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Working Party on Brakes and Running Gear (GRRF)
(Fiftieth session, 10-12 September 2001,

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 13
(Braking)

Transmitted by the expert from the European Association
of Automobile Suppliers (CLEPA)
Representing the Informal Working Group for Modular Approval of Trailers

Note: The text reproduced below was prepared by the expert from CLEPA in order to update the proposal for a modular type approval of trailers contained in documents TRANS/WP.29/GRRF/1998/18 and Add.1. This represents the agreement reached in the informal working group in charge of drafting a proposal for the modular approach for approval of trailer braking systems. Documents TRANS/WP.29/GRRF/2000/20 and Informal Document 1 from the 49th Session of GRRF represent a consolidation of the proposals.

Except where stated reference to **annex 16** is to be replaced by **annex 19**

Except where stated reference to **annex 17** is to be replaced by **annex 20**

Annex 11,

Amend paragraph 1.4., to read:

"1.4. The vehicle concerned is a trailer equipped with air operated S-cam **or disc brakes** 1/ which satisfies the

Annex 11 - Appendix 2,

Paragraph 2., amend as follows:

"

C = **brake** input torque

C_{max} = maximum permissible **brake** input torque

C_o = threshold **brake input** torque, i.e. minimum **input** torque necessary to produce a measurable **output** torque

....."

Paragraph 3.4.1.4., amend to read:

"3.4.1.4 outside of the brake drum **or brake disc**"

Paragraph 3.5.1.2., amend to read:

"3.5.1.2. surface of the drums **or discs**. The applications shall be shall not exceed 6.5 bar, and the **brake** input torque (C) shall not exceed the maximum technically permissible **brake** input torque (C_{max}). The average of the three results shall be taken as the cold performance."

Paragraph 3.5.2.1., amend to read:

"3.5.2.1.not exceeding 100°C, measured at the outside surface of the **brake** drum **or brake disc**."

Paragraph 4.1., the table, amend to read:

"

Item	Criteria
------	----------

4.1.1.	a) Brake drum cylindrical section b) Brake drum or brake disc material c) Brake drum or brake disc mass	No Change allowed No Change allowed May increase up to +20 per cent from the reference drum or disc mass
4.1.2.	a) Proximity of wheel to outside surface of brake drum or outside diameter of brake disc (dimension E) b) Part of brake drum or brake disc not covered by wheel (dimension F)	Tolerances to be determined by the Technical Service conducting the tests.
4.1.3.	a) Brake lining or brake pad material b) Brake lining or brake pad width c) Brake lining or brake pad thickness d) Brake lining or brake pad actual surface area e) Brake lining or brake pad method of attachment))) No change allowed)))
4.1.4.	Brake geometry (As in Fig.2A or 2B of appendix 3 as appropriate)	No change allowed
.....	

"

Paragraph 4.3.1.3., amend to read:

"4.3.1.3 The **brake input** torque (C) is then calculated as follows:"

Annex 11 - Appendix 3,

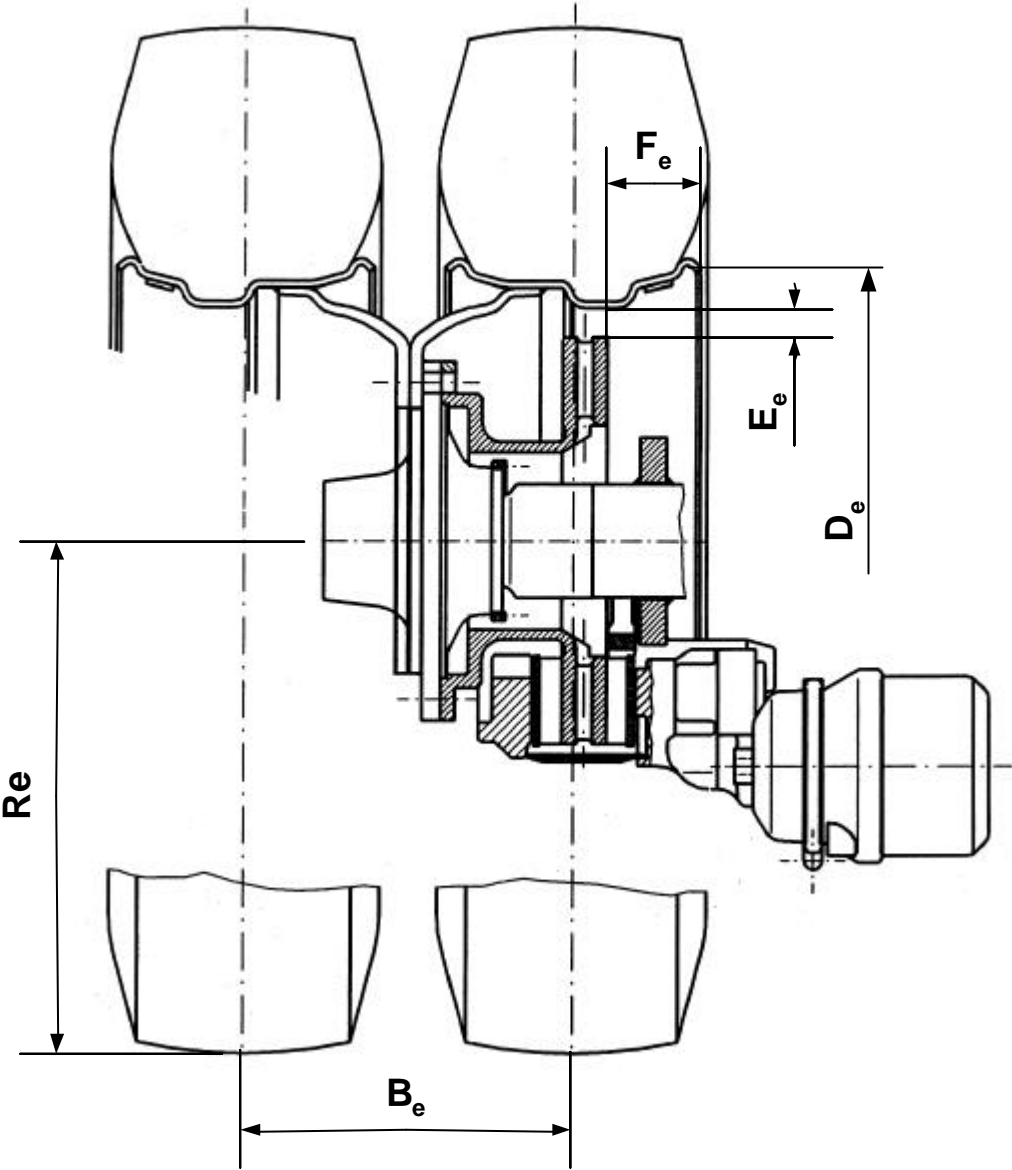
Item 1.2., amend to read (including the footnote 3/):

"1.2
.....
Technically **permissible brake** input torque C_{max}
Automatic brake adjustment device: integrated/non-integrated 1/

Brake drum **or Brake disc** 1/:
Internal diameter **of drum or outside diameter of disc** 1/
Effective radius
Thickness 3/
Mass
Material

Insert a new Figure 1B for disc brakes, to read:

"Figure 1B



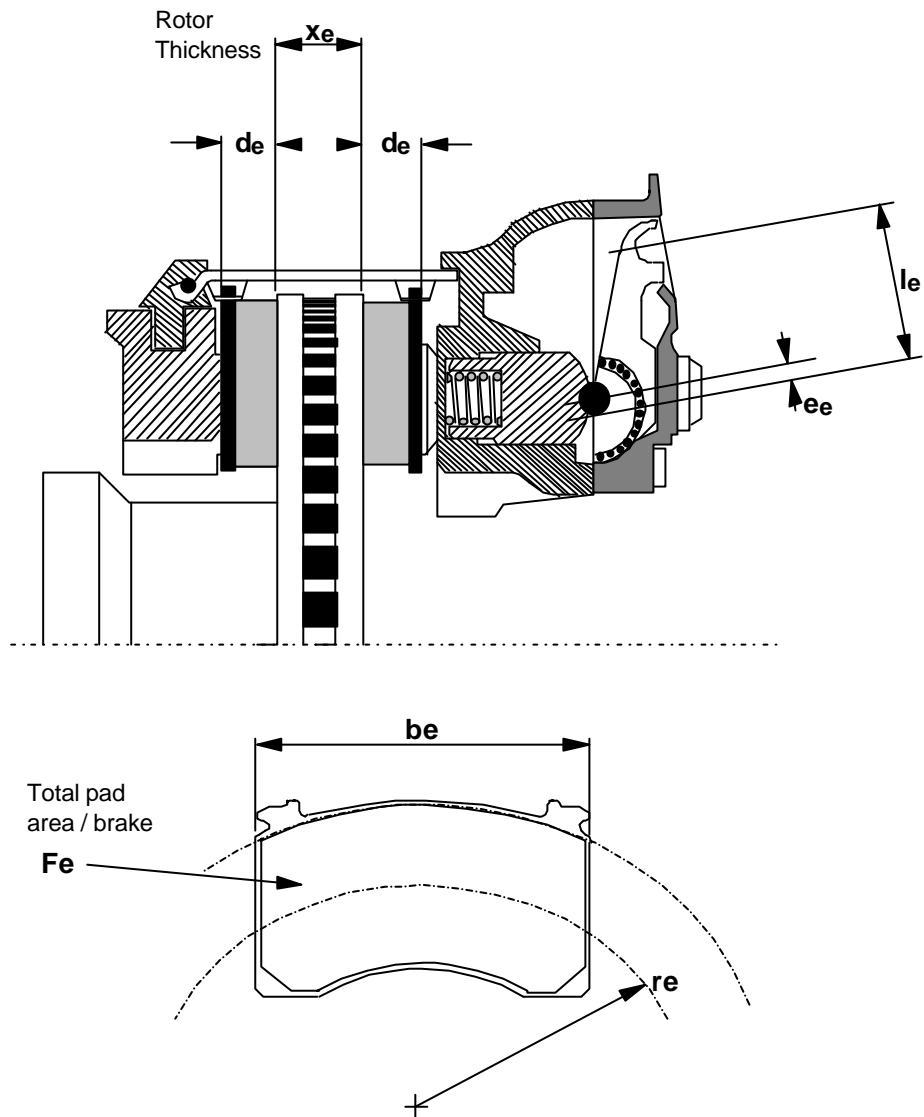
B_e (mm)	D_e (mm)	E_e (mm)	F_e (mm)	R_e (mm)

"

Figure 2, renumber as Figure 2A

Insert a new Figure 2B for disc brakes, to read:

Figure 2B



l_e (mm)	e_e (mm)	d_e (mm)	x_e (mm)	r_e (mm)	b_e (mm)	F_e (cm ²)

”

3/ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively a separate Approval Authority authorisation issued with the report."

Annex 12, appendix 3,

Item 10., should be deleted

Item 11.(former), renumber as item 10.

Insert new items 11. and 12., and the corresponding footnote 3/, to read:

"11. This test has been carried out and the results reported in accordance with relevant provisions of annex 12 to ECE Regulation No.13 as last amended by the ---- Series of Amendments

Technical Service 3/ carrying out the test

Signed: Date:

12. Approval Authority 3/

Signed: Date:

3/ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively a separate Approval Authority authorisation issued with the report."

Annex 12, appendix 4

Item 6., should be deleted

Item 7.(former), renumber as item 6.

Insert new items 7. and 8., and the corresponding footnote 3/, to read:

"7. This test has been carried out and the results reported in accordance with relevant provisions of annex 12 to ECE Regulation No. 13 as last amended by the ---- Series of Amendments

Technical Service 3/ carrying out the test

Signed: Date:

8. Approval Authority 3/

Signed: Date:

3/ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively a separate Approval Authority authorisation issued with the report."

Annex 19., Amend title to read

PERFORMANCE TESTING OF BRAKING COMPONENTS

Note below item 1.1.4., amend to read :

"(Note: Procedures for determining the fade test performance for trailer brakes **and automatic brake wear adjustment devices are** defined in annex 11 of this Regulation)"

Add a new paragraph 1.2., to read :

"1.2 The above test reports may be used in conjunction with the procedures defined in Annex 20 to this Regulation or at the time of evaluating a trailer which is being subject to actual performance requirements defined for the respective trailer."

Item 4.1.1., amend to read:

"4.1.1. air operated S cam and disc brakes 3/ fitted to trailers."

Item 4.3.1.3., amend to read :

"4.3.1.3. The make and type of brake lining(s) **or brake pad(s)**"

Item 4.3.1.4., amend to read :

"4.3.1.4. The brake drum **or brake disc** material."

Item 4.4.1.3., amend to read ;

"4.4.1.3. The dynamic tyre radius at the test loading shall be determined **as prescribed for the test method.**"

Item 4.4.2.1., amend to read

"4.4.2.1. **In the case of drum brakes the tests shall** start with new brake linings"

Add a new item 4.4.2.2. and renumber subsequent paragraphs:

"4.4.2.2. **In the case of disc brakes the tests shall** start with new brake pads and new disc(s), machining of the pad material shall be at the discretion of the brake manufacturer."

Item 4.4.2.3.(new), amend to read

"4.4.2.3. temperature at the lining/drum **or pad/disc** interface shall not exceed 100°C before each brake application."

Item 4.4.2.4.(new), amend to read:

"4.4.2.4. the lining/drum **or pad/disc** interface on the first brake application shall not exceed 100°C."

Item 4.4.2.5.(new), amend to read :

"4.4.2.5. On completion of the 30 brake applications defined in paragraph **4.4.2.4.** above and after"

Item 4.4.2.6.(new), amend to read :

"4.4.2.6. at the lining/drum **or pad/disc** interface shall not exceed 150° C before each brake application."

Item 4.4.2.7.3.(new), amend to read :

"4.4.2.7.3. Make a brake application with each of the input torques determined in paragraph **4.4.2.7.1.** from an initial speed of 60 km/h. The initial temperature at the lining/drum **or pad/disc** interfaces shall not exceed 100° C before each application."

Item 4.4.2.8.(new), amend to read :

"4.4.2.8. Repeat the procedures defined in paragraphs **4.4.2.6. and 4.4.2.7.3.** above until the performance"

Item 4.4.3.1., amend to read :

"4.4.3.1. The temperature measured at the lining/drum **or pad/disc** interface shall not exceed 100° C, at the start of each brake application."

Item 4.5.1.3., amend to read :

"4.5.1.3. The trailer shall be loaded (as closely as possible) to the **maximum technically permitted** mass for each brake, however, additional mass may be added if required to ensure that sufficient mass is over the axle under test to achieve a braking rate of 0.55 TR/(**maximum technically permitted** mass per brake) without wheel lock."

Item 4.5.1.4., amend to read :

"4.5.1.4. The dynamic rolling radius of the tyre **may be verified**"

Item 4.5.1.10., amend to read :

"4.5.1.10. The braking performance of the axle under test shall be determined by calculating the deceleration determined from a direct measurement of velocity and distance between $0.8v_1$ and v_2 . Where v_2 shall not be less than $0.1v_1$. This shall be deemed to be equivalent to the mean fully developed deceleration (MFDD) as defined in Annex 4 above."

Item 4.5.2.4.3., amend to read :

"4.5.2.4.3. at the lining/drum **or pad/disc** interface."

Item 4.5.2.5., amend to read (including new footnote 5/):

"4.5.2.5. The **inertia (I_T)** of the dynamometer shall be set as close as possible, with ± 5 per cent tolerance, including the internal friction of the dynamometer, to that part of the linear inertia of the vehicle acting upon one wheel necessary for a performance of $0.55TR$ /**maximum technically permitted** mass according to the following formula:

$$I_T = P_d R^2$$

where

I_T = **actual** rotary inertia (kgm^2)

R = tyre rolling radius defined by the formula $0.485 D$

$D = d + 2H$ 5/

d = rim diameter conventional number (mm)

H = Nominal section height (mm) = $S_1 \times 0.01 Ra$

S_1 = Section width (mm)

Ra = nominal aspect ratio

P_d = Maximum technically permitted mass/brake as defined in paragraph 4.3.1.5.

5/ **Outer diameter of tyre, as defined in Regulation No. 54"**

Item 4.5.2.6., amend to read :

"4.5.2.6. velocity not exceeding **0.33v** over the"

Item 4.5.2.9., amend to read :

4.5.2.9. The brake performance shall be determined by applying the following formula to the measured brake output torque

$$\text{braking rate} = \frac{M_t R}{I_g}$$

where:

M_t = Average brake output torque (Nm) - **based on distance**
 g = deceleration due to gravity (m/s/s)

The average brake output torque (M_t) **shall be calculated from the deceleration determined from a direct measurement of velocity and distance between $0.8v_1$ and $0.1v_1$. This shall be deemed to be equivalent to the mean fully developed deceleration (MFDD) as defined in Annex 4 above.**

Item 4.5.3.4., amend to read :

"4.5.3.4. not exceeding **0.33v** over the brake(s)."

Item 4.5.3.7., amend to read :

"4.5.3.7.

The average brake output torque (M_t) shall be based on the measured values between the moment the application pressure/force reaches ~~90 per cent ± 3 per cent of~~ its asymptotic value ~~within 0.7s~~ from the onset of pressure rise at the brake input device and when the energy input has reached the value W_{60} that is defined in paragraph 4.5.3.8."

Item 4.5.3.8.1., amend to read :

"4.5.3.8.1. If the test speed v cannot be maintained at 60 ± 2 km/h during the measurement of"

Item 4.6.1., amend to read :

"4.6.1. a model of which is shown in **item 2.3. of appendix 3 to annex 11.**

Item 5.2.1., amend to read :

"5.2.1. **The manufacturer of the ABS shall supply to the Technical Service an Information Document of the system(s) requiring performance verification. This document shall contain at least the information defined in appendix 5 to this annex.**"

Delete items 5.2.1.1. to 5.2.1.4.1. inclusive

Item 5.3.1., amend to read :

"5.3.1. defined in paragraph **2.1. of appendix 5**, the Technical Service shall carry out tests on representative trailers"

Item 5.3.1.3., amend to read :

"5.3.1.3. Brake type: approval shall be limited to **S** cam or **disc** brakes but should other types become"

Delete item 5.3.1.6.

Item 5.4.1., amend to read :

"5.4.1. application list defined in paragraph **2.1. of appendix 5** to this annex. However, worst case"

Item 5.4.1.1., amend to read :

"5.4.1.1. the manufacturers information document (**see paragraph 2.1. of appendix 5 to this annex**)."

Item 5.4.1.2.1., amend to read :

"5.4.1.2.1. **Axle loading - The trailer(s) to be tested shall be loaded so that the axle load is 2,500 kg or 25 per cent of the permissible axle load whichever is the lower.**"

Add a new paragraph 5.4.1.2.2., to read and renumber subsequent paragraphs

"5.4.1.2.2. **It shall be ensured that anti-lock cycling can be achieved throughout the dynamic tests defined in paragraph 6.1.3. of annex 13 to this Regulation.**"

Item 5.4.2.2.2 (former) renumber as 5.4.1.2.3

Item 5.4.1.2.4.1., (former 5.4.1.2.3.1.) amend to read :

"5.4.1.2.4.1. **Prior to the commencement of the energy consumption test (paragraph 5.4.1.2.3) in the case of brakes with non integrated brake wear adjustment the brakes shall be set to a condition where the relationship (R_I) of brake chamber push rod travel (s_T) against lever length (l_T) is 0.2. This relationship shall be determined for a brake chamber pressure of 6.5 bar.**

Example :

$l_T = 130\text{mm},$

s_T at 6.5 bar brake chamber pressure = 26mm

$R_I = s_T / l_T = 26/130 = 0.2$

In the case of brakes with integrated automatic brake wear adjustment the brakes shall be set to a the normal running clearance specified by the manufacturer.

Setting of the brakes as defined above shall be carried out when the brakes are cold ($\leq 100^\circ \text{C}$)"

Item 5.4.1.2.4.2., amend to read :

"5.4.1.2.4.2. The number of equivalent brake applications (n_{er}) shall be noted.

The equivalent number of static brake applications (n_e) is to be recorded in the test report.

Where $n_e = 1.2 \cdot n_{er}$ and is to be rounded up to the nearest whole integer"

Item 5.4.1.6., amend to read :

"5.4.1.6. Documentation relating to the controller(s) shall be made available as required by paragraph 5.1.5 of the Regulation and paragraph 4.1. of annex 13 to this Regulation, including footnote 12."

Annex 19 - Appendix 1

Delete item 3.4.

Paragraph 5., amend to read:

"5. This test has been carried out and the results reported in accordance with annex 19 to ECE Regulation No. 13 as last amended by the ---- Series of amendments.

Technical Service 3/ conducting the test:

Signed: Date:"

Paragraph 6., amend to read:

7. **Approval Authority 3/**

Signed: Date:"

Footnote 3/ amend to read :

3/ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively a separate Approval Authority authorisation issued with the report.

Annex 19 - Appendix 3

Paragraph 5., amend to read :

5. This test has been carried out and the results reported in accordance with annex 19 to ECE Regulation No. 13 as last amended by the ---- Series of Amendments.

Technical Service 3/ conducting the test:

Signed :

Date:

Paragraph 6., amend to read (including footnote):

6. Approval Authority 3/

Signed:

Date:

Footnote 3/ amend to read :

3/ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively a separate Approval Authority authorisation issued with the report.

Appendix 5. amend to read :

Appendix 5

"TRAILER ANTI-LOCK BRAKING SYSTEM INFORMATION DOCUMENT

1. General
 - 1.1. Name of manufacturer
 - 1.2. System name
 - 1.3. System variations
 - 1.4. System configurations (e.g. 2S/1M, 2S/2M etc.)
 - 1.5. Explanation of the basic function and/or philosophy of the system.
2. Applications
 - 2.1. List of trailer types and ABS configurations for which approval is required.
 - 2.2. Schematic diagrams of the system configurations installed on the trailers defined in paragraph 2.1. above with consideration given

to the following parameters:

Sensor locations
Modulator locations
Lift axles
Steering axles
Tube: type - bore size(s) and lengths

- 2.3. Relationship of tyre circumference to the resolution of the exciter, including tolerances.
- 2.4. Tolerance of tyre circumference between one axle and another fitted with the same exciter.
- 2.5. Scope of application with respect to suspension type e.g. balanced mechanical etc. with reference to the manufacturer and model/type.
- 2.6. Recommendations on differential brake input torque (if any) in relation to the ABS configuration and trailer bogie.
- 2.7. Additional information (if applicable) to the application of the anti-lock braking system.
- 3. Component description
 - 3.1. Sensor(s)
Function
Identification (e.g. part number(s))
 - 3.2. Controller(s)
General description and function
Identification (e.g. part number(s))
Safety aspects of controller(s)
Additional features (e.g. retarder control, automatic configuration, variable parameters, diagnostics)
 - 3.3. Modulator(s)
General description and function
Identification (e.g. part number(s))
Limitations (e.g. maximum delivery volumes to be controlled)
 - 3.4. Electrical Equipment
Circuit diagram(s)
Powering methods
Warning lamp sequence(s)
 - 3.5. Pneumatic Circuits
Braking schematics covering the ABS configurations as applied to the trailer types defined in paragraph 5.2.1.2.1.
Limitations on pipe, tube sizes and associated lengths that have

an effect on system performance (e.g. between modulator and brake chamber)

3.6. Electro Magnetic Compatibility

3.6.1. Documentation demonstrating compliance with the provisions of Paragraph 4.4. of annex 13 to this Regulation."

Annex 19 - Appendix 6

Item 2.5., amend to read :

"2.5 Energy consumption - equivalent number of static brake applications."

Add a new paragraph 4.10., to read (renumber subsequent paragraph):

"4.10. **System configurations and applications that comply with the category A requirements.**"

Paragraph 5., amend to read :

5. Date of Test:

This test has been carried out and the results reported in accordance with annex 19 to ECE Regulation No. 13 as last amended by the ---- Series of Amendments.

Technical Service 1/ conducting the test:

Signed: Date:

Paragraph 6., amend to read (including footnote):

6. **Approval Authority 1/**

Signed: Date:

Attachment: Manufacturers information document

Footnote 1/ amend to read :

1/ To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively a separate Approval Authority authorisation issued with the report.

Annex 19 - Appendix 7

Amend definitions as to read:

SYMBOL	DEFINITION
n_e	Equivalent number of static brake applications for the purpose of type approval
n_{er}	Equivalent number of static applications obtained during testing

Delete symbol and reference below:

SYMBOL	DEFINITION
v_1^*	speed at which the brake performance measurement commences

Annex 20

Item 1.1., amend to read:

1.1. " accordance with annexes 11 and **19.**"

Item 1.2. amend to read:

"1.2. conforming to the model specified in annex 2 **and annex 2 appendix to this Regulation.**"

Add a new paragraph 1.3., to read:

1.3. **For the purposes of the calculations defined within this annex the centre of gravity height shall be determined in accordance with the method defined in appendix 1 to this annex**

Item 2.1., amend to read:

"2.1. by the trailer manufacturer. **In support of the approval the trailer manufacturer shall supply to the Technical Service at least the following:**"

Add a new item 2.1.1., to read:

"2.1.1. **A copy of the ECE or EEC Type Approval Certificate and an Information Document of a trailer hereafter referred to as the "reference trailer" on which the service braking performance comparison is to be based. This trailer will have been subject to the actual tests defined in annex 4 to this Regulation for the appropriate trailer or equivalent EEC Directive. A trailer that has been approved to the alternative procedure defined in this annex may not be used as a reference trailer.**"

Add a new item 2.1.2., to read:

"2.1.2. Copies of the annex 11 and annex 19 test reports."

Add a new item 2.1.3., to read

2.1.3 A documentation package that contains the relevant verification information including the relevant calculations for the following:

Performance Requirements	Annex 20 reference
Cold service braking performance	3.0
Parking brake performance	4.0
Emergency brake performance	5.0
Failure of brake distribution system	6.0
Breakage or leakage from auxiliary systems	7.0
Anti - lock braking	8.0

Add a new item 2.1.4., to read:

"2.1.4. A trailer, representative of the trailer type to be approved hereafter referred to as the "subject trailer"."

Item 2.2., amend to read :

"2.2. The manufacturer of the "reference trailer" and "subject trailer" shall be the same."

Delete items 2.2.1., 2.2.2. and 2.3

Item 3.1., amend to read :

"3.1. To demonstrate compliance with the Type O service braking cold performance it shall be verified, by calculation, that the "subject trailer" has sufficient brake force (TR) available to achieve the prescribed service braking performance and that there is sufficient adhesion available on a dry road surface (assumed to have a coefficient of adhesion of 0.8) to utilise this brake force."

Delete items 3.1.1., 3.1.1.1., 3.1.1.2. and 3.1.2.

Item 3.2.1.2., amend to read :

"3.2.1.2. Any difference in the brake input torque between one axle and another within a bogie of the "subject trailer" shall not differ from that of the "reference trailer"."

Item 3.2.1.3., amend to read :

"3.2.1.3. The number and arrangement of **axles i.e. lifting, steering etc.** of the "subject trailer" shall not differ from that of the reference trailer."

Delete footnote 1/

Item 4.2.1., amend to read :

"4.2.1. " using the following formula:

$$T_{pi} = (Th_s \cdot l - C_o) \cdot n \cdot B_f / R_s"$$

Delete items 7., 7.1.1., 7.2., 7.2.1., 7.2.2.1. and 7.2.1.2.

Item 8.3.1.1., amend to read :

"8.3.1.1. In the case of brakes with non integrated brake wear adjustment the brakes on the subject trailer shall be set to a condition where the relationship (R_I) of brake chamber push rod travel (s_T) against lever length (l_T) is 0.2.

Example :

$$l_T = 130\text{mm},$$

$$R_I = s_T / l_T = s_T / 130 = 0.2$$

$$s_T = \text{Push rod travel at 6.5 bar brake chamber pressure} \\ = 130 \times 0.2 = 26\text{mm}"$$

Item 8.3.1.2., amend to read:

"8.3.1.2. In the case of brakes with integrated automatic brake wear adjustment the brakes shall be set to a normal running clearance."

Add a new item 8.3.1.3., to read :

"8.3.1.3. Setting of the brakes as defined above shall be carried out when the brakes are cold ($\leq 100^\circ \text{C}$)"

Add a new item 8.3.1.4., to read :

"8.3.1.4. With the brakes adjusted according to relevant procedure defined above and the load sensing device(s) set to the laden condition and the initial energy level set according to paragraph 6.1.2. of annex 13 to this Regulation, the energy storage device(s) shall be isolated from further supply. The brakes shall be applied with a control pressure of 6.5 bar at

the coupling head and then fully released. Further brake applications shall be made up to the number n_e determined from the test conducted in accordance with paragraph 5.4.1.2.4.2. of annex 19 to this Regulation and defined in paragraph 2.5. of the anti-lock braking system Approval Report. During this application, the pressure in the operating circuit shall be sufficient to provide a total braking force at the periphery of the wheels equal to not less than 22.5 per cent of the maximum stationary wheel load and without causing automatic application of any braking system not under the control of the anti-lock braking system."

Item 9.1.2.1., amend to read :

"9.1.2.1. conforms to the **relevant** requirements of annex 6."

Item 9.1.3.1., amend to read :

"9.1.3.1. The Technical Service shall verify that the subject trailer conforms to the requirements of **annex 7 and annex 8 as appropriate.**"

Annex 20 - Appendix 1

Definition of h3, amend to read :

"h3 = centre of gravity height of payload and bodywork (laden)
= **(h7 . 0.3) + h6**"

Definition of h5, amend to read :

"h5 = centre of gravity height of bodywork (**unladen**) = **(h7 . 0.5) + h6 + s**"

Definition of s, amend to read :

"s = spring deflection **between laden and unladen**"