



# 54<sup>th</sup> PMP IWG Meeting

## GTR No. 24 1<sup>st</sup> AMENDMENT



UNITED NATIONS

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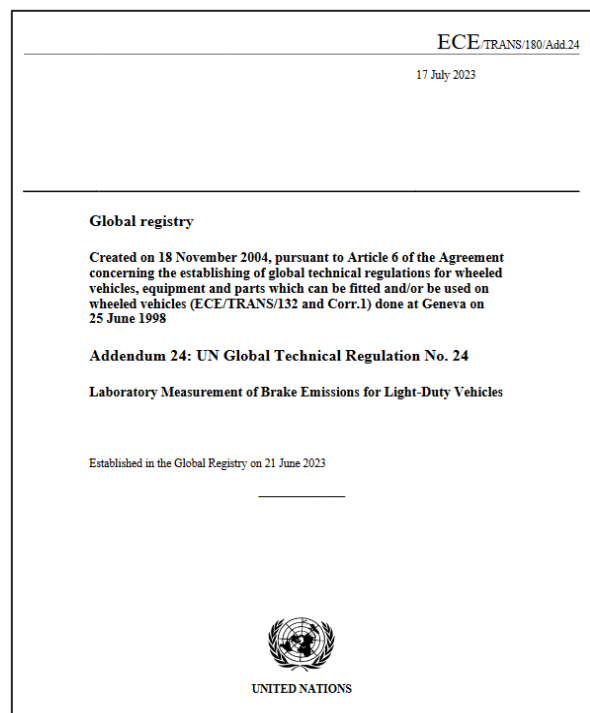
*Geneva, 9<sup>th</sup> Jan 2024*

Joint  
Research  
Centre

# 1<sup>ST</sup> AMENDMENT TO GTR-24 – OVERVIEW

The current version of the UN GTR No. 24. as of 09.01.2024 was adopted by the WP.29 on 17.07.2023. The document is available at:

<https://unece.org/transport/documents/2023/07/standards/un-gtr-no24-laboratory-measurement-brake-emissions-light-duty>



***Different elements of the 1<sup>st</sup> amendment of the UN GTR No. 24. have been discussed and addressed in 5 PMP Meetings in 2023:***

- 2023-04-27: PMP Webconference (exhaust and non-exhaust)
- 2023-05-24: PMP Webconference (non-exhaust)
- 2023-06-29: PMP Webconference (non-exhaust)
- 2023-09-28: PMP Webconference (non-exhaust)
- 2023-11-22: PMP Webconference (non-exhaust)

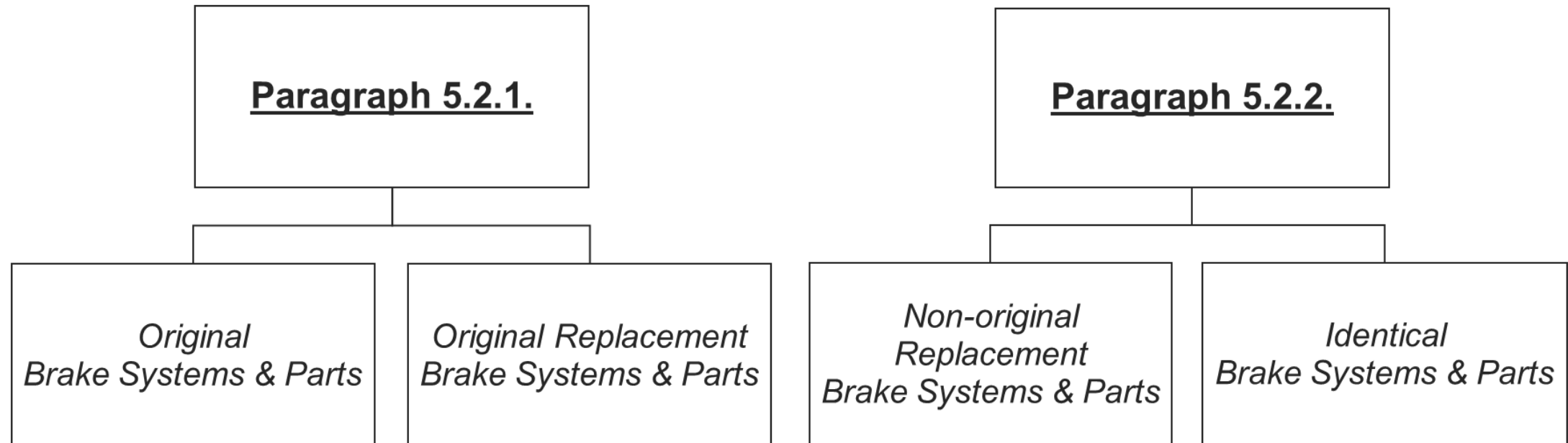
# 1<sup>ST</sup> AMENDMENT TO GTR-24

## MAIN POINTS

- ✓ Definition of original and replacement parts and definition of brake families for non-original replacement parts (i.e. aftermarket parts);
- ✓ Refinement and adjustment of fixed friction braking share coefficients representing the worst-case scenario in each vehicle category;
- ✓ Addition of Annex C with a procedure for the determination of the vehicle-specific friction braking share coefficient on a chassis dynamometer;
- ✓ Definition of different temperature parameters for the cooling air adjustment of carbon-ceramic disc brakes;
- ✓ Definition of active and passive filtration systems – Introduction of a requirement for active filters and agreement on the need for further specs.

# 1<sup>ST</sup> AMENDMENT TO GTR-24 REPLACEMENT PARTS


- ✓ Definitions for original and non-original replacement as well as for identical parts have been added to the GTR-24. These cover disc brake pads, drum linings, discs, and drums.
- ✓ Definition of brake families for original and non-original replacement parts (i.e. aftermarket parts) have been elaborated.



# 1<sup>ST</sup> AMENDMENT TO GTR-24 FIXED FRICTION SHARE COEFFICIENTS

- ✓ A new category was added to cover mild-hybrids with smaller batteries. NOVC-HEV Cat. 0 covers mild-hybrids with a traction REESS nominal voltage between 12-20V;
- ✓ The c factors in Table 5.3 of the GTR-24 (ex-Table 5.1) were recalculated using a correction ( $1/0.87=1.15$ ) for aligning the c definition in the two cycles as it is defined in the newly introduced Annex C.

Brake type	Vehicle Type	Friction Braking Share Coefficient (c)
Full-friction braking	ICE and other vehicle types not covered in this Table	1.0
	NOVC-HEV Cat.1	0.63
Non-friction braking	NOVC-HEV Cat.2	0.45
	OVC-HEV	0.30
	PEV	0.15



Brake type	Vehicle Type	Friction Braking Share Coefficient (c)
Full-friction braking	ICE and other vehicle types not covered in this Table	1.0
	NOVC-HEV Cat.0	0.90
Non-friction braking	NOVC-HEV Cat.1	0.72
	NOVC-HEV Cat.2	0.52
	OVC-HEV	0.34
	PEV	0.17

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## ANNEX C

During the 87<sup>th</sup> GRPE session, the GRPE requested the PMP to develop a procedure for the determination of the vehicle-specific friction braking share coefficient. Annex C was developed for this purpose. The contents are:

- ✓ **Purpose of Annex C** (A paragraph describing why Annex C was developed);
- ✓ **Scope and Application** (A paragraph providing details about the scope of Annex C and how this shall be applied in the context of the GTR-24);
- ✓ **Reference Method and Calculation** (Details about the reference and the alternative methods along with the subsequent calculations are provided);
- ✓ **Testing Setup and Specifications** (Details about the vehicle selection, test preparation, data recording, chassis dynamometer settings, and test sequence are provided);
- ✓ **Equivalency of Methods** (Specifications regarding the selection of vehicle, testing of the alternative method, and equivalency criterion are given);
- ✓ **Equivalency of Test Cycles** (Discusses what alternative cycles shall be used);
- ✓ **Test Output** (Discusses what provisions shall be followed when declaring the test results).

# 1<sup>ST</sup> AMENDMENT TO GTR-24 CARBON CERAMIC DISCS

- ✓ “Carbon-ceramic disc“ means a brake disc manufactured of a carbon fiber reinforced ceramic matrix material with or without a ceramic friction layer;
- ✓ The group classification in Table 10.2 may be unrealistic for some carbon-ceramic discs as they show different temperature behavior;
- ✓ For this reason, more relaxed temperature parameters for the cooling adjustment of carbon-ceramic disc brakes have been defined. Additionally, definition for CC discs has been added in the GTR-24.

Table 10.2.

**Default temperature metrics and tolerances for brakes during Trip #10 of the WLTP-Brake cycle**

<i>Group</i>	<i>ABT [A<sub>1</sub>]</i>	<i>IBT [A<sub>2</sub>] ± Tolerance</i>	<i>FBT [A<sub>3</sub>] ± Tolerance</i>
$WL_{n-f}/DM \leq 45$	$\geq 50 \text{ }^\circ\text{C}$	$65 \pm 25 \text{ }^\circ\text{C}$	$95 \pm 35 \text{ }^\circ\text{C}$
$45 < WL_{n-f}/DM \leq 65$	$\geq 55 \text{ }^\circ\text{C}$	$75 \pm 25 \text{ }^\circ\text{C}$	$115 \pm 35 \text{ }^\circ\text{C}$
$65 < WL_{n-f}/DM \leq 85$	$\geq 60 \text{ }^\circ\text{C}$	$85 \pm 25 \text{ }^\circ\text{C}$	$130 \pm 35 \text{ }^\circ\text{C}$
$WL_{n-f}/DM > 85$	$\geq 65 \text{ }^\circ\text{C}$	$95 \pm 25 \text{ }^\circ\text{C}$	$150 \pm 35 \text{ }^\circ\text{C}$

## 10.1.2 Verification of Parameters and Tolerances for Brake Temperature

(a) ... **For carbon-ceramic disc brakes, the default temperature metrics apply; however, the ABT [A1] temperature metrics are lowered by 15 °C and the tolerances to the low end of the temperature regime for the IBT [A2] and FBT [A3] are further relaxed by 15 °C;**

# 1<sup>ST</sup> AMENDMENT TO GTR-24 FILTRATION SYSTEMS

- ✓ Definitions of active and passive filtration systems have been added to the regulation;
- ✓ Specific requirements need to be defined to account for the activation of the blower in active filtering devices when testing on the brake dyno;
- ✓ For the time being, these systems are allowed to be tested according to the GTR-24 for their emissions as long as all specifications defined in the GTR are met (e.g. temperatures, dimensions, cooling airflow, etc.);
- ✓ Following the PMP discussions, the proposal for the 1<sup>st</sup> amendment is to define the activation of the filtering devices through dedicated dyno signals and allow for some time for the pump to run AFTER the end of the braking event. This time has been set to 5 sec after the end of the brake event;
- ✓ Following the PMP discussions, it was decided that a more elaborated analysis on the specifications of the active filters will be introduced in the next amendment to the GTR-24.



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## OTHER CHANGES

- ✓ Off-road vehicles have erroneously been excluded from the scope of the GTR instead of the intended non-road machinery. This has been corrected in the 1<sup>st</sup> amendment;
- ✓ It was reported that the placement of the dial gauge tip causes issues during the temperature measurement of the discs. The specification has been amended to correct the measurement point;
- ✓ Multi-filter holders have been allowed to better automate the testing procedure. Additional requirements have been specified for multi-filter holders in paragraph 12.1.3.1.;
- ✓ Post-sampling conditioning specifications have been relaxed. The filters may remain in the testing room for more than 8h provided that they remain sealed within the filter holder and that the conditions in the testing room are stable for temperature and humidity;
- ✓ Typical filter loadings for low emitting brakes can be  $<30\mu\text{g}$ . The repeatability requirement for the repeated weighing is limited to  $10\mu\text{g}$  (instead of  $30\mu\text{g}$ ) and all corresponding values in paragraph 12.1.4. (g) have been adjusted accordingly;
- ✓ The calibration criterion for brake fluid displacement has been updated. This is  $\pm 0.5\%$  maximum in each one of 5 different fluid volumes from 1-20  $\text{cm}^3$ , or according to the manufacturer's specification.

# 1<sup>ST</sup> AMENDMENT TO GTR-24 – OVERVIEW

Proposal for the 1<sup>st</sup> Amendment to UN GTR No. 24 submitted as “working document” and main modifications submitted as “informal document” in October 2023 are available at:

<https://unece.org/transport/documents/2023/12/working-documents/track-iwg-pmp-proposal-new-amendment-un-gtr-no-24>

<https://unece.org/sites/default/files/2023-12/GRPE-90-06e.pdf>

Proposal for amending the working document of the 1<sup>st</sup> Amendment to UN GTR No. 24 submitted as “informal document” and main modifications submitted as “informal document” in January 2024 are available at:

<https://unece.org/transport/documents/2024/01/informal-documents/pmp-proposal-amend-ecetranswp29grpe20244>

<https://unece.org/transport/documents/2024/01/informal-documents/pmp-additions-grpe-90-06>



**Economic Commission for Europe**  
Inland Transport Committee  
World Forum for Harmonization of Vehicle Regulations:  
Working Party on Pollution and Energy  
Ninetieth session  
Geneva, 9–12 January 2024  
Item 24(a) of the provisional agenda  
**Particle Emissions**  
UN Global Technical Regulation No. 24  
(Light-duty brake emissions)

**Proposal for a new Amendment to UN GTR No. 24  
(Laboratory Measurement of Brake Emissions for Light-Duty Vehicles)**

Submitted by the Informal Working Group on Particle Measurement Programme (PMP) \*

This document proposes a new Amendment to UN GTR No. 24, as a consolidated version. The proposal includes a vehicle-specific non-friction braking measurement procedure, definition of brake emission families and other changes with the aim of improving the overall protocol. The modifications to the current text of the Regulation are marked in track changes.

\* In accordance with the programme of work of the Inland Transport Committee for 2023 as outlined in proposed programme budget for 2024 (A/78/6 (Sect. 20), table 20.5), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

# Thank you



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