Submitted by the expert from Italy

Informal document **GRRF-80-31**
80th GRRF, 15-18 September 2015,
Agenda item 6

Proposal to introduce requirements for the approval of replacement brake discs for L-category vehicles in UN Regulation No. 90

Submitted by ITALY

(Revision 2)

80° GRRF
15-18 September 2015

Preamble

At the **78°** session of GRRF (16 Sept 2014), ITALY had tabled a proposal (doc **ECE/TRANS/WP.29/GRRF/2014/23**), to include in UN-R 90 a set of new requirements for the approval of replacement brake discs for L-category vehicles, taking into consideration the latest technologies available in the market.

At the **79°** GRRF session (16 Feb 2015), ITALY forwarded a **Revision 1** of the proposal (**ECE/TRANS/WP.29/GRRF/2014/23/Rev.1**), containing some amendments based on comments raised by CPs, as well as some additional improvements through informal documents (**GRRF-79-11e** , **GRRF-79-13e**).
During the 79° session, GRRF agreed with the above mentioned improvements, but raised also further comments and request of amendments.

Today (80° GRRF session), ITALY is thus willing to propose a **Revision 2** of the proposal: **ECE/TRANS/WP.29/GRRF/2014/23/Rev.2**

It includes:
- the improvements previously presented with the 2 informal documents
- modifications addressing the comments raised at 79° GRRF
- some minor additional editorial improvements

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:
Paragraph 5.3.3.2.1, where the reference to the «lamellar cast iron» would imply the need to include a definition

Revision:
The proposed new paragraph to be inserted, has been modify as follows:

From:

5.3.3.2.1 **Lamellar cast iron for brake disc and brake drum of categories M, N and O.**
In order to be considered "Equivalent" the replacement brake disc or drum shall be from the same material subgroup as the original brake disc or drum.
Four original part material subgroups are defined."

To:

5.3.3.2.1. **For vehicles of category M,N,O**, in order to be considered "Equivalent" the replacement brake disc or drum shall be from the same material sub-group as the original brake disc or drum.
Four original part material sub-groups are defined

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:

Packaging and marking requirements.

NL objected the possibility to allow the use of the official brake disc manufacturer's website where to include info concerning the replacement brake disc for vehicles of L cat, as an alternative to writing them on the package

The proposal was due to the impossibility to include the vast number of codes in a single and space-limited label:

- in case of motorcycles, a same brake disc may be fitted on a very high number of applications
- this huge list is very often subject to updating

ITALY was also ready to investigate other solutions:

- use a QR code linked to a closed pdf file including the official updated list of applications,

to whom the dealer may have access

- include in the label on the package, only the codes of the most significant models, referring to the website

for the complete updated list.

"**6.2.1.4. In the case of motor vehicles of categories L_1, L_2, L_3, L_4 and L_5:**

……..

6.2.1.4.2. Website address of the brake disc manufacturer, where following information can be found:

- **Applications;**
- **Date of time period for single application;**
- **Original part number of the brake disc, if any.**"

Revision:

The proposal to use the website is withdrawn.

Current prescriptions for packaging as from M,N will apply for vehicles of L cat.

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:

In annex XV (Criteria for groups of discs for vehicle), a reference to the possibility to retreive from «trade magazines» data otherwise not available from the product sheet.
The proposal had been objected by UK.

"Data for the new calculation of kinetic energy must be traced from the product data sheet issued by the vehicle manufacturer; if such data is missing in the product data sheet, it can be traced in trade magazines".

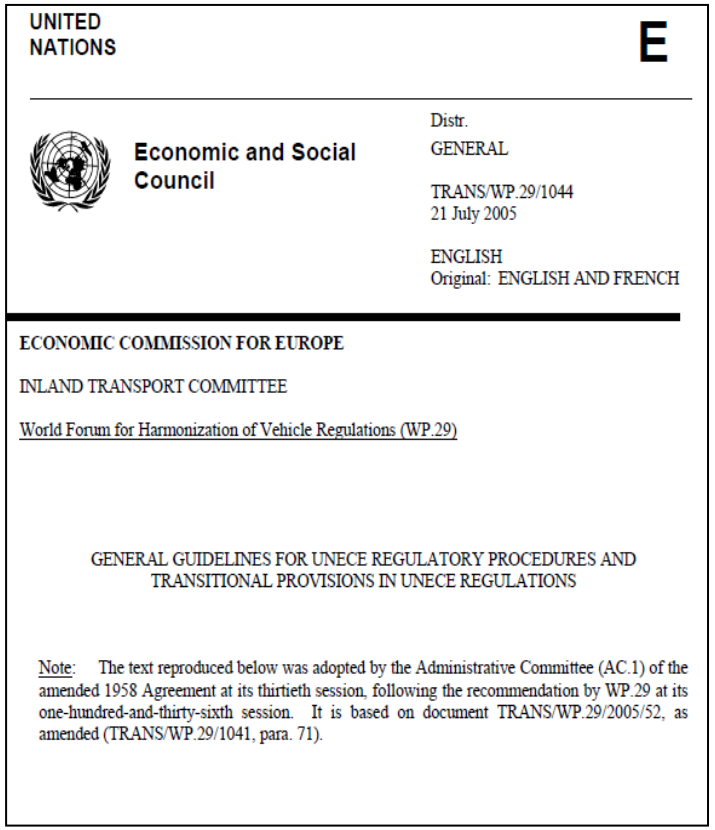
Revision:

The reference to «trade magazines» has been deleted.

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:
GRRF Chairmanship suggested to review the Transitional Provisions.

Revision:
Paragraph 12 related to Transitional provisions has been amended, taking inspiration from the General Guidelines
for UNECE Regulatory Procedures
and Transitional Provisions in UNECE Regulations
(TRANS/WP.29/1044/Rev.1)



UNITED NATIONS

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ECONOMIC COMMISSION FOR EUROPE

INLAND TRANSPORT COMMITTEE

World Forum for Harmonization of Vehicle Regulations (WP.29)

GENERAL GUIDELINES FOR UNECE REGULATORY PROCEDURES AND TRANSITIONAL PROVISIONS IN UNECE REGULATIONS

Note: The text reproduced below was adopted by the Administrative Committee (AC.1) of the amended 1958 Agreement at its thirtieth session, following the recommendation by WP.29 at its one-hundred-and-thirty-sixth session. It is based on document TRANS/WP.29/2005/52, as amended (TRANS/WP.29/1041, para. 71).

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:

Need to include tolerance for Temperature in the Tables concerning the Thermal Fatigue Test.

Revision:

A tolerance of [+/- 10%] is included for «Starting temperature before the brakings» in following tables:

- Table A14 / 5.1.3.1.2 (front disc)
- Table A14 / 5.1.4.1.3 (rear disc)

Thermal fatigue test								
Step	Vehicle gross weight [kg]	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the brakings [°C] +/- 10 °C*	*Time between 2 consecutive brakings [s]*	*Brakings quantity [---]*	*Max speed of the permitted airflow during the brake application [m/s]*
1 thermal	75% / discs q.ty	50% Vmax	5	7	100 (a)	30	5	20
2 functional	75% / discs q.ty	80% Vmax	5	8	200	---	1	30
3 mechanic	100% / discs q.ty	60% Vmax	5	10	200	---	2	30
Steps from 1 to 3 = 1 cycle; repeating for a total of 20 cycles (= 160 brakings)								

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:

§ 5.1.4.1.2 concerning Fade test.
The use of “rotation speed of the cooling fan” has been questioned.
Suggestion to adopt other parameters such as airflow or temperature has been proposed by NL.

Revision:

The "rotation speed of the cooling fan" has been replaced with the "airflow max speed" parameter.
This is based on testing data elaborated during recent weeks, new values have been included in :

- Table A14 /5.1.3.1.1
- Table A14 / 5.1.3.1.2
- Table A14 / 5.1.4.1.1
- Table A14 / 5.1.4.1.2
- Table A14 / 5.1.4.1.3

From:
« Rotation speed of the cooling fan, [min^{-1}]»

To:
« Max speed of the permitted airflow during the brake application, [m/s]»

Thermal fatigue test

Step	Vehicle gross weight [kg]	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s^2]*	*Starting temperature before the brakings [°C] +/- 10 °C*	*Time between 2 consecutive brakings [s]*	*Brakings quantity [---]*	*Max speed of the permitted airflow during the brake application [m/s]*
1 thermal	75% / discs q.ty	50% Vmax	5	7	100 (a)	30	5	20
2 functional	75% / discs q.ty	80% Vmax	5	8	200	---	1	30
3 mechanic	100% / discs q.ty	60% Vmax	5	10	200	---	2	30

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Comment raised at 79° GRRF:

During the 79° GRRF, an amendment to the definition of «identification code» was made in order to make reference to R 78 as far as braking system for L vehicles are concerned.

This would imply the necessity to also modify UN R 78.

Revision:

The amendment is withdrawn.

As a consequence, amendments to the Definitions are now proposed: →

Paragraph 2.3.3.1., amend to read:

"2.3.3.1. Original replacement brake discs and brake drums"

Add new paragraphs 2.3.3.1. and 2.3.3.1.2., to read:

"2.3.3.1.1. In the case of vehicle categories M, N and O: original brake discs/ brake drums intended for servicing the vehicle and carrying an identification code as defined in paragraph 2.3.2. affixed in such a way as to be indelible and clearly legible.

2.3.3.1.2. In the case of vehicle categories L_1, L_2, L_3, L_4 and L_5: original brake discs/ brake drums intended for servicing the vehicle."

Paragraph 2.3.3.2., amend to read:

"2.3.3.2. Identical brake discs"

Add new paragraphs 2.3.3.1. and 2.3.3.1.2., to read:

"2.3.3.2.1. In the case of vehicle categories M, N and O: a replacement brake disc which is chemically and physically identical in every respect with the exception of the vehicle manufacturer mark, which is absent, to the original brake disc.

2.3.3.2.2. In the case of vehicle categories L_1, L_2, L_3, L_4 and L_5: a replacement brake disc which is chemically and physically identical in every respect."

ECE/TRANS/WP.29/GRRF/2014/23/Rev 2

Additional (editorial) improvements:

In Tables of both FRONT and REAR discs

5.1.3.1.1. **Burnishing**

According to Table A14/5.1.3.1.1.

Table A14/5.1.3.1.1.

Burnishing							
Step	*Vehicle gross weight [kg]*	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the braking [°C] MAX*	*Brakings quantity [---]*	*Max speed of the permitted airflow during the brake application [m/s]*
1	75% / disc q.ty	80	30	4	100	60	30

«MAX» has been included

5.1.3.1.2. **Fatigue test**

According to Table A14/5.1.3.1.2.

Table A14/5.1.3.1.2.

Thermal fatigue test								
Step	Vehicle gross weight [kg]	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the brakings [°C] +/- 10 °C*	*Time between 2 consecutive brakings [s]*	*Brakings quantity [---]*	*Max speed of the permitted airflow during the brake application [m/s]*
1 thermal	75% / discs q.ty	50% Vmax	5	7	100 (a)	30	5	20
2 functional	75% / discs q.ty	80% Vmax	5	8	200	---	1	30
3 mechanic	100% / discs q.ty	60% Vmax	5	10	200	---	2	30
Steps from 1 to 3 = 1 cycle; repeating for a total of 20 cycles (= 160 brakings)								

«consecutive» instead of «following»

79° GRRF

Preamble

At the 78° session of GRRF held on 16 Sept 2014, ITALY had tabled a proposal (doc **ECE/TRANS/WP.29/GRRF/2014/23**)

It was aimed at including in UN-R 90 a set of new requirements for the approval of replacement brake discs for L-category vehicles, taking into consideration the latest technologies available in the market.

GRRF agreed to ask ITALY to revise the proposal and submit at 79° GRRF session, taking into account all the comments received.

To this extent, ITALY has forwarded the following documents for today's discussion:

- Working document **ECE/TRANS/WP.29/GRRF/2014/23/Rev.1**
- Informal document **GRRF-79-11e**
- Informal document **GRRF-79-13e**

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Comment raised during 78° GRRF:
Need to exclude L6 and L7 categories.

Revision:
We have included reference to L_1, L_2, L_3, L_4, L_5 throughout the document, excluding L_6 and L_7

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Comment raised during 78° GRRF:
Need to modify the definition of both ″Original replacement brake discs for category L ″ (2.3.3.1.2) and ″Identical brake discs for category L ″ (2.3.3.2.2), for competitive reasons.

Revision:
The original definitions are restored, same as for M, N and O categories.

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Comment raised during 78° GRRF:

Paragraph 5.3.3.1.1., amend to read:

"5.3.3.1.1. For discs the following maximum values shall be met:

	M_1, N_1, O_1, O_2	M_2, M_3, N_2, N_3, O_3, O_4	L_1, L_2, L_3, L_4, L_5
Thickness variation	0.015 mm	0.030 mm	**0.020 mm**
Cheek thickness variation (for ventilated disc only)	1.5 mm	2.0 mm	---
Lateral run-out friction surface	0.050 mm*	0.150 mm*	**0.150 mm*****
Location bore variation	H9	H9	**D10 or H11 ********
"Top hat" parallelism	0.100 mm	0.100 mm	---
Location face flatness	0.050 mm	0.050 mm	**0.100 mm**
Friction surface roughness**	3.2 µm	3.2 µm	**1.6 µm**

* n/a in the case of a floating disc.

** Ra-value according to ISO 1302:2002.

*** **0.100 mm for maximum straightness for "full floating" disc (without elastic constraints between bell and braking ring)**

**** **n/a for vehicles categories L1, L2, L3, L4, L5**

***** **Location bore variation where applicable, related to manufacturing process."**

Italy proposal (1): the DTV is modified from 0,015 to 0,020 mm in order to consider the standard of production adopted at international level

Why no values for L ??

Not applicable to L, since no application with vent discs exist

Both D10 and H11 tolerances are widely adopted in OEM, depending from production process

Not applicable to L, since the disk is always mounted externally on the wheel rim, and not interposed between the wheel hub and the rim

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Comment raised during 78° GRRF:
May the definition of a list of stainless steel materials pose problem of design restriction?

Add a new paragraph5.3.3.2.2., to read:

"**5.3.3.2.2 Martensitic stainless steel for braking ring of categories L1, L2, L3, L4 and L5. In order to be considered "Equivalent" the replacement brake disc shall be from the same material subgroup as the original brake disc. Five original part material subgroups are defined.**

	Test standard	*Subgroup 1 JIS SUS 410*	*Subgroup 2 X 10 Cr 13 EN 10088/2*	*Subgroup 3 X 12 Cr 13 EN 10088/2*	*Subgroup 4 X 20 Cr 13 EN 10088/2*	*Subgroup 5X 30 Cr 13 EN 10088/2*
Carbon Content (per cent)		**0.02-0.10**	**0.08-0.12**	**0.08-0.15**	**0.16-0.25**	**0.26-0.35**
Silicon Content (per cent)		**Max 0.80**	**Max 1.00**	**Max 1.00**	**Max 1.00**	**Max 1.00**
Manganese Content (per cent)		**0.50-2.50**	**Max 1.00**	**Max 1.50**	**Max 1.50**	**Max 1.50**
Chromium Content (per cent)		**10.00-14.50**	**12.00-14.00**	**11.50-13.50**	**12.00-14.00**	**12.00-14.00**
Iron Content (per cent)		**rest**				
Hardness HRC	**ISO 6508-1:2005**	**30-40**	**30-40**	**30-40**	**30-40**	**30-40**

We confirm that the list can be regarded as exhaustive of the materials used in production
(Example: JIS SUS **420** is included in X20Cr13)

Italy proposal (2): HRC is changed from (32-38) to (30-40) in order to be adapted with the OEM standard and production process

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Comment raised during 78° GRRF:

Need to define a better classification, not based on commercial definition

Table A14/2.2.5.

Application	*Front disc*	*Rear disc*
	Tangential f orce F [kN] MIN	
Sport, Tourer and Road Enduro	14	12
Custom	10	15
Scooter	12	10
Off-road	12	7

A new classification is proposed, based on disc DIAMETER and THICKNESS

Table A14/2.2.5.

Disc Diameter [mm]	*Spessore disco [mm]*	*Tangential f orce F [kN] MIN*
≥ 150 < 200	≤ 4	≥ 8
	> 4	≥ 10
≥ 200 < 250	≤ 3	≥ 8
	>3 ≤ 4	≥ 10
	> 4	≥ 12
≥ 250 < 300	≤ 3	≥ 8
	> 3 ≤ 4	≥ 10
	> 4	≥ 12
≥ 300 < 350	≤ 4	≥ 8
	> 4 ≤ 5	≥ 11
	> 5	≥ 14

Notes:
- No groups defined for peripherical discs (> 350)
- Fixed, floating and composed discs have all a diameter < 3 50 mm
- In current production , max of 330 mm is reached

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Italy proposal (3):

In Annex 14 (new), the **thermal FATIGUE test** has been modified for both front and rear discs.

FRONT DISC

5.1.3. Front disc

5.1.3.1. Test programme

5.1.3.1.1. Burnishing

According Table A14/5.1.3.1.1.

Table A14/5.1.3.1.1.

TUV Directive

Burnishing				
Step	*Initial speed [km/h]*	*Final speed [km/h]*	*Acceleration (+) and deceleration (–) [m/s²]*	*Step duration [s]*
1	80	40	– 3	3.7
2	40	80	+ 3	3.7
3	80	80	---	20
Steps 1 to 3 = 1 cycle; repeating 19 times the cycle for a total of 20 cycles				

5.1.3.1.2. Emergency stop

According Table A14/5.1.3.1.2.

Table A14/5.1.3.1.2.

Emergency stop				
Step	*Initial speed % of Vmax (a) [%]*	*Final speed % of Vmax (a) [%]*	*Acceleration (+) and deceleration (–) [m/s²]*	*Step duration (b) [s]*
1	80	5 (km/h)	– 10	0.078 * Vmax
2	5 (km/h)	80	+ 3	0.258 * Vmax
3	80	80	---	240

(a) Vmax in km/h

(b) Vmax in m/s

5.1.3.1.3. Fatigue test

According Table A14/5.1.3.1.3.

Table A14/5.1.3.1.3.

TUV Directive

Fatigue test				
Step	*Initial speed % of Vmax (a) [%]*	*Final speed % of Vmax (a) [%]*	*Acceleration (+) and deceleration (–) [m/s²]*	*Step duration (b) [s]*
1	80	40	– 8	0.05 * Vmax
2	40	80	+ 6	0.067 * Vmax
3	80	20	– 8	0.075 * Vmax
4	20	80	+ 6	0.1 * Vmax
5	80	40	– 8	0.05 * Vmax
6	40	60	+ 6	0.033 * Vmax
7	60	40	– 6	0.033 * Vmax
8	40	60	+ 6	0.033 * Vmax
9	60	40	– 6	0.033 * Vmax
10	40	80	+ 6	0.067 * Vmax
11	80	60	– 8	0.025 * Vmax
12	60	60	---	10
13	60	40	– 6	0.033 * Vmax
14	40	80	+ 6	0.067 * Vmax
Steps 1 to 14 = 1 cycle; repeating 29 times the cycle for a total of 30 cycles				

5.1.3. Front disc

5.1.3.1. Test programme

5.1.3.1.1. Burnishing

According Table A14/5.1.3.1.1.

OEM procedure: longer test for a better /pad/disc alignment

Table A14/5.1.3.1.1.

Burnishing							
Step	Vehicle gross weight [kg]	Initial speed [km/h]	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the braking [°C]*	*Brakings quantity [---]*	*Rotation speed of the cooling fan [min⁻¹]*
1	75%	80	30	4	100	60	3,000

5.1.3.1.2. Fatigue test

According Table A14/5.1.3.1.2.

Table A14/5.1.3.1.2.

Thermal fatigue test								
Step	Vehicle gross weight [kg]	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the brakings [°C]*	*Time between 2 following brakings [s]*	*Brakings quantity [---]*	*Rotation speed of the cooling fan [min⁻¹]*
1 thermal	75% / discs q.ty	50% Vmax	5	7	100 (a)	30	5	2,000
2 functional	75% / discs q.ty	80% Vmax	5	8	200	---	1	3,000
3 mechanic	100% / discs q.ty	60% Vmax	5	10	200	---	2	3,000
Steps from 1 to 3 = 1 cycle; repeating for a total of 20 cycles (= 160 brakings)								

(a) Starting temperature of the 1° braking only

- **Emergency stop has been included into fatigue test and improved.**
- **TUV fatigue test is too severe (at first cycle, T was > 800 °C !!)**

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Italy proposal (3):

In Annex 14 (new), the **thermal FATIGUE test** has been modified for both front and rear discs.

5.1.4. Rear disc

5.1.4.1. Test program

5.1.4.1.1. Burnishing

According Table A14/5.1.3.1.1.

Table A14/5.1.4.1.1.

Burnishing				
Step	*Initial speed [km/h]*	*Final speed [km/h]*	*Acceleration (+) and deceleration (–) [m/s²]*	*Step duration [s]*
1	80	40	– 2	5.56
2	40	80	+ 3	3.7
3	80	80	---	20
Phases 1 to 3 = 1 cycle; repeating 19 times the cycle for a total of 20 cycles				

5.1.4.1.2 Emergency stop

According Table A14/5.1.4.1.2.

Table A14/5.1.4.1.2.

Emergency stop				
Step	*Initial speed % of Vmax (a) [%]*	*Final speed % of Vmax (a) [%]*	*Acceleration (+) and deceleration (–) [m/s²]*	*Step duration (b) [s]*
1	50	5 (km/h)	– 5	0.095 * Vmax
2	5 (km/h)	50	+ 3	0.16 * Vmax
3	50	50	---	240

a) Vmax in km/h

b) Vmax in m/s

5.1.4.1.3 Fatigue test

According Table A14/5.1.4.1.3.

Table A14/5.1.4.1.3.

Fatigue test				
Step	*Initial speed % of Vmax (a) [%]*	*Final speed % of Vmax (a) [%]*	*Acceleration (+) and deceleration (–) [m/s²]*	*Step duration (b) [s]*
1	50	20	– 3	0.1 * Vmax
2	20	50	+ 6	0.05 * Vmax
3	50	10	– 3	0.14 * Vmax
4	10	50	+ 6	0.067 * Vmax
5	50	20	– 3	0.1 * Vmax
6	20	40	+ 6	0.033 * Vmax
7	40	10	– 2	0.15 * Vmax
8	10	40	+ 6	0.05 * Vmax
9	40	10	– 2	0.15 * Vmax
10	10	50	+ 6	0.067 * Vmax
11	50	20	– 3	0.1 * Vmax
12	20	40	+ 6	0.033 * Vmax
13	40	10	– 2	0.15 * Vmax
14	10	50	+ 6	0.067 * Vmax
Steps 1 to 14 = 1 cycle; repeating 29 times the cycle for a total of 30 cycles				

REAR DISC

5.1.4. Rear disc

5.1.4.1. Test program

5.1.4.1.1. Burnishing

According Table A14/5.1.4.1.1.

Table A14/5.1.4.1.1.

Burnishing							
Step	*Vehicle gross weight [kg]*	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the brakings [°C]*	*Brakings quantity [---]*	*Rotation speed of the cooling fan [min⁻¹]*
1	55%	60	30	2	100	60	3,000

5.1.4.1.2 Fatigue test

According Table A14/5.1.4.1.2.

Table A14/5.1.4.1.2.

Thermal fatigue test								
Step	*Vehicle gross weight [kg]*	*Initial speed [km/h]*	*Final speed [km/h]*	*Deceleration [m/s²]*	*Starting temperature before the braking [°C]*	*Time between 2 following braking [s]*	*Brakings quantity [---]*	*Rotation speed of the cooling fan [min⁻¹]*
1 thermal	55%	40% Vmax	20% Vmax	3	100 (a)	30	5	2,000
2 functional	55%	50% Vmax (b) 60% Vmax (c) 75% Vmax (d)	5	4	200	---	1	3,000
3 mechanic	100%	40% Vmax (b) 48% Vmax (c) 60% Vmax (d)	5	5	200	---	2	3,000
Steps from 1 to 3 = 1 cycle; repeating for a total of 20 cycles (= 160 brakings)								

(a) Starting temperature of the 1° braking only
(b) Disc diameter < 240 mm
(c) Disc diameter ≥ 240 < 280 mm
(d) Disc diameter ≥ 280 mm

ECE/TRANS/WP.29/GRRF/2014/23/Rev.1

Italy proposal (3):
In Annex 14 (new), the **thermal FATIGUE test** has been modified for both front and rear discs.

5.1.5. Test result (brake disc thermal fatigue test)

The test is regarded as having been passed if the cycles prescribed in:

(a) Tables A14/5.1.3.1.1. – 5.1.3.1.2. for front discs

(b) Tables A14/5.1.4.1.1. – 5.1.4.1.2. for rear discs

are completed without damage or failure.

Instead of 30

If less than 20 cycles, according to "Thermomechanical Fatigue test" in Tables A14/5.1.3.1.2. and A14/5.1.4.1.2., but more than 15 are completed without damage or failure, then the test must be repeated on a new replacement part.

Instead of 20

Under these circumstances both tests must complete more than 15 cycles without damage or failure for the part to have passed the test.

If less than 15 cycles are completed before damage or failure, then a test should be conducted on the original part and the results compared.

If the damage of failure point is no worse than the quantity of cycles of the original part – 10 per cent, then the test is regarded as having been passed.

The number of cycles have been slightly reduced, BUT the severity of brakings have been also increased.

GRRF-79-11e (informal doc)

In Annex 14, "Requirements for replacement brake discs for vehicles of categories L1, L2, L3, L4 and L5“

Paragraph 2.2.4. , correct to read:

"2.2.4. Apply the force F, specified in Table ~~2.1.2.5.~~ **A14/2.2.5**., as shown in Fig.1“

***Justification**: editorial*

GRRF-79-13e (informal doc)

[AMENDMENT 1]Include a note (b) in Table A14/5.1.3.1.3 as follows:

5.1.3.1.3. Fatigue test

According Table A14/5.1.3.1.3.

Table A14/5.1.3.1.3.

Thermal fatigue test								
Step	Vehicle gross weight [kg]	Initial speed [km/h]	Final speed [km/h]	Decele-ration [m/s^2]	Starting temperature before the brakings [°C]	Time between 2 following brakings [s]	Brakings quantity [---]	Rotation speed of the cooling fan [min^{-1}]
1 thermal	75% / discs q.ty	50% Vmax	5	7	100 (a)	30	5	2.000
2 functional	75% / discs q.ty	80% Vmax	5	8	200	---	1	3.000
3 mechanic	100% / discs q.ty	60% Vmax	5	10	200	---	2	3.000
Steps from 1 to 3 = 1 cycle; repeating for a total of 20 cycles (= 160 brakings)**(b)**								

(a) Starting temperature of the 1° braking only

(b) In case of early wear of the friction material of the pads, the use of another pads set is allowed; in this case, before completing the test, the new pads set must be burnished according to paragraph 5.1.3.1.1., always using the brake disc under test.

***Justification**: The note has been introduced in order to allow the operator to carry out and conclude the test in case of premature wear of the friction material of the pads.*

GRRF-79-13e (informal doc)

[AMENDMENT 2]Modify Table A14/5.1.4.1.1 as follows:

5.1.4. Rear disc

5.1.4.1. Test program

5.1.4.1.1. Burnishing

According Table A14/5.1.4.1.1.

Table A14/5.1.4.1.1.

Burnishing							
Step	Vehicle gross weight [kg]	Initial speed [km/h]	Final speed [km/h]	Decele-ration [m/s^2]	Starting temperature before the braking [°C]	Brakings quantity [---]	Rotation speed of t cooling fan [min^{-1}]
1	**50%**	60	30	2	100	60	3.000

***Justification**: the % of the "vehicle gross weight" has been reduced from 55% to 50% in conformity with what is foreseen in par 5.1.4.1.3.*

GRRF-79-13e (informal doc)

[AMENDMENT 3]Include a paragraph5.1.4.1.2 as follows:

5.1.4.1.2. Fade test

According Table A14/5.1.4.1.2.

Table A14/5.1.4.1.2.

Fade test								
Step	**Vehicle gross weight** [kg]	**Initial speed** [km/h]	**Final speed** [km/h]	**Decele-ration** [m/s^2]	**Starting temperature before the braking** [°C]	**Time between 2 following brakings** [s]	**Brakings quantity** [---]	**Rotation speed of cooling fan** [min^{-1}]
1	**50%**	**40%Vmax**	**20%Vmax**	**2**	**100**	**30**	**15**	**800**

Justification: *the proposed "Fade" test has the aim of stabilising the friction coefficient of pads.*
The Fade test has the target of spilling the gas out from friction material, otherwise these gases leak during the "Fatigue" test causing a reduction of the friction coefficient.
This could bring to the need of an increase of braking pressure up to excessive values, so that a sudden consumption of the friction material may happen.
This phenomenon is typical for organic friction material, while pads with sintered friction material are less subject to it.

GRRF-79-13e (informal doc)

[AMENDMENT 4]Modify Table A14/5.4.1.3 as follows:

5.1.4.1.3 Fatigue test

According Table A14/5.1.4.1.3.

Table A14/5.1.4.1.3.

Thermal fatigue test								
Step	Vehicle gross weight [kg]	Initial speed [km/h]	Final speed [km/h]	Deceleration [m/s²]	Starting temperature before the brakings [°C]	Time between 2 following brakings [s]	Brakings quantity [---]	Rotation speed of the cooling fan [min⁻¹]
1 thermal	**50%**	40% Vmax	20% Vmax	3	100 (a)	30	5	2.000
2 functional	**50%**	50% Vmax (b)	5	4	200	---	1	3.000
		60% Vmax (c)						
		75% Vmax (d)						
3 mechanic	**90%**	40% Vmax (b)	5	5	200	---	2	3.000
		48% Vmax (c)						
		60% Vmax (d)						
Steps from 1 to 3 = 1 cycle; repeating for a total of 20 cycles (= 160 brakings)**(e)**								

(a) Starting temperature of the 1° braking only

(b) Disc diameter **≤ 245** mm

(c) Disc diameter **> 245** < 280 mm

(d) Disc diameter ≥ 280 mm

(e) In case of early wear of the friction material of the pads, the use of another pads set is allowed; in this case, before completing the test, the new pads set must be burnished according to paragraphs 5.1.4.1.1. – 5.1.4.1.2., always using the brake disc under test.

***Justification 1**: the % of "vehicle gross weight" has been reduced from 55% to 50% (for step 1 and 2) and from 100 to 90% (for step 3), in order to optimize the mechanical stress on the brake disc, so as to reach a Tmax of around 500 °C , instead of 660 °C*

***Justification 2**: the threshold for the diameter of the rear discs has been modified from 240mm to 245mm in order to take into account a typology of rear discs typically used on sport motorcycles*

***Justification 3**: This note is added to allow the operator to finalize the test in case of premature wear of the friction material of the pads*

GRRF-79-13e (informal doc)

[AMENDMENT 5]: Amend definition paragraph 2.3.2 as follows:

"*Identification code*" identifies the brake discs or brake drums covered by the braking system approval according to Regulations Nos. 13, ~~and~~ 13-H **and 78**

***Justification**: a reference to UN-R78 is needed for braking system of vehicles of category L*

GRRF-79-13e (informal doc)

[AMENDMENT 6 editorial]: for consistency with R.E.3, modify L1, L2, L3, L4, L5 with: L_1, L_2, L_3, L_4, L_5, throughout the document.

[AMENDMENT 7 editorial]: in Table A14/2.2.5, change the heading "spessore disco" with: "disk thickness".

[AMENDMENT 8 editorial]: in paragraph 3.4.2.1, change "part C" with capital "Part C".

***Justification**: all editorial*