

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

Meeting #19 – Thursday 28 February, 2019, 14:00 – 15:00

Minutes of Meeting – Final Version

1. Tour de table: Participants: AUDI-(SG) Sebastian GRAMSTAT; AVL-(TM) Thanasis MAMAKOS; AVL-(MA) Michael ARNDT; BMW-(RL) Rasmus LEICHT; BMW-(KL) Katharina LAMMEL; BREMBO-(FR) Francesco RICCOBONO; Ford-(MM) Marcel MATHISSEN; Federal Mogul-(MM) Marcus MORBACH; GM-(MR) Matt ROBERE; HORIBA-(DL) Dmytro LUGOVYY; ITT-(SA) Simone ANSALONI; JARI-(HH) Hiro HAGINO; JRC-(TG) Theodoros GRIGORATOS; Link-(CA) Carlos AGUDELO; Link-(RV) Radi VEDULA; TMD Friction-(AP) Andreas PAULUS; TSI-(SP) Stephan PERCOT; TSI-(BA) Bob ANDERSON.

2. Soak time of novel cycle: TG briefly presented a slide describing the topic (see picture below).

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Topic: Soak time - Brake temperature at the beginning of the individual trips of the novel cycle

Problem description: Long soak times required for the brake to reach the starting temperature of each trip result in a prolongation of the cycle. This creates logistic and practical problems. Additionally, long soak times might introduce artefacts particularly in the measurement of PM emissions as air flow is applied in order to cool down the brakes faster.

Question: Would it be possible to reduce soak times to the expense of accuracy in the initial temperature? What would be the influence of higher initial brake temperature to the overall temperature profile and thus to the emissions?

Useful Data: Run the cycle with full soak times against running it by setting a maximum soak time for trips that do not reach the temperature immediately (i.e. 5 min) and compare average and maximum cycle temperatures. Additionally, if possible record PM and PN emissions of the two different options by using the same brake materials and operating conditions.

Desirable solution: Agree on a common way to run the cycle for the emission measurement campaigns with regards to the application of soak time.

During the previous meeting TG asked TF2 participants to bring data regarding the topic of long soak times between the trips. Related question raised by SC regards the measurement of PM and PN emissions during soak time as this may introduce an artefact.

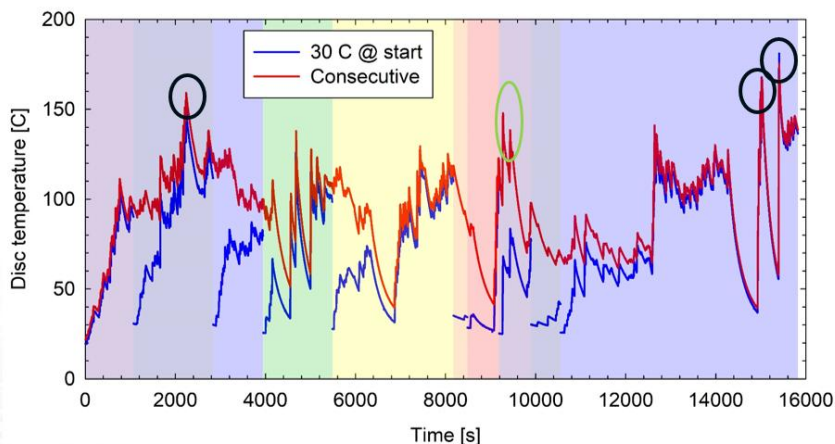
A discussion regarding different experiences with the application of the novel cycle took place. DL mentioned a total time of 20 min for soak times during the whole cycle, while CA mentioned approximately 180 min. TM reported more than 4h of soak times. These differences reflect the magnitude of the problem.

TM presented some slides from a measurement campaign of AVL at TU Ilmenau. Temperature profile with and w/o the application of soak times is depicted below. A cooling air flowrate of 270 m³/h which corresponds to approximately 40 km/h was applied. No significant differences in the average and maximum temperatures were observed. ***TM to report average and maximum temperature for both options as well as detailed soak time for each individual stop.*** Measurement of cycle average solid PN concentrations showed no significant difference between the two versions.

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Disc temperature profiles



Start temperature did not affect the peak temperature in the different segments.

One notable exception being trip 8.

CA mentioned that rotation of the disc during soak time is an important parameter that could reduce significantly the duration. Also enclosure design should be taken into account. DL mentioned that maybe the key parameter is not the air speed but the total amount of air cooling the brake system. Link will provide some more data during the next meeting.

Possible Solutions – The following options exist in order to avoid long soak times: Run the cycle without soak times, run the cycle with a fixed duration for all soak times (i.e. 5 min), increase the target starting temperature of the brake system (i.e. 40°C). In any case recommendations on how other technical aspects (i.e. rotation of the disc, measurement of PN emissions, etc.) should be handled need to be decided.

3. Next Meeting: Next TF2 meeting will take place on March 14th. Topic of the meeting will be soaking times. New data will be added for evaluation in TF2.