

# PMP – Particle Measurement Program Informal Working Group

## Task Force 2– Brake Dust Sampling and Measurement

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Meeting #17 – Thursday 13 September, 2018, 14:00 – 15:00

### Minutes of Meeting – Final Version

**1. Tour de table:** Participants: AUDI-(SG) Sebastian GRAMSTAT; AVL-(TM) Thanasis MAMAKOS; BAM-(SS) Stefan SEEGER; BMW-(RL) Rasmus LEICHT; BREMBO-(FR) Francesco RICCOBONO; CARB-(SC) Sonya COLLIER; Ford-(JG) Jarek GROCHOWICZ; Ford-(CS) Christian SCHMIDT; Ford-(MM) Marcel MATHISSEN; HORIBA-(YO) Yoshinori OTSUKI; Hiro HAGINO; JRC-(TG) Theodoros GRIGORATOS; Link-(CA) Carlos AGUDELO; Opel-(OB) Olaf BAUSCH; TMD Friction-(IP) Ilja PLENNE; TSI-(SP) Stephan PERCOT; TU Ilmenau-(DH) David HESSE; TU Ilmenau-(TF) Toni FEISSEL.

**2a. Discussion on the document “Common Parameters for Testing”:** **Discussion on whether the cycle should be time or temperature controlled.** TG explained that based on the ToR the aim of the PMP group is to develop a common methodology for measuring brake wear emissions. This includes a standard brake cycle which will be similar for everyone. For that reason, the cycle should be time and not temperature controlled. However, it is fundamental to ensure comparability of the results from different set-ups. JG presented Ford’s proposal on how to proceed with the emissions measurements. This can be summarized to the following:

- Run the time controlled cycle with the standard set-up to replicate the vehicle’s temperature profile. Comparison of the temperature and wear in every location (variability study);
- Run the time controlled cycle with the emissions set-up. Record the temperature profile, compare with the vehicle, and report back to the TF2;
- If measured temperatures are identical to the vehicle no further actions are required and the emissions set-up can be used for particle measurement as it is.
- If temperatures significantly differ from the vehicle an adjustment will be required. Proposal for adjustment if temperatures differ 10% from the average and maximum temperature.

Ford proposed three different scenarios for the adjustment. First solution would be to adjust the incoming cooling air flow. If this is not possible the solution would be to change the brake intervals (make shorter or longer accordingly). FR asked if this is similar to temperature controlled profile. JG explained that it is not exactly since only brake intervals are affected to match the vehicle’s temperature. Last solution would be to run the temperature controlled profile. SS commented that chamber dimensions should play a significant role to the temperature profile and therefore they should be reported.

It was agreed to proceed with Ford’s proposal. For that reason brake parts similar to those used for the vehicle tests will be required. Ford will provide the parts. Brembo to check if discs of the same batch are available. Audi could provide an extra set for validation of the set-up with a second brake system of different dimensions. ALL MEMBERS TO DECLARE WHETHER THEY WOULD LIKE TO PARTICIPATE – FORD (AND AUDI) WILL NEED TO KNOW HOW MANY SETS ARE REQUIRED.

**2b. Discussion on the document “Common Parameters for Testing”:** **Discussion on common bedding-in procedure.** TG proposed to run 20 repetitions of the most demanding trip of the WLTP

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cycle instead of running the whole cycle 5 times. JG commented that most probably bedding-in will not be sufficient if we reduce the time by more than 50%. Ford will perform an energy dissipation check and come back on this aspect. SG suggested to run one WLTP before adjusting the cooling air flow. For emissions testing there was a consensus that 4-5 repetitions will be required for appropriately bedding-in the material.

**2c. Discussion on the document “Common Parameters for Testing”: Common method for measuring the brake temperature.** TG mentioned that a proposal for the temperature measurement will come from TF1. The method should be similar for all labs. SC asked about the use of sliding TCs. Ford clarified that the temperature adjustment was done with sliding TCs. JG mentioned that embedded TCs provide less variability and the final method should recommend embedded TCs.

**2d. Discussion on the document “Common Parameters for Testing”: Measurement of PM concentration based on the gravimetric method described in Chapter 5.** TG asked TF2 members to carefully study Chapter 5 prepared by Dekati and Brembo with the assistance of TSI and come back with questions regarding the procedure.

**2e. Discussion on the document “Common Parameters for Testing”: Estimation of the losses in the duct. Calculation of residence time in the duct.** TG explained that LINK PALS Macro is a relatively easy and free of charge way to have a first indication regarding the residence time and the duct losses. Labs are not obliged to use any of the suggested tools, however, they should report the aforementioned parameters based on their in-house applied methods. CA gave a short explanation on the use of LINK PALS Macro and the reason behind its creation. An invitation on how to use it will follow.

**TF1 members are working on the template for reporting the test results and will come back with a proposal (to be slightly adjusted in case of particle measurements).**

**3. Next Meeting:** Next TF2 meeting will take place on October 4<sup>th</sup>.