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World Forum for Harmonization of Vehicle Regulations**Working Party on Brakes and Running Gear****Seventy-sixth session**

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Item 5(a) of the provisional agenda

Motorcycle braking – Regulation No. 78**Proposal for amendments to Regulation No. 78 (Uniform provisions concerning the approval of vehicles of categories L₁, L₂, L₃, L₄ and L₅ with regard to braking)****Submitted by the expert from the International Motorcycles Manufacturers Association***

The text reproduced below was prepared by the expert from the International Motorcycles Manufacturer Association (IMMA) to introduce amendments clarifying the current text on the use of Combined Braking Systems (CBS). The modifications to the current text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Paragraph 5.1.9, amend to read:

"5.1.9 In cases where two separate service brake systems are installed, the systems may share a common brake, ~~if a failure in one system does not affect the performance of the other~~ a common transmission, or both if the requirements of Annex 3, paragraph 12 are met."

Annex 3, insert new paragraph 12. to read:

"12. CBS failure test

12.1. General information:

(a) This test will only apply to vehicles fitted with CBS of which the separate service brake systems share a common brake, a common transmission or both;

(b) The test is to confirm the performance of the service brake systems in the event of a common hydraulic hose or mechanical cable failure.

12.2. Test conditions and procedure:

(a) Alter the brake system to produce a hydraulic hose or mechanical cable type failure causing a complete loss of braking in the portion of the system which is shared;

(b) Perform the dry stop test specified in section 4.3. in laden condition. Other conditions to be observed are 4.3.1. (c) and 4.3.2. (a), (b), (d), (e) and (f). Instead of the provisions in section 4.3.2. (c), only apply the control for the service brake system not affected by the simulated failure.

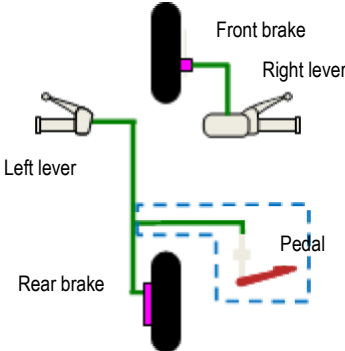
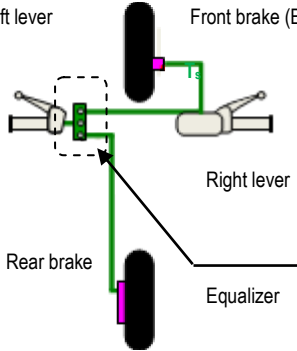
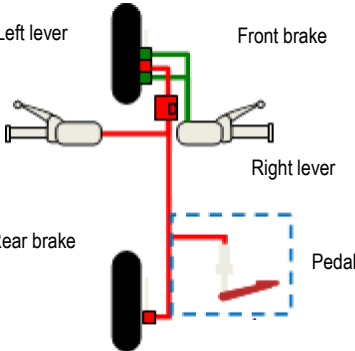
12.3. Performance requirements

When the brakes are tested in accordance with the test procedure set out in paragraph 12.2., the stopping distance shall be as specified in column 2 or the MFDD shall be as specified in column 3 of the following table:

Column 1	Column 2	Column 3
Vehicle Category	STOPPING DISTANCE (S) (Where V is the specified test speed in km/h and S is the required stopping distance in metres)	MFDD
Front wheel(s) braking only		
L ₁	$S \leq 0.1 V + 0.0111 V^2$	$\geq 3.4 \text{ m/s}^2$
L ₂	$S \leq 0.1 V + 0.0143 V^2$	$\geq 2.7 \text{ m/s}^2$
L ₃	$S \leq 0.1 V + 0.0087 V^2$	$\geq 4.4 \text{ m/s}^2$
L ₄	$S \leq 0.1 V + 0.0105 V^2$	$\geq 3.6 \text{ m/s}^2$
L ₅	$S \leq 0.1 V + 0.0117 V^2$	$\geq 3.3 \text{ m/s}^2$
Rear wheel(s) braking only		
L ₁	$S \leq 0.1 V + 0.0143 V^2$	$\geq 2.7 \text{ m/s}^2$
L ₂	$S \leq 0.1 V + 0.0143 V^2$	$\geq 2.7 \text{ m/s}^2$
L ₃	$S \leq 0.1 V + 0.0133 V^2$	$\geq 2.9 \text{ m/s}^2$
L ₄	$S \leq 0.1 V + 0.0105 V^2$	$\geq 3.6 \text{ m/s}^2$
L ₅	$S \leq 0.1 V + 0.0117 V^2$	$\geq 3.3 \text{ m/s}^2$

II. Justification

1. The current provision in UN Regulation No. 78 (para. 5.1.9), requiring that "two separate brake systems may only share a common brake if a failure in one system does not affect the performance of the other", limits the application of Combined Brake Systems (CBS).
2. Not all CBS architectures can meet this requirement although they will outperform conventional brake systems.
3. Not all CBS architectures were however considered at the time the original CBS requirements were drafted (in the 1980s) and it is therefore understood that GRRF did not intentionally exclude such systems by introducing this requirement.
4. Architecture B is an example of a CBS that shares a transmission (T_s) and a brake (B_s).

<i>Conventional Brake System</i>	<i>Combined Brake System (CBS)</i>	
<i>Architecture A</i>	<i>Architecture B</i>	<i>Architecture C</i>
		
<ul style="list-style-type: none"> ▪ Left lever (pedal) operates rear brake only ▪ Right lever operates front brake only 	<ul style="list-style-type: none"> ▪ Left lever operates CBS ▪ Right lever operates front brake only 	<ul style="list-style-type: none"> ▪ Left lever (pedal) operates CBS ▪ Right lever operates front brake only

CBS Architecture B

5. While a failure in e.g. the "front system" (F_A) may affect the performance of the CBS, the rear system (operated by the left lever) will continue to be operational.

<i>Normal operating conditions</i>		<i>Fail conditions</i>
<i>Right lever operation</i>	<i>Left lever operation (CBS)</i>	<i>Failure A (F_A)</i>
<p>Front brake = activated</p> <p>Left lever</p> <p>Right lever</p> <p>Rear brake = not affected</p>	<p>Front brake = activated</p> <p>Left lever</p> <p>Right lever</p> <p>Rear brake = activated</p>	<p>Front brake</p> <p>Left lever</p> <p>Right lever</p> <p>Rear brake</p> <p>F_A</p>
	Front brake	Defect
	Rear brake	Operational by left lever

6. In order to ensure that, in case of a failure in one system, the performance of the other system still equals that of a conventional system, it is proposed to allow that two separate brake systems share a brake and/or a transmission, provided that the other system meets the single brake system performance requirements in case of a failure of such shared component(s). To that end, a failure test is proposed for CBS brake systems of Architecture B. IMMA is of the opinion that such a failure test requirement should ensure the acceptance of such a CBS in terms of demonstrated robustness and guaranteed minimum braking performance.

Other CBS architectures such as Architecture C

7. A failure test is not necessary for this type of CBS architecture because there are no shared components with the exception of a brake cylinder which is one of the components that are regarded to not be liable to breakage as described in 12.1.(b).