

Submitted by the expert from Italy

Informal document **GRVA-11-35**
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Agenda item 9(b)

Proposal for a revision of UN Regulation No. 90

Working Documents:

- ECE/TRANS/WP29/GRVA/2021/28
- ECE/TRANS/WP29/GRVA/2021/29

GRVA 11th session

1. Brake Disc Grouping Criteria for L-cat vehicles

ECE/TRANS/WP29/GRVA/2021/28

Background

While implementing R90 regulation (for the approval of replacement discs for motorcycles), some important shortcomings were found.

In particular, Annex 15 defining criteria for the discs grouping, is hardly applicable.

The application of the 9 criteria for the definition of disc groups, generates a **huge number of groups** (some consisting of a single disc).

In addition, Annex 15 does not clearly define how to choose the **reference disc** for disc grouping.

The following proposal aims at making the definition of disk groups easier, reducing their number while providing the same guarantees from a technical point of view.

Annex 15 - § 2. Reference disc

Current:	No written rules for “reference disc” selection. The disc to be tested could be different from the reference disc used for disc group definition, provided that it is the one subject to <i>“the highest braking torque and to the largest energy to be absorbed”</i>
Modification Proposal:	The “reference disc” used for disc group definition <u>must</u> be the one with highest K.E ratio (defined according to ...), thinnest and more lightened bell and lower number of fasteners. The approval tests <u>must</u> be performed on the same disc.
Improvements:	Avoided ambiguity in the choice of the reference disk. The approval tests will be performed on the most stressed disc belonging the group.

R90 - Annex 15 “Groups of discs”

The similarity between the discs is defined by 9 grouping criteria, that must be simultaneously fulfilled; 5 of which are valid for all the discs while additional 4 apply to floating and composed discs only.

The current Annex 15 criteria aim to include in the same group only discs with similar geometrical characteristics.

The following proposal, while maintaining the same 9 criteria, also allows discs with a different geometry to be included in the same group as long as the disc itself is subjected to lower thermal and mechanical stresses than the reference disc.

Annex 15 - § 2.3 Braking surface lightening

Current Grouping Criteria:

Braking surface lightening: any solution is allowed (holes, slots, wave, etc.) provided that:

§ 2.3.1 For discs having the same diameter and thickness: the mass change of the braking surface swept by the pads must be within the range of ± 20 per cent with respect to the reference disc.

§ 2.3.2 All other cases: the ratio between the area of the disc braking surface, as defined in paragraph 4., and the lightening area (sum of the area of holes, slots, etc.) must match those of the reference disc, with tolerance of -20 per cent maximum.

Modification Proposal:

Braking surface lightening: any solution is allowed (holes, slots, wave, etc.) provided that the ratio of kinetic energy (of the worst vehicle applications contemplated) to braking surface mass must be lower than the reference disc.

Improvements:

The aim of this similarity criteria is to group discs with equal or bigger capacity to withstand braking energy (heat and thermal stress).

This criteria doesn't give any limitation on disc thickness or mass, but fix a limitation on heat capacity of disc that must be bigger than the reference disc.

Annex 15 - § 2.6 Spokes of the bell lightening (floating only)

Current Grouping Criteria: Spokes of the bell with full/empty ratio – measured on the average circumference between end of the mounting face and beginning of the braking surface – within the range ± 20 per cent, thickness within the range (+ 30 per cent) \div (– 10 per cent) and same mechanical properties, as specified in the international standard for materials, with respect to the reference disc.

Modification Proposal: Spokes of the bell with full/empty ratio – measured on the average circumference between end of the mounting face and ~~beginning of the braking surface~~ *the maximum diameter of bell* – ~~within the range ± 20 per cent~~ *with tolerance of – 20 per cent maximum*, thickness ~~within the range (+ 30 per cent) \div (– 10 per cent)~~ *with tolerance of – 15 per cent maximum* and same mechanical properties, as specified in the international standard for materials, with respect to the reference disc. (See next slides for details).

Improvements: The proposed modification guarantee that the calculation of bell lightening is related only to the bell characteristics (no influence of braking surface geometry on the results) .

The removal of upper limit for % variation of bell thickness and lightening ratio doesn't invalidate the safety criteria used for groups definition (thicker and less lightened bells are stronger than reference bell).

Annex 15 - § 2.7 Fasteners quantity (floating only)

Current Grouping Criteria:	Same technical solution for the bell-braking surface fasteners (same drawing and materials; for the quantity of bell-braking surface fasteners, permitted the same quantity with a tolerance of +2 -0).
Modification Proposal:	Same technical solution for the bell-braking surface fasteners (same drawing and materials; for the quantity of bell-braking surface fasteners, permitted the same or higher quantity with a tolerance of +2 -0).
Improvements:	The removal of upper limit fasteners quantity doesn't invalidate the safety criteria used for groups definition (discs with higher number of fasteners are stronger than reference disc).

Annex 15 - § 2.9 Outer diameter

Current Grouping Criteria:

Outer diameter included in the range of 50 mm, according to Table 2.9.

Range [mm]	One piece	Composite fixed	Floating discs
≥ 150 < 200	X	X	X
≥ 200 < 250	X	X	X
≥ 250 < 300	X	X	X
≥ 300 < 350	X	X	X

Modification Proposal:

Outer diameter included in the range of 50 mm, according to Table 2.9.

Range [mm]	One piece	Composite fixed	Floating discs
≥ 150 < 250	X	X	X
≥ 250 < 350	X	X	X

Improvements:

The proposed ranges are more representative of the applications on the market:

up to 250 mm -> less severe applications (scooter discs or motorcycle rear brakes)

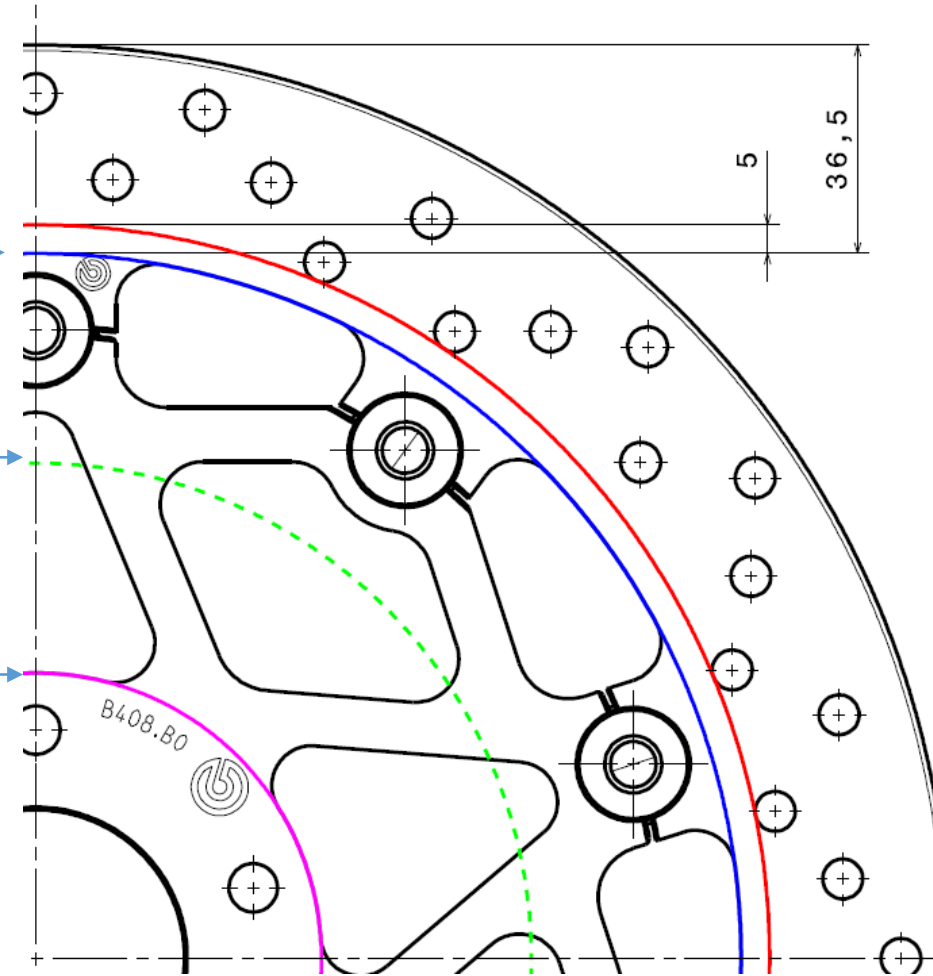
over 250 mm -> more severe applications (motorcycle front brakes)

Annex 15 – Modification Summary

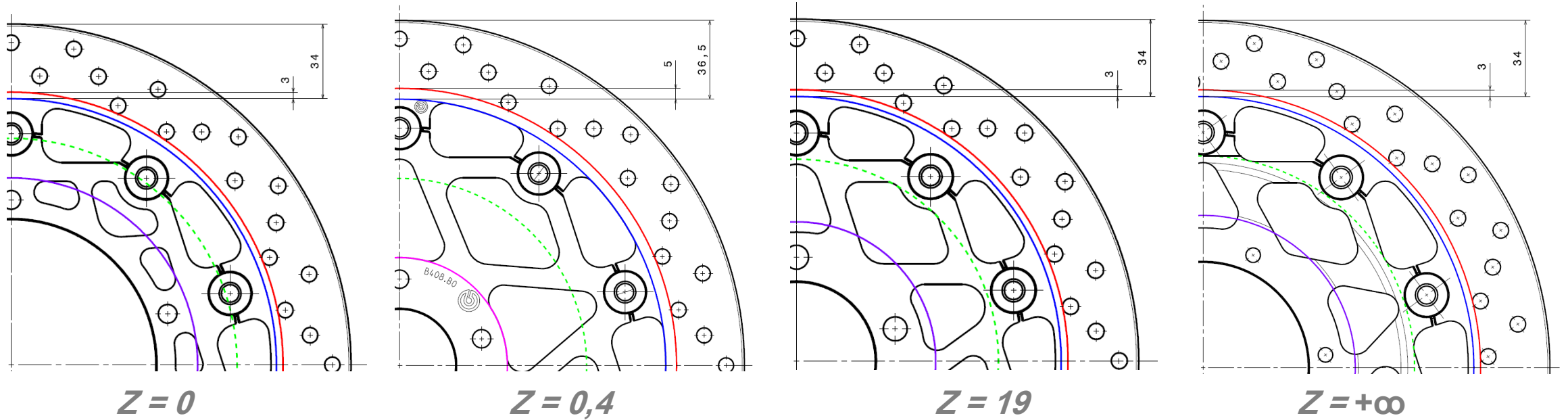
	R90 current	Proposal
§ 2.1 Brake disc type	fixed, floating, composed	No modifications
§ 2.8 Quantity of fixing holes	not binding	No modifications
§ 2.2 Brake disc surface material	from table (X12, X20, X30)	No modifications
§ 2.9 Outer diameter	200, 250, 300, 350 mm	To 249; From 250
§ 2.3 Brake surface lightening	-20% min from REF with different diam. and th., BSM +/- 20% from REF with same diam. and th.	K.E./Mass ≤ REF (reference is the one with greatest value)
§ 2.4 Mounting bell	Steel or aluminum	No modifications
§ 2.6 Lightening of the mounting bell (ratio full/empty)	bell lightening +/- 20% from REF; th. + 30% / - 10% from REF	bell lightening ≥ from REF; th. -15 % max From REF;
§ 2.5 Fixed element material	Same material for pin	No modifications
§ 2. 7 Number of fixed element	Tolerance 0 / + 2 from REF	Nr. of pin ≥ REF

Lightening mounting bell

§ 2.6 Spokes of the bell with full/empty ratio –
measured on the average circumference between end
of the mounting face and beginning of the braking
surface



Lightening mounting bell



Calculation made on disc with similar bell shape gives very different results:

CASE1: The average circumference is external to the bell $Z=0$

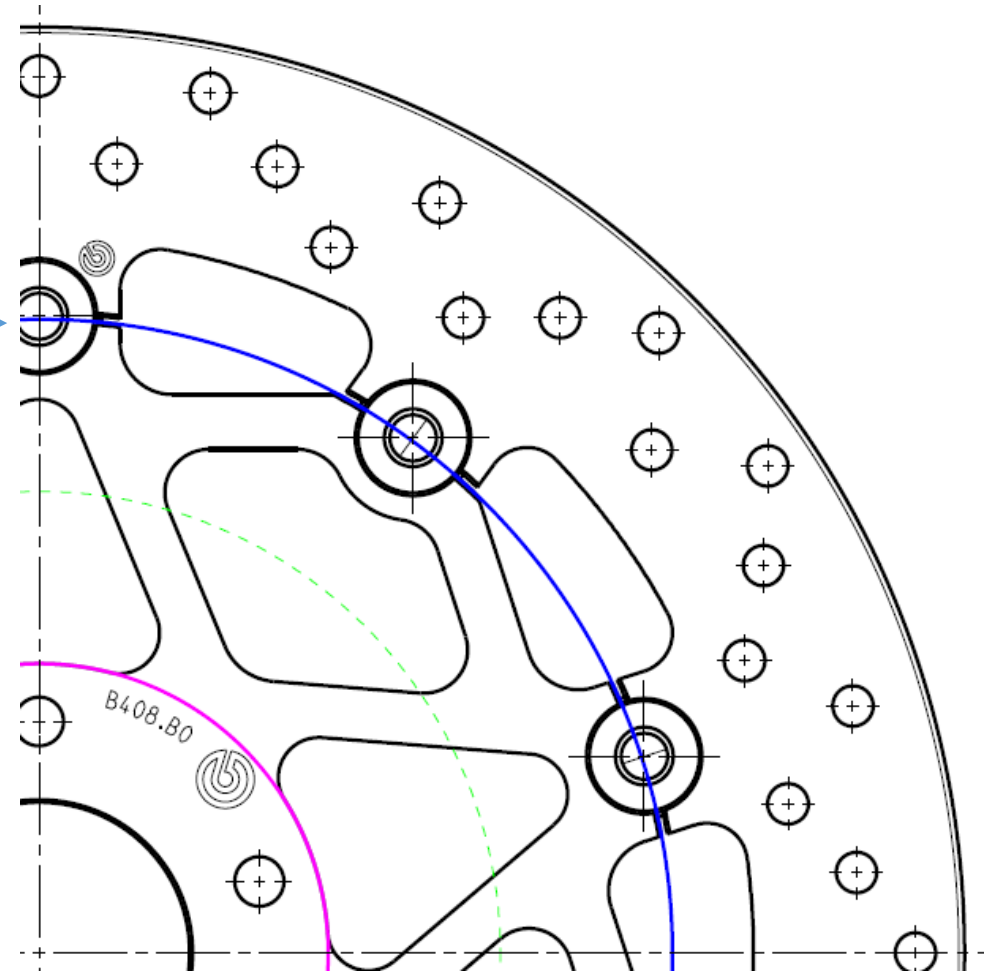
CASE 2/3: Discs with similar shape have different ratio $Z=0,4$ Vs 19

CASE 4: The average circumference is external to bell spokes $Z=\infty$

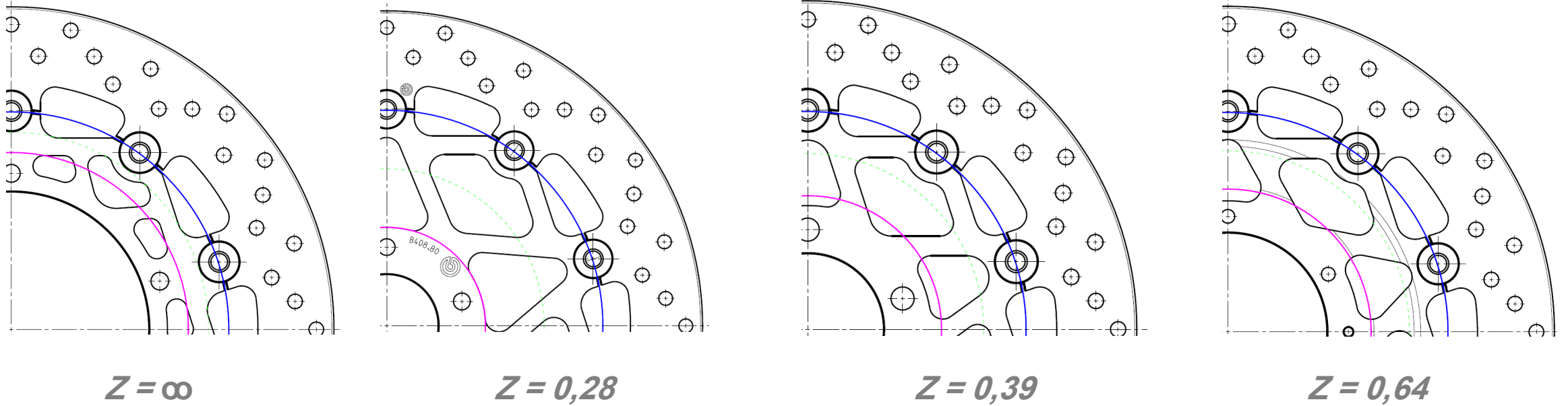
Lightening mounting bell

Modification proposal:

§ 2.6 **Spokes of the bell** with full/empty ratio –
measured on the average circumference between end
of the mounting face and ~~beginning of the braking~~
~~surface~~ the maximum diameter of bell



Lightening mounting bell



By applying the proposed modification the calculation is related only to the bell characteristics (no influence of braking surface geometry on the results) and gives a more balanced output.

2. Drum Brakes for L-cat vehicles

ECE/TRANS/WP29/2021/29

Rationale

This proposal is intended to actually complete the regulation and its scope.

It does not modify in any matter its technical content.

In particular, it aims at completing Annex 7a (concerning the grouping criteria of the brake lining assemblies for L-cat vehicles, providing instructions for the grouping of **brake shoes** (drum brakes), as already done for brake pads.

