calibration, and regular check-ups

8. Appendixes

    8.1. Coagulation estimates (how to handle bimodal lognormal distributions?)

    8.2. Uncertainty of measurement

    8.3. Material density and porosity correction

    8.4. …

9. References