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

Meeting #39 – Wednesday 13 APRIL 2022 15:00 – 17:00 CEST

Minutes of Meeting – Final Version

1. Participants: As in the file ***"39th TF2 Meeting Attendance"*** uploaded in TEAMS.

2. Introduction: Theo Grigoratos (TG) welcomed the TF2 members and informed the group regarding the status of the previous clauses. Today's meeting is dedicated to the presentation and discussion of proposals for amendments in Clauses 3-5 of the TF2 protocol. The proposed text has been submitted to TEAMS and comments are requested by Thursday 21.04 COB. The consolidated text will be brought again to the TF2 for a final review before its submission to the PMP group for approval.

3. Clauses 3-4 presentation: TG provided a presentation related to the proposed amendments in Clauses 3-4 of the TF2 protocol. The details of the proposal and the data-supported evidence are summarized in the attached presentation "GTR - Clauses 3-5". The amended text is available in the submitted document "PMP Brake Protocol - Clause 3-5 Clean". Three different sub-clauses have been introduced in the newly formulated Clause 3:

Clause 3.1: Provides general information related to the cooling airflow/speed measurement – Specifications for the measurement device have been adopted from the GTR 15 – The necessity for measuring the flow accurately was demonstrated – Provisions for the measurement accuracy have been introduced – Proposal to locate the flow measurement downstream of the sampling location – Compliance criteria regarding the exact position are proposed

PM Isokinetic sampling requires that tunnel flow violations both are restricted – Data show that 68% of the ILS tests were performed with less than 1% flow/speed violations – Proposal to keep the average cooling air flow/speed within ±5% of the set value – Provisions also for the instantaneous flow/speed have been discussed – Provisions on how to correctly report flow/speed were also introduced;

Clause 3.2.: Discusses the proposals relative to the dynamometer climatics and the effective cooling air conditioning – No major changes compared to the previous version of this Clause have been introduced – Data show that temperature was easily handled by the labs – Relative humidity was also successfully handled with some exceptions – Suggestions for minor amendments related to the instantaneous signals have been introduced;

Clause 3.3.: Discusses the cooling air background concentrations – A short analysis of the ILS results related to the background and the actual PN emission levels was presented – Scenarios on what would be the background levels were also analyzed – There is a need to limit background concentrations to 10^8 #/km; therefore, a limit value of 10 #/cm^3 is proposed based on the ILS data and emission levels.

Clause 4: Issues with measuring the brake pads temperature have been reported – Proposal to remove the specification for measurement of pad/shoe temperature from the GTR – Official emissions testing shall not be compromised by interferences or artificial temperature increase.

Many discussions took place during the presentation. Dmytro Lugovyy (DL) asked whether the specification of the 2% accuracy for the flow/speed measurement device would eliminate certain sensors from the market – TG explained that there are sensors available that achieve this accuracy and this spec is applied in the exhaust regulations and should not be a problem for the brake emissions protocol.

A discussion regarding differences in measurements of the flow upstream and downstream followed. Carlos Agudelo (CA) asked if the PM/PN sampling flows were considered when comparing upstream vs. downstream – TG replied that this should be checked again for verification. Heinz Bacher (HB) commented that measuring downstream could be interfered by particle deposits. TG replied that ILS data shows that despite the difficulties it is possible. HB added that differences between upstream and downstream flow could be due to sensor inaccuracies or temperature and humidity correction and commented that leak checks could be tricky and difficult to perform. TG mentioned that probably labs used the same instruments meaning that sensor inaccuracies should be canceled out; however, this is not verified. A discussion on the possibility of restricting bends followed – CA mentioned that this might be necessary since allowing for 180° bends could lead to erroneous flow measurements.

A discussion on the proposed ±5% deviation of the nominal flow followed. Ravi Vedula (RV) proposed to introduce a graph similar to that of speed to be used as an example. HB commented that 5% might be too high if we want to achieve accurate PM measurements. TG agreed and commented that data support even lower deviations. Comments will be submitted by the group to lower the proposed maximum allowed deviation. Christoph Weidinger (CW) asked whether these specs apply also for bedding – TG commented that they shall not be necessary; however, it shall be specified that bedding shall be carried out with the same flow.

A discussion on the temperature and relative humidity results followed. A suggestion for the implementation of absolute humidity recommendations instead of relative humidity was introduced by AVL. TG explained that if a thorough analysis can support certain limit values it could be considered. So far, only results and analysis with relative humidity data are available. HB proposed to set the temperature value from 20°C to a value of 23°C to enable the comparison of regen-technologies with vehicle tests. TG replied along the same lines – data for making decisions about these changes are missing at this point. TG asked the TF2 to provide their views on these suggestions.

Finally, a discussion on the proposed background limit of 10 #/cm^3 followed. TG demonstrated with data that higher background levels are not suitable for measuring brake PN. Technical issues shall be tackled. It seems difficult to implement a background level as a percentage of the emissions as this would allow for different labs to have different specs on the same test.

TF2 participants are invited to submit their proposal on the draft amended text by Thursday 21 April EOB.

4. Next Meeting: The next meeting will take place on Wednesday 20.04.2022 from 15.00-17.00. The topic will be Clause 6 of the TF2 protocol. Clause 11 related to reporting will also be discussed.