

BRAKES GTR –2nd DRAFT – Prepared 2004-09-16

Aaaaa = input from D.Brault

Bbbbb= input from G.Soodoo

(Ccccc)= editorial comment

1. SCOPE

(To include purpose of the gtr and vehicle types covered)

[suggest we reflect the naming convention per: TRANS/WP.29/2004/25 - PROPOSAL FOR A DRAFT CONSOLIDATED RESOLUTION ON COMMON DEFINITIONS AND PROCEDURES TO BE USED IN GLOBAL TECHNICAL REGULATIONS (R.E.5) ...this may take some time to get used to... but no better time than the present??... or do we wait until it is finalized...]

2. DEFINITIONS

(Provisionally listed in a table as Attachment 1)

3. GENERAL REQUIREMENTS

(To include eg. performance evaluation details, durability, system function, system design, operation, inspection etc. etc..)

4. TEST CONDITIONS, PROCEDURES AND PERFORMANCE REQUIREMENTS.

4.1 General

4.1.1 Test ~~surface track~~

- For dynamic brake tests, (excluding ABS) the test area shall have a clean, dry and level surface *(How to define)*
- Unless otherwise specified, the surface friction shall provide [a nominal peak friction coefficient (PFC) of $0.9 \pm \dots\%$ using an **ASTM method E 1337-90.**]
(Needs clarification)
- For parking brake tests, the test area shall have a clean, dry and solid surface.
- For 2 wheeled (**category 3-1 and 3-3**) motorcycles, the lane width shall be 2.5 m.
- For 3 wheeled (**category 3-2, 3-4 and 3-5**) motorcycles, the lane width shall be 2.5 m + the vehicle width.

4.1.2 Ambient temperature:

The ambient temperature shall be between 4° C and 38° C.

4.1.3 Wind speed:

The wind speed shall be not more than 5 m/s

4.1.4 Vehicle position and wheel lock

- The vehicle shall be positioned in the centre of the test lane for the beginning of each stop.
- Stops shall be made without ~~any part of~~ the vehicle wheels passing outside the test lane and without wheel lock up.

4.1.5 Test sequence

TEST ORDER <i>(To be confirmed)</i>	SECTION
1. Dry Stop Tests	4.3
2. Dry Stop – with both brake systems activated	4.4
3. High Speed	4.5
4. Wet Brake	4.6
5. Heat Fade	4.7
6. If fitted:	
6.1 Parking Brake	4.8
6.2 ABS	4.9
6.3 Partial failure test, for a split brake system	4.10

4.2 Preparation

4.2.1 Engine idle speed:

Engine idle speed shall be set to the manufacturer's specification.

4.2.2 Tyre pressures:

Tyres shall be inflated to the manufacturer's specification for the vehicle loading condition.

4.2.3 Hand control lever application point:

The input force shall be applied at a point 50 mm from the outer end of the lever.
[The outer end of the hand control lever shall not project beyond the outer end of the handgrip by more than 30 mm when the hand lever is in its position of maximum compression (see figure x). [taken from UNECE Reg. 60] All measurements shall be made parallel to the handgrip axis.] *(Is this relevant to motorcycles?) add sketch of lever*

4.2.4 Brake temperature measurement:

The brake temperature shall be measured either in the approximate centre of the face of the most heavily loaded shoe or disc pad in each brake; or, on the approximate centre of the braking path of the disc or drum.

4.2.5 Burnishing procedure:

(Final text to include an explanation that manufacturers will burnish before certification testing and that administrations will use this method when conducting CoP/Audit testing)

- Vehicle unladen.
- Engine disconnected
- Test speed:
Initial speed = >50 km/h
Final speed = 5 – 10 km/h
- Vehicle deceleration:
Single brakes – Front brake = 3.0-3.5 m/s². Rear brake = 1.5-2.0 m/s²
CBS – 3.5-4.0 m/s²
- Number of stops: 100 per brake system
- Initial brake temperature before each stop = <100° C.
- Accelerate to the initial test speed after each stop and maintain that speed until the initial brake temperature falls to the specified value. The next stop may then be made.

4.3 Dry Stop Test – with a single brake system activated

4.3.1 Vehicle condition.

- Laden
For vehicles fitted with CBS : also unladen
(The unladen test checks for front/rear brake balance, by checking for wheel lock)

- Engine disconnected

4.3.2 Specific test conditions and procedure

- Initial brake temperature = ~~≥55°C~~ ≤ 100° C
- Test speed :
L1, L2 (category 3-1 & 3-2) vehicles : 40 km/h
L3, L4, L5 (category 3-3, 3-4 & 3-5) vehicles : 60 km/h

- Brake application:
Each brake system separately.
- Brake actuation force:
Hand control <200N
Foot control <350N for 3-1, 3-2, 3-3, 3-4 vehicles
<500N for 3-5 vehicles
- Number of stops : until the vehicle passes, with a maximum of 6 tests
- For each stop, accelerate the vehicle to the test speed and then activate the brake system under the conditions specified above

4.3.3 Performance requirements

When the brakes have been tested in accordance with test procedure 4.3.2, the stopping distance shall be as specified in column 2 or the MFDD shall be as specified in column 4.

Category	STOPPING DISTANCE (S)	OR	MFDD
For single front brakes only:			
L1 (3-1)	$S = \leq 0.1 V + V^2/90$		3.4m/s ²
L2 (3-2)			
L3 (3-3)			
L4 (3-4)			
L5 (3-5)			
For single rear brakes only			
L1	$S = \leq 0.1 V + V^2/70$		2.7 m/s ²
L2			
L3			
L4			
L5			
CBS, both laden and unladen:			
L1+L2	$S = \leq 0.1 V + V^2 /115$		4.4 m/s ²
L3			
L4			
L5			
For vehicles with CBS – secondary brake only:			
ALL	$S = \leq 0.1 . v + v^2 / 65$		2.5 m/s ²

4.4 Dry Stop Test – with both brake systems activated

4.4.1 Vehicle condition.

- Unladen
- Engine disconnected

4.4.2 Test conditions and procedure

- Initial brake temperature = $\geq 55^{\circ}\text{C}$ $\leq 100^{\circ}\text{C}$
- Test speed : 100 km/h or 0.8 V max, whichever is the lower.
Minimum test speed = 45 km/h.
- Brake application:
Both brake systems shall be activated at the same moment.
- **Brake actuation force:**
Hand control <250N
Foot control <400N
- Number of stops : until the vehicle passes, with a maximum of 6 tests
- For each stop, accelerate the vehicle to the test speed and then apply the brakes under the conditions specified above

4.4.3 Performance requirements

When the brakes have been tested in accordance with the test procedure in 4.4.2, the stopping distance (S) shall be $\leq 0.1 V + 0.0060V^2$
[where V is the test speed in km/h and S is in metres]
or the MFDD shall be $\geq 6.4\text{m/s}^2$

(Need clarification and limits for 3-wheelers)

4.5 High Speed Test

4.5.1 Vehicle condition

- Test is applicable to vehicle categories 3-3, 3-4, 3-5 only
- Unladen
- Engine connected

4.5.2 Test conditions and procedure

- Initial brake temperature $\leq 100^{\circ} \text{ C}$
- Test speed : 160 km/h or 0.8 V max, whichever is the lower.
Minimum test speed = 80 km/h
- Brake application:
Both brake systems shall be activated at the same moment
- Brake actuation force:
Hand control $< 200\text{N}$
Foot control $< 350\text{N}$ for 3-1, 3-2, 3-3, 3-4 vehicles
 $< 500\text{N}$ for 3-5 vehicles
- Number of stops : until the vehicle passes, with a maximum of 4 tests
- For each stop, accelerate the vehicle to the test speed and then activate the brake system under the conditions specified above

4.5.3 Performance requirements

- When the brakes have been tested in accordance with the test procedure in 4.5.2, the stopping distance (S) shall be $\leq 0.1 V + V^2/149$
[where V is the test speed in km/h and S is in metres]
or the MFDD shall be $\geq 5.8\text{m/s}^2$

ATTACHMENT 1

PROVISIONAL LIST OF DEFINITIONS (2004-09-13)

Alphabetical

TERM	EXPLANATION	SOURCE
ABS - Controller - Modulator - Sensor Brake CBS Control Disconnected (engine) Initial Brake temperature Laden Unladen Single Brake Split service Transmission V max Wheel lock Secondary brake Average Deceleration Mean Fully Developed Deceleration (MFDD) Peak friction coefficient Stopping distance		