PARTICLE MEASUREMENT PROGRAMME

PMP-IWG Meeting – 09 January 2023

“GTR on Brake Emissions”
Final Updates

Theo Grigoratos and Barouch Giechaskiel

Joint Research Centre

BRAKE EMISSIONS GTR
1. HARMONIZATION

Technical Rationale

Current text in paragraph 3: “… Furthermore, different countries will show varying levels of development, population densities, and costs associated with braking system technology. Consequently, the regulatory stringency of legislation is expected to vary from region to region for the foreseeable future. ***Therefore, the definition of emission limit values is not part of this UN GTR.***”

Comment: It is ok not to have in this version of the GTR a harmonized limit goal for brake emissions but we may introduce a sentence stating that the aim is still to have globally harmonized emission limits for brake particulate emissions

Proposal by GRPE chair in paragraph 3: “…Consequently, the regulatory stringency of legislation is expected to vary from region to region for the foreseeable future. Therefore, the definition of emission limit values is not part of this UN GTR. ***Nevertheless, the long-term goal is still to define globally harmonized performance requirements and emission limits in forthcoming amendments to this GTR.***”

BRAKE EMISSIONS GTR
2. EMISSION FAMILIES

Some GRPE CPs and other stakeholders questioned whether the current definition of the emission families ensure equivalent emissions behaviour – as an example some PMP stakeholders mentioned two similar brake systems with friction materials that may differ only regarding their chemical composition (e.g. one being more abrasive compared to the other).

The text has been amended as follows: A brake family is defined by a brake assembly considering the calliper, disc or drum, pad or shoe, and certain vehicle parameters:

- ✓ Type of calliper (floating or fixed calliper, number and size of pistons, type of retraction elements);
- ✓ Type of brake: disc (friction surface, single, dual, ventilated, solid, dimensions, mass, ***material formulation***) or drum-backplate assembly (friction surface, simplex, duplex, dimensions, mass, ***material formulation***);
- ✓ Type of friction material: pad (friction surface, size, shape, material, backing plate, ***material formulation***) or shoe (friction surface, size, design, material, backing plate, ***material formulation***).

BRAKE EMISSIONS GTR
3. NON-FRICTION BRAKING

Vehicle Type	Non-Friction Braking Coefficient (c)
NOVC-HEV Cat. 1	**0.63**
NOVC-HEV Cat. 2	**0.45**
OVC-HEV	**0.30**
PEV	**0.15**

- ✓ *The coefficients were elaborated considering the worst performing vehicle in each category and applying a 20% correction to take into account the change in the cycle (OICA correlation);*
- ✓ *Two tests with BEV2 were treated as outliers due to their high values of friction share compared to other JRC, OICA, and third-party data;*
- ✓ *Only one data point available in the NOVC-HEV Cat. 2 – Coefficient calculated considering a 20% correction to take into account that the execution of the brake dyno test assumed a full regen capability over the entire test;*
- ✓ *A footnote was added stating that "A detailed testing methodology to determine vehicle-specific coefficients will be included in the first amendment to this UN GTR".*

BRAKE EMISSIONS GTR
4. DEFINITION OF NOVC-HEV

Definition of NOVC-HEV Cat. 1

Problem: GRPE CPs (UK, Germany) and other stakeholders questioned whether the current definition and the corresponding emissions coefficient for NOVC-HEV Cat 1. cover adequately also low capacity battery mild-hybrids – Additionally some commented that the current definition allows for applying the 0.63 coefficient to ICE vehicles by simply introducing a 12V battery and making them low capacity mild-hybrids.

	Battery size [Wh]							
	count	mean	std	min	25%	50%	75%	max
Drive battery nominal voltage [V]								
12.0	3	120	N/A	120	120	120	120	120
13.0	1	130	N/A	130	130	130	130	130
14.0	10	344	401	154	154	154	154	1106
21.6	24	216	N/A	216	216	216	216	216
25.0	6	2010	11	2000	2000	2010	2020	2020
44.0	81	568	219	334	440	440	880	880
44.2	14	469	99	386	386	386	580	580
44.4	6	407	57	333	361	444	444	444
45.0	12	441	N/A	441	441	441	441	441
46.0	1	874	N/A	874	874	874	874	874
46.2	33	790	241	370	924	924	924	924
47.8	4	459	N/A	459	459	459	459	459
48.0	75	442	55	384	384	470	470	662

- ✓ *5% of the registered mild-hybrids have a battery lower than 20V – capacity lower than 0.2 kWh (14/270 vehicles);*
- ✓ *The vast majority of mild-hybrids have a battery of at least 22V and a capacity of >0.2 kWh;*
- ✓ *The worst-case of 0.63 was derived using data from a 24V and a 48V mild-hybrids.*

Data from WLTP test data that Type-approval authorities shall submit to the COM according to Article 14 of the (EU) 2021/392 on the monitoring and reporting of data relating to CO2 emissions from passenger cars and light commercial vehicles.

BRAKE EMISSIONS GTR
4. DEFINITION OF NOVC-HEV

Definition of NOVC-HEV Cat. 1

Proposed solution – current text has been amended to include an additional provision: "Not off-vehicle charging hybrid electric vehicle – Category 1" (NOVC-HEV Cat. 1) means a hybrid electric vehicle that features a traction REESS with a nominal voltage ***higher than 20V and*** lower than or equal to 60V that cannot be charged from an external source.

- ✓ Vehicles with a battery lower or equal to 20V will be treated as ICE and calculate their emissions using a coefficient of 1.0;
- ✓ Table 5.1 shall be amended accordingly to include other vehicle types not covered with the emissions coefficient of 1.0;
- ✓ Any possible overestimation of PM/PN emissions of these vehicles will be corrected with the introduction of a testing method to determine vehicle-specific friction braking share coefficients.

Brake type	*Vehicle Type*	*Friction Braking Share Coefficient (c)*
Full-friction braking	ICE ***and other vehicle types not covered in the non-friction braking categories in this table***	1.0
Non-friction braking	NOVC-HEV Cat.1	0.63
	NOVC-HEV Cat.2	0.45
	OVC-HEV	0.3
	PEV	0.15

BRAKE EMISSIONS GTR
5. RECOMMENDED VALUES

Enclosure recommended values

During the PMP on 13.12.2022 it was proposed to use the following recommended values for the enclosure: *(a) It is recommended to design an enclosure with a length close to 1350 mm; (b) It is recommended to design an enclosure with a height close to 600 mm; (g) It is recommended to design an enclosure with an axial depth close to 400 mm*.

JRC proposed to withdraw the recommended values for the enclosure dimensions from the GTR if these were not acceptable to all PMP members.

OICA communicated its objection on the use of recommended values in this GTR version; therefore, they were removed from the document.

A few other recommendations have also been removed to avoid confusion (e.g. for the PM sampling line the sentence "A sampling line with a constant inner diameter close to 15 mm is recommended" was removed).

Thank you

European Commission