Particle Measurement Programme

PMP-IWG

Non-Exhaust Emissions Updates

Theo Grigoratos and Barouch Giechaskiel

01 DEC 2021
AGENDA ITEM 3a
TIMELINE FOR THE GTR

Theo Grigoratos & Barouch Giechaskiel
GTR Preparation - Related Documents

- A “technical report” that briefly describes the process used to develop the GTR – to be submitted as GRPE Informal Document at the JAN 2023 session;
- A “technical rationale and justification” which describes the technical issues to be solved with the GTR – to be submitted as GRPE Informal Document at the JAN 2023 session;
- The text of the GTR itself which is found right after the "technical rationale and justification".

A draft version of the GTR to be submitted as Informal Document at the JUN 2022 session for consideration

Final GTR to be submitted as Working Document for OCT 2022 in order to be considered for JAN 2023
Roadmap to the GTR – Timeline

Completion of the ILS exercise – Submission of the results to the SC

High level PM/PN results for repeatability and reproducibility of the proposed method

Incorporation of the regenerative braking concept to the method

Completion of the draft GTR to be submitted in June GRPE session

Deadline for comments to the draft GTR - Final modifications

Submission of the draft GTR at the June GRPE session – Request for comments on the draft GTR

Submission of the final Working Document (GTR) for adoption at the January 2023 GRPE session

Submission of the “technical report” and “technical rationale and justification” – Adoption of the GTR

Preparation of the draft GTR

Refinement of methodologies

Introduction of “lessons learnt” from the ILS to the proposed method

PMP Activities

TF2 Activities

TF3 Activities

TF4 Activity
AGENDA ITEM 3b
TF3 UPDATE ON THE ILS

Theo Grigoratos
InterLaboratory Study - Objectives

✔ Verify the feasibility and applicability of the defined minimum specifications for sampling and measuring brake emission particles (TF2 Output);

✔ Provide recommendations to the TF2 on further improving and/or extending the set of the defined specifications;

✔ Examine the repeatability and reproducibility of PM and PN emission measurements with the application of the defined specifications;

✔ Examine the repeatability and reproducibility of test conditions (i.e. speed, torque, temperature) with the application of the defined specifications;

✔ Propose alternatives that can improve the efficiency of some of the methods and specifications proposed (i.e. bedding procedure)
# Task Force 3 at a Glance

**Organization – Management**

T. Grigoratos (JRC)

**Steering Committee***

C. Agudelo (LINK), B. Giechaskiel (JRC), S. Gramstat (AUDI), J. Grochowicz (FORD), T. Mamakos (AVL) and M. Mathissen (FORD)


**OEM Brake providers:** AUDI (S. Gramstat), BMW (K. Kolbeck, J. Von-Wild), FORD (R. Vogt, J. Grochowicz, M. Mathissen), STELLANTIS (O. Bausch, D. Ehrlich), VW (J. Niediek)

*The main role of the SC is 1. Support the preparations of the ILS, 2. Handle questions and feedback to TF3 colleagues related to various aspects during the testing campaign, and 3. Assist with data processing and possible publications*
## Hardware – Tested Brakes

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<thead>
<tr>
<th>Brake</th>
<th>Mandatory</th>
<th>OEM - Model</th>
<th>Axle</th>
<th>Vehicle Test Mass</th>
<th>Nominal Dyno WL</th>
<th>Applied Dyno WL</th>
<th>Brake Force Distrib.</th>
<th>Rolling Radius</th>
<th>Nominal Test Inertia</th>
<th>Applied Test Inertia</th>
<th>Disc or Drum</th>
<th>Calliper Type</th>
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# ILS – Current Status (26.11.2021)

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- **Completed tests 34%**
- **On-going tests 9%**

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**Test Completed**  **Test On-going**  **Not decided**  **Lab Completed**
AGENDA ITEM 3c
UPDATE ON TF4 ACTIVITY

Jarek Grochowicz & Theo Grigoratos
Task Force 4 – Overview

✓ TF4 aims in proposing a simplified approach for generalizing the PMP brake emissions testing procedure to electrified vehicles featuring regenerative braking (Mild-Hybrids, Full Hybrids, PHEVs, and BEVs)

✓ The TF4 group is moderated by FORD (J. GROCHOWICZ) and JRC (T. GRIGORATOS). TF4 includes 125 participants from 59 entities, worldwide – So far, an average number of 57 participants attended the meetings

✓ Six TF4 meetings have already taken place – the group meets on a weekly basis since the beginning of November. The aim is to submit the final proposal to the PMP IWG by the end of March 2022

✓ The minutes of the meetings, technical presentations, and other material related to the testing specifications are available on TEAMS and will become available on the PMP website
Task Force 4 – Roadmap (Completed and Ongoing Items)

- High Level Approach: Brake Community in agreement with Powertrain Departments proposes a simplified methodology for testing of electrified vehicles*, relying on literature/norms for the method definition whenever possible:
  - Agreement on powertrain types to be reflected in the procedure (Completed)
  - Agreement on the test setup: Identical setup as for the Internal Combustion Engine (ICE) vehicles (Completed)
  - Agreement on test cycle: Same test cycle as for ICE vehicles – Bedding procedure similar to that of ICE vehicles (Completed)
  - Recuperation strategies must be replicated on brake dynamometer (Updated recuperation simulation algorithms designed and implemented on one dyno type). Proposal of TF4: Other dyno manufacturers follow this or a similar/equivalent dyno functionality approach (Ongoing)

- Team decision (UNECE PMP Group) if this is a feasible/reasonable approach
- Conduct a small scale measurement campaign to test robustness of the procedure
Task Force 4 – Roadmap (Next Steps)

✓ High Level Approach: Brake Community in agreement with Powertrain Departments proposes a simplified methodology for testing of electrified vehicles*, relying on literature/norms for the method definition whenever possible:

  • Agree with Powertrain Representatives on realistic boundary conditions and settings for parameters specific for EVs.
  • Ensure that the test can be run by independent laboratories
  • Estimate to which degree this approach represents real vehicle behavior: Target to be discussed and defined xx% (e.g. dissipated energy and in-stop brake behaviour)

✓ Team decision (UNECE PMP Group) if this is a feasible/reasonable approach
✓ Conduct a small scale measurement campaign to test robustness of the procedure
AGENDA ITEM 1b
TYRES AND GRBP

Theo Grigoratos & Barouch Giechaskiel
The GRBP (Groupe Rapporteur Bruit et Pneumatiques – Working Party on Noise and Tyres) has prioritised the development of a Tyre Abrasion Test method.

1) Method for rating tyres based on their abrasion performance

2) Quantification of microplastic emissions from tyres

3) Correlation between abrasion rate and durability of tyres

A common Task Force between GRBP and GRPE will address the issue of tyre abrasion and particle emissions from tyre wear following the development of the method and in collaboration with the LEON-Project (2nd Phase – Beyond 2023).

Proposal: A small group (5 members) from the PMP to actively participate at the relative GRBP Working Group meetings – Expression of interest to Theo Grigoratos (Note At the PMP ToR: Only monitoring)
AGENDA ITEM 4
ANY OTHER BUSINESS

David Hesse and Philipp Eichler
German Environment Agency
On-going project with TU Ilmenau (Germany)

✓ Project goal: Contribution to the environmental impact of brake wear particles of different brake systems available on the market as well as the reduction potential of new technologies:
  
  • Disc and drum brakes of different dimensions; Comparison of front and rear axle brakes
  • Alternative friction materials (Coated and Grey Cast Iron Discs; variation of brake pad mixture)
  • Potentials of emission reduction through regenerative braking (PHEV + BEV)

✓ Measurements according to the PMP brake emission protocol (and use of additional measuring devices); Identification of characteristics/properties per tested brake (emission factors, particle size distribution, bedding-in, ...) and support of PMP activities with the generated results

✓ Time frame of the project: 02/2021 to 01/2024 - From Q3/2022 Tire Emissions: Application and validation of a proposed abrasion rate method; Determination of wear emission factors from different tire types/dimensions; Option: PM$_{10}$ and PM$_{2.5}$ fractions
Thank you