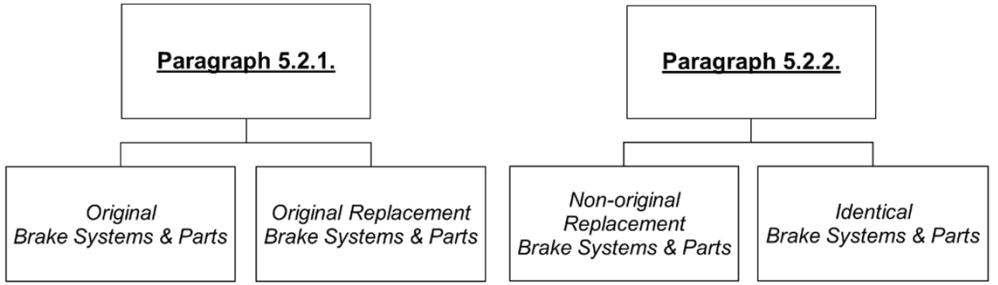
GTR-24 – First Amendment – Final changes

Topic/Problem	Explanation/Solution	Added Text
Main Text		
Paragraph 3.3.: Definitions for original, original replacement, identical, non-original replacement systems and part were either incomplete or missing.	Definitions from UNR No. 90 have been adopted for all types of brake parts and assemblies. Now, both regulations are fully aligned in terms of the definitions. Specific provisions apply for the emissions testing families that are not aligned with UNR No. 90 (for identical brake systems). This introduction also affected the numbering of the rest of the definitions in paragraph 3.3.	3.3.18. "Original brake parts" means either an original brake pad, an original brake pad assembly, an original drum brake lining, an original brake drum or an original brake disc. 3.3.18.1. "Original brake pad" means a brake pad type referenced in the vehicle type approval documentation according to UN Regulation No. 13, UN Regulation No.13-H, or UN Regulation No. 78. 3.3.18.2. "Original drum brake lining" means a drum brake lining conforming to the data attached to a vehicle type approval documentation. 3.3.18.3. "Original brake disc" means a brake disc covered by the vehicle braking system type approval according to UN Regulation No. 13, UN Regulation No.13-H, or UN Regulation No. 78. 3.3.18.4. "Original brake drum" means a brake drum covered by the vehicle braking system type approval according to UN Regulation No. 13, UN Regulation No.13-H, or UN Regulation No. 78. 3.3.19. "Identical brake parts" means either an identical brake pad, an identical drum brake lining, an identical brake drum or an identical brake disc. 3.3.19.1. "Identical brake pad" is a replacement brake pad which is chemically and physically identical to the original brake pad in every respect except for the vehicle manufacturer mark which is absent. 3.3.19.2. "Identical drum brake lining" is a replacement drum brake lining identical to the drum brake lining supplied and fitted as original equipment and included in the vehicle type approval to UN Regulation No. 13 or UN Regulation No. 13-H except for the vehicle/brake assembly manufacturers mark which is omitted. 3.3.19.3. "Identical brake disc" is a replacement brake disc which is chemically and physically identical to the original brake disc in every respect except for the vehicle manufacturer mark which is absent. 3.3.19.4. "Identical brake drum" is a replacement brake drum which is chemically and physically identical to the original brake disc in every respect except for the vehicle manufacturer mark which is absent.

		3.3.20. "Replacement brake parts" means either a replacement brake pad assembly type, a replacement drum brake lining type, a replacement brake drum, or a replacement brake disc. 3.3.20.1. "Original replacement brake pad" means an original brake pad intended for servicing the vehicle and carrying an identification code affixed in such a way as to be indelible and clearly legible. 3.3.20.2. "Non-original replacement brake pad" means a brake pad of a type approved under UN Regulation No. 90 as a suitable service replacement for an original brake pad. 3.3.20.3. "Original replacement drum brake lining" means an original brake drum lining intended for servicing the vehicle and carrying an identification code affixed in such a way as to be indelible and clearly legible. 3.3.20.4. "Non-original replacement drum brake lining" means a brake drum lining of a type approved under UN Regulation No. 90 as a suitable service replacement for an original brake drum lining. 3.3.20.5. "Original replacement brake disc" means an original brake disc intended for servicing the vehicle and carrying an identification code affixed in such a way as to be indelible and clearly legible. 3.3.20.6. "Non-original replacement brake disc" means a brake disc of a type approved under UN Regulation No. 90 as a suitable service replacement for an original brake disc. 3.3.20.7. "Original replacement brake drum" means an original brake drum intended for servicing the vehicle and carrying an identification code affixed in such a way as to be indelible and clearly legible. 3.3.20.8. "Non-original replacement brake drum" means a brake drum of a type approved under UN Regulation No. 90 as a suitable service replacement for an original brake drum. 3.3.20.9. "Identification code" identifies the brake discs or brake drums covered by the braking system approval according to UN Regulation No. 13 and UN Regulation No. 13-H. It contains at least the manufacturer's trade name or trademark and an identification number.
Paragraph 3.3.: Definitions for active and passive filters were missing.	Definitions for active and passive filters have been provided by CLEPA and introduced in the GTR. This introduction	3.3.21. "Passive brake filter systems" means the parts which are mounted additionally to the foundation brake system to collect the brake dust particles generated by the friction between brake disc and the brake pads. No additional energy is required during the usage of the brake filter system.

	also affected the numbering of the rest of the definitions in paragraph 3.3.	3.3.22. "Active brake filter systems" means components which are connected to the foundation brake system to collect the brake dust particles generated by the friction between brake disc and the brake pads. Additional energy is required during the usage of the brake filter system within the vehicle and on the brake dynamometer.
Paragraph 3.7.2: Non friction braking.	The definition has been amended to reflect the introduction of NOVC-HEV Cat. 0. Consequently, the minimum voltage of 12V has been introduced instead of the previously defined 20V cut-off point for defining non-friction braking.	3.7.2. "Non-friction braking" in the context of this UN GTR means the decelerating of the vehicle also by different technical means without using solely the friction braking system, e.g. such as regenerative braking. It applies to pure electric vehicles and hybrid electric vehicles with a traction REESS nominal voltage greater than ~~20V~~12V.
Table 4.2. (and other occurances in the text)	$C_{p,b}$ - Torque to pressure ratio of the considered brake b – Unit: N·m/bar. All pressure units in the GTR shall be referred to kPa and not bar.	$C_{p,b}$ - Torque to pressure ratio of the considered brake b – Unit: N·m/kPa. kPa has substituted bar 8 times throughout the GTR No. 24.
Paragraph 5.2.: Brake emissions family - Restructuring of the relevant chapter	Figure 5.1. has been added to provide clarity on which brakes shall be grouped into families based on 5.1.1. and 5.1.2. The text has been aligned accordingly. Text in red in the next column represent the newly introduced text. ~~Strikethrough~~ indicates deleted text. Captions in Tables 5.1. and 5.2. have been adjusted accordingly. Minor adjustment to 5.2.3. and 5.2.4. to reflect the introduced changes have also been done.	5.2.1. Characteristics of Brake Emissions Families for "Original" and "Original Replacement" Brake Parts and Systems All vehicle types, independent of their electrification grade, may be part of one brake emissions family. Only vehicles that feature an identical brake assembly with respect to the characteristics listed in (a)-(d) may be part of the same brake emissions family. This categorization applies to "Original" and "Original Replacement" brakes as defined in paragraphs 3.3.18. and 3.3.20. of this UN GTR, respectively: 5.2.2. Characteristics of Brake Emissions Families for "Non-Original Replacement" and "Identical" Brake Parts and Systems "Non-original replacement" and "Identical" ~~Brakes~~ brake parts or systems that feature the same characteristics as defined in (a)-(g) may be part of the same brake emissions family. Tables 5.1. and 5.2. provide an overview of the ~~families~~ family allocation for ~~original and~~ non-original replacement and identical disc and drum brakes as defined in paragraphs 3.3.20. and 3.3.19. of this UN GTR, respectively: Figure 5.1. provides a schematic representation of the brake emissions family allocation for the different types of brakes to paragraphs 5.2.1. and 5.2.2. of this UN GTR.

<table>
<tr><td></td><td></td><td> 
</td></tr>
<tr><td>Table 5.3. Friction braking share coefficients for all vehicle types</td><td>The values have been corrected accordingly to take into account the 0.87 in the denominator when calculating the friction braking share coefficient. Topic presented in more detail during the PMP on 22.11.2023. Values in red in the next column represent the newly introduced values. ~~Strikethrough~~ indicates deleted values.</td><td>
<table>
<tr><th>Brake type</th><th>Vehicle Type</th><th>Friction Braking Share Coefficient (c)</th></tr>
<tr><td>Full-friction braking</td><td>ICE and other vehicle types not covered in the non-friction braking categories in this Table</td><td>1.0</td></tr>
<tr><td>Non-friction braking*</td><td>NOVC-HEV Cat. 0</td><td>0.90</td></tr>
<tr><td></td><td>NOVC-HEV Cat. 1</td><td>0.~~63~~72</td></tr>
<tr><td></td><td>NOVC-HEV Cat. 2</td><td>0.~~45~~52</td></tr>
<tr><td></td><td>OVC-HEV</td><td>0.~~30~~34</td></tr>
<tr><td></td><td>PEV</td><td>0.~~15~~17</td></tr>
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</td></tr>
<tr><td>Paragraph 7.3. Brake Dynamometer and Automation Systems</td><td>Specification (a) for the brake dynamometer was outside the needs of the GTR No. 24. Thus, it has been updated accordingly. Text in red in the next column represent the newly introduced text. ~~Strikethrough~~ indicates deleted text.</td><td>The brake dynamometer shall consist of at least the following elements:
(a) A variable-speed electric motor to accelerate or keep the rotational speed constant~~. It also~~ and modulate~~s~~ the test inertia according to the testing needs ~~in real driving conditions and simulates non-friction braking~~;</td></tr>
<tr><td>Paragraph 9.2.3.: Provision for active filtering devices when testing on the brake dyno.</td><td>Following the PMP discussion on 22.11.2023 and the presentations from OICA and CLEPA, the proposal 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. The proposed addition reflects these conditions/requests. A more elaborated</td><td>9.2.3. Emissions Measurement Section
In case of active brake filtering devices, the testing facility shall use the “Brake Pressure” and “Linear Speed” signals to activate the filtering function at the brake event start time as defined in paragraph 13.1. In such a case, the active filtering function may be deactivated up to maximum 5 seconds after the brake event end time as defined in paragraph 13.1.</td></tr>
</table>

	analysis on the specifications of the active filters will be introduced in the next amendment to this GTR.	
Annex C		
Paragraph 2 – Scope and application	The proposed text allows for the use of the method described in Annex C for all vehicle categories with non-friction braking capabilities. However, there is no evidence how the method works for the newly introduced NOVC-HEV Cat. 0. Thus, it is proposed to exclude this category now and revisit its introduction when data become available. Text in red in the next column represent the newly introduced text. ~~Strikethrough~~ indicates deleted text.	The method described in Annex C may be applied to all vehicle types with non-friction braking capabilities, except for NOVC-HEV Cat. 0. It is meant as enhancement for Table 5.3. of this UN GTR and describes the methodology for establishing the vehicle-specific friction braking share coefficients for specific vehicle categories (i.e. ~~NOVC-HEV Cat. 0,~~ NOVC-HEV Cat. 1, NOVC-HEV Cat. 2, OVC-HEV, and PEV).
Paragraphs 3.2.2.3., 3.3.4., and 4.2.3. on Electromechanical Brakes	According to OICA, the procedure for electro-mechanical brakes is not maturely developed. In order not to hinder the development of this technology, OICA proposed to mention the need to develop the procedure for electromechanical in the second amendment. Therefore, the text in these paragraphs is deleted. After consulting with the GRPE secretariat the relevant paragraphs will be kept followed by the text “reserved”. This applies also to paragraphs 3.3.4. and 4.2.3. Several other parts mentioning features related to EMBs have been deleted. Equations in Annex C have been renumbered.	[3.2.2.3. Electromechanical Brakes ~~Method~~] [Reserved] [3.3.4. Calculation of C_e] [Reserved] [4.2.3. Sensors for Force Measurements on Electromechanical Brakes] [Reserved]
Paragraph 4.2.1.1. Piezoelectric sensors	Updated specifications have been submitted for sensor calibrations. Values not defined in the previous version have been defined. Text in red in the next	Sensor calibrations shall meet the following specifications: (a) The accuracy of the sensor system shall be within 2 per cent of full-range or ±5 Nm, whichever is greater; (b) The amplifiers for the torque sensors shall be adjusted to zero before the test with no brake torque applied to the system;

	column represent the newly introduced text. ~~Strikethrough~~ indicates deleted text.	(c) ~~Adjustments of more than [±X Nm] of full-scale are not permitted;~~ ~~(d)~~ After the test, the torque sensors shall be checked for zero drift. A maximum zero-drift of ~~[±X~~ 0.5 per cent ~~Nm]~~of full-scale is acceptable. The linearity of the sensor shall be checked according to the recommendation of the measurement system manufacturer. It shall not show residuals larger than 2 per cent of full-scale or ±5 Nm, whichever is greater at any point of the operational range above zero. The measurement system shall be compensated for temperature influence according to the manufacturer specifications. The reference calibration sensor shall be calibrated according to ISO 17025 within the last 12 month of usage.
Paragraph 5.3. Equivalency Criterion	In the previous version, the conditions under which the alternative method shall be deemed to be equivalent to the reference method were left open. This has been addressed in the current proposal.	The alternative method shall be deemed to be equivalent to the reference method if any of the following conditions is fulfilled: $\left\lvert\frac{c_{alt} - c}{c}\right\rvert \leq 10 \text{ per cent}$ $\lvert c_{alt} - c\rvert \leq 0.02$
Paragraph 7.1. Offset of the Friction Braking Share Coefficient ("Declaration")	In the previous version, this was paragraph 6.2. It defined that the vehicle-specific friction braking share coefficient could be increased by the manufacturer to cover statistical uncertainties. This has been limited to a certain extend and moved to reporting as it is more relevant. Text in red in the next column represent the newly introduced text. ~~Strikethrough~~ indicates deleted text.	The vehicle-specific friction braking share coefficient calculated according to this Annex may be increased by the manufacturer ~~to cover the statistical and procedural uncertainties~~ by up to 50 per cent of the measured value or 0.05 absolute value, whichever is greater.