

## 1. SCOPE

This Regulation covers the production of retreaded pneumatic tyres\* designed primarily for vehicles of category M2, M3, N, O3 and O4 1 2. However, it does not apply to the production of:

- 1.1. Retreaded tyres with a speed capability below 80 km/h;
- 1.2. Tyres originally produced without speed symbols and/or load indices;
- 1.3. Tyres originally produced without type approval and without either an "E" or "e" mark.

## 2. DEFINITIONS - See also figure in Annex 9

For the purpose of this Regulation:

- 2.1. Range of retreaded tyres means a range of retreaded tyres as quoted in paragraph 4.1.5
- 2.2. "*Retreader*" means the person or body who is responsible to the Type Approval Authority (TAA) for all aspects of the type-approval under this Regulation and for ensuring the conformity of production.
- 2.3. "*Tyre Manufacturer*" means the person or body who was responsible to the TAA having granted the original new type approval and for ensuring the conformity of production under the applicable Regulation for new tyres.
- 2.4. "*Material manufacturer / material supplier*" means the person or body who provides to the retreader the retreading or repair materials.
- 2.5. "*Brand name/trademark*" means the identification of the brand or trademark as defined by the retreader and marked on the sidewall(s) of the tyre. The brand name/trademark may be the same as that of the retreader.
- 2.6. "*Trade description/commercial name*" means an identification of a range of tyres as given by the retreader. It may coincide with the brand name/trademark.
- 2.7. "Structure" of a tyre means the technical characteristics of the tyre's carcass. The following structures are distinguished in particular:
  - 2.7.1. "Diagonal" or "Bias ply" describes a tyre structure in which the ply cords extend to the beads and are laid at alternate angles substantially less than 90° to the centreline of the tread.

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\* For the purpose of this Regulation "tyres" means "pneumatic tyres".

- 2.7.2. "Bias belted" describes a tyre structure of diagonal (bias ply) type in which the carcass is stabilised by a belt, comprising two or more layers of substantially

inextensible cord material laid at alternate angles close to those of the carcass.

- 2.7.3. "Radial" or "radial-ply" describes a tyre structure in which the ply cords extend to the beads and are laid substantially at 90° to the centreline of the tread, the carcass being stabilized by an essentially inextensible circumferential belt;
- 2.8. "Category of use"
  - 2.8.1. "Normal tyre" is a tyre intended for normal road use only.
  - 2.8.2. "Special use tyre" is a tyre intended for mixed use, both on and off road and/or at restricted speed. These tyres are primarily designed to initiate and maintain the vehicle in motion in off-road conditions.
  - 2.8.3. "Snow tyre" means a tyre whose tread pattern, tread compound or structure, are primarily designed to achieve in snow-conditions a performance better than that of a normal tyre with regard to its ability to initiate or maintain vehicle motion".
    - 2.8.3.1 "Snow tyre for use in severe snow conditions" means a snow tyre whose tread pattern, tread compound or structure is specifically designed to be used in severe snow conditions and that fulfils the requirements of paragraph 7.2. of this Regulation.
  - 2.8.4. "Traction tyre" means a tyre in class C2 or C3 bearing the inscription TRACTION and intended to be fitted primarily to the drive axle(s) of a vehicle to maximize force transmission in various circumstances.
- 2.9. "Bead" means the part of a tyre which is of such shape and structure as to fit the rim and hold the tyre on it.
- 2.10. "Cord" means the strands forming the fabric of the plies in the tyre.
- 2.11. "Ply" means a layer of "rubber" coated parallel cords.
- 2.12. "Belt" applies to a radial ply or bias belted tyre and means a layer or layers of material or materials underneath the tread, laid substantially in the direction of the centre line of the tread to restrict the carcass in a circumferential direction.
- 2.13. "Breaker" applies to a diagonal ply tyre and means an intermediate ply between the carcass and tread.
- 2.14. "Protective breaker" applies to a radial ply tyre and means an optional intermediate ply between the tread and the belt to minimize damage to the belt.
- 2.15. "Chafer" means material in the bead area to protect the carcass against chafing or abrasion by the wheel rim.

- 2.16. "Carcass" means that structural part of a tyre other than the tread and outermost , "rubber" of the sidewalls which, when inflated, supports the load.
- 2.17. "Tread" means that part of a tyre which is designed to come into contact with the ground, protects the carcass against mechanical damage and contributes to ground adhesion.
- 2.18. "Sidewall" means the part of a tyre between the tread and the area designed to be covered by the rim flange.
- 2.19. "Lower area of tyre" means the area included between the line of maximum section width of the tyre and the area designed to be covered by the edge of the rim.
- 2.20. "Tread groove" means the space between the adjacent ribs or blocks in the tread pattern.
- 2.21. "Section width" means the linear distance between the outside of the sidewalls of an inflated tyre, when fitted to the specified measuring rim, but excluding elevations due to labelling (marking), decoration or protective bands or ribs.
- 2.22. "Overall width" means the linear distance between the outside of the sidewalls of an inflated tyre, when fitted to the specified measuring rim, and including labelling (marking), decoration or protective bands or ribs.
- 2.23. "Section height" means a distance equal to half the difference between the outer diameter of the tyre and the nominal rim diameter.
- 2.24. "Nominal aspect ratio" means one hundred times the number obtained by dividing the number expressing the nominal section height by the number expressing the nominal section width, both dimensions being in the same units.
- 2.25. "Outer diameter" means the overall diameter of an inflated, newly retreaded tyre.
- 2.26. "Tyre-size designation" means, except in the case of types of tyre for which the tyre-size designation is shown in the first column of the tables in Annex 5 to this Regulation, a designation showing:
- 2.26.1. The nominal section width (S1).
  - 2.26.2. The nominal aspect ratio or, depending on the tyre design type, the nominal outer diameter expressed in mm;
  - 2.26.3. An indication of the structure placed in front of the rim diameter marking as follows:
    - 2.26.3.1. on diagonal (bias-ply) tyres, a dash "-" or the letter "D";
    - 2.26.3.2. on radial-ply tyres, the letter "R";

2.26.4. A conventional number "d" (the "d" symbol) denoting the nominal rim diameter of the rim and corresponding to its diameter expressed either by codes (numbers below 100) or in millimetres (numbers above 100). Numbers corresponding to both types of measurements may be used in the designation;

2.26.4.1. The values of the "d" symbols expressed in millimetres are shown below:

Nominal Rim Diameter Code - "d"	Value of the "d" symbol expressed in mm
8	203
9	229
10	254
11	279
12	305
13	330
14	356
15	381
16	406
17	432
18	457
19	483
20	508
21	533
22	559
24	610
25	635
14.5	368
16.5	419
17.5	445
19.5	495
20.5	521
22.5	572
24.5	622
26	660
28	711
30	762

2.26.5. an indication of the tyre to rim fitment configuration when it differs from the standard configuration and is not already expressed by the symbol "d" denoting the nominal rim diameter code.

2.27. "Nominal rim diameter (d) " means the diameter of the rim on which a tyre is designed to be mounted.

- 2.28. "Rim" means the support, either for a tyre-and-tube assembly or for a tubeless tyre, on which the tyre beads are seated.
- 2.28.1. "Tyre to rim fitment configuration" means the type of rim to which the tyre is designed to be fitted. In the case of non-standard rims this will be identified by a symbol applied to the tyre, for example, "A".
- 2.29. "Measuring rim" means the rim specified as a 'measuring rim width' or 'design rim width' for a particular tyre size designation in any edition of one or more of the International Tyre Standards.
- 2.30. "Test rim" means any rim specified as approved or recommended or permitted in one of the International Tyre Standards for a tyre of that size designation and type.
- 2.31. "International Tyre Standard" means any one of the following standard documents:
- (a) The European Tyre and Rim Technical Organisation (ETRTO) 1/: 'Standards Manual';
  - (b) The European Tyre and Rim Technical Organisation (ETRTO) 3/: 'Engineering Design Information - obsolete data';
  - (c) The Tire and Rim Association Inc. (TRA) 2/: 'Year Book';
  - (d) The Japan Automobile Tire Manufacturers Association (JATMA) 3/: 'Year Book';
  - (e) The Tyre and Rim Association of Australia (TRAA) 4/: 'Standards Manual';
  - (f) The Assiciacao Brasileira de Pneus e Aros (ABPA) 5/: 'Manual de Normal Técnicas';
  - (g) The Scandinavian Tyre and Rim Organisation (STRO) 6/: 'Data Book'.
- 2.32. "Chunking" means the breaking away of pieces of rubber from the tread.
- 2.33. "Cord separation" means the parting of the cords from their rubber coating.

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The tyre standards can be obtained from the following addresses:

- <sup>3</sup> ETRTO, 78, Rue Defacqz, B-1060 Brussels, Belgium
- 2/ TRA, 175 Montrose West Avenue, Suite 150, Copley, Ohio, 44321 USA
- 3/ JATMA, 9th Floor, Toranomon Building No. 1-12, 1-Chome Toranomon Minato-ku, Tokyo 105, Japan
- 4/ TRAA, Suite 1, Hawthorn House, 795 Glenferrie Road, Hawthorn, Victoria, 3122 Australia
- 5/ ABPA, Avenida Paulista 244-12º Andar, CEP, 01310 Sao Paulo, SP Brazil
- 6/ STRO, Älggatan 48 A, Nb, S-216 15 Malmö, Sweden

- 2.34. "Ply separation" means the parting of adjacent plies.
- 2.35. "Tread separation" means the pulling away of the tread from the carcass.
- 2.36. "Service description" means the specific combination of the load index and speed symbol of the tyre.
- 2.37. "*Load index*" means a numerical code which indicates the load the tyre can carry at the speed corresponding to the associated speed symbol and when operated in conformity with the service conditions specified by the original tyre manufacturer or the retreader. A tyre can have more than one load index to indicate its load capacity when used in single or dual (twin) formation, or to indicate an alternative load capacity (Unique point) on which a load variation in accordance with paragraph 2.40. and Annex 8 to this Regulation is not permitted.

The list of load indices and the corresponding loads are shown in Annex 4 to this Regulation.

- 2.38. "Speed symbol" means:
- 2.38.1. An alphabetical symbol indicating the speed at which the tyre can carry the load given by the associated load index;
- 2.38.2. The speed symbols and corresponding speeds are as shown in the table below:

Speed symbol	Corresponding maximum speed (km/h)
F	80
G	90
J	100
K	110
L	120
M	130
N	140
P	150
Q	160
R	170
S	180
T	190
U	200
H	210

- 2.39. "Unique Point" means an additional service description, marked adjacent to the normal service description, but which must not be used for calculating a load capacity variation with speed as defined in paragraph 2 and in Annex 8 to this Regulation."
- 2.40. "Load-capacity variation with speed" means an alternative load capacity for

the tyre when used at a speed different from that indicated by the speed symbol in the normal service description. The permissible variations are given in the table in Annex 8 to this Regulation.

- 2.41. "Retreading production unit" means a site or group of localized sites where finished retread tyres are produced.
- 2.42. "Retreading" means the generic term for reconditioning a used tyre by replacing the worn tread with new material. It may also include renovation of the outermost sidewall surface (e.g. ASP) and replacement of the crown plies or the protective breaker. It covers the following process methods:
  - 2.42.1. "Top capping" - replacement of the tread;
  - 2.42.2. "Re-capping" - replacement of the tread and with the new material extending over part of the sidewall; 7/
  - 2.42.3. "Bead to bead" - replacement of the tread and renovation of the sidewall including all or part of the lower area of the tyre. 9/
- 2.43. "Casing" is the worn tyre comprising carcass and remaining tread and sidewall material.
- 2.44. "Buffing" is the process of removing old material from the casing to prepare the surface for the new material.
- 2.45. "Repair" is the remedial work carried out to damaged casings within recognised limits.
- 2.46. "Tread material" is a material in a condition suitable for replacing the worn tread. It can be in several forms for example:
  - 2.46.1. "Camel-back" - pre-cut lengths of material which has been extruded to give the required cross section profile and subsequently fitted cold to the prepared casing. The new material must be cured;
  - 2.46.2. "Strip-wound" - a ribbon of tread material which is directly extruded and wound on to the prepared casing and built up to the required cross sectional contour. The new material must be cured;
  - 2.46.3. "Direct extrusion" - tread material extruded to give the required cross sectional profile and directly extruded on to the prepared casing. The new material must be cured;
  - 2.46.4. "Pre-cured" - a previously formed and cured tread applied to the prepared casing. The new material must be bonded to the casing.
- 2.47. "Standard Reference Test Tyre (SRTT)" means a tyre that is produced, controlled and stored in accordance with the American Society for Testing

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7/ Including the process method used in applying of ASP.

and Materials (ASTM) standards:

- (a) E1136 – 17 for the size P195/75R14 and referred to as "SRTT14";
  - (b) F2872 – 16 for the size 225/75 R 16 C and referred to as "SRTT16C";
  - (c) F2871 - 16 for the size 245/70R19.5 and referred to as "SRTT19.5";
  - (d) F2870 – 16 for the size 315/70R22.5 and referred to as "SRTT22.5".
- 2.48. "Cushion gum" is a material used as a bonding layer between new tread and casing and for repairing minor damage.
- 2.49. "Cement" is an adhesive solution to hold new materials in place prior to the curing process.
- 2.50. "Cure" is the term used to describe the change in physical properties of the new material which is brought about usually by the application of heat and pressure for a set period of time under controlled conditions.
- 2.51. "Representative tyre size" means the tyre size which is submitted to the test described in Annex 10 to this Regulation to assess the performance of a range of tyres produced by the retreading production facility with regard to their performance for use in severe snow conditions. It can be either a retreaded tyre produced with a pre-cured tread or a retreaded tyre with mould cure process".
- 2.52. "*Standard Reference Test Tyre*" or "*SRTT*" means a tyre that is produced, controlled and stored in accordance with the standards of ASTM International:
- (a) F2872 – 16 for the size 225/75R16C and referred to as "SRTT16C",
  - (b) F2871 – 16 for the size 245/70R19.5 and referred to as "SRTT19.5",
  - (c) F2870 – 16 for the size 315/70R22.5 and referred to as "SRTT22.5",
  - (d) F2493 – 20 for the size P225/60R16 and referred to as "SRTT16".
- 2.53. "Control tyre" means a new production tyre that is used to establish the snow grip performance of tyre sizes unable to be fitted to the same vehicle as the standard reference test tyre – see paragraph 3.4.3. of Annex 10 to this Regulation.
- 2.54. "*Snow grip index ("SG")*" means the snow grip performance of a candidate tyre relative to the performance of the applicable SRTT.
- 2.55. "*Candidate tyre*" means a tyre, that is submitted to one of the procedures for snow performance testing relative to snow tyre for use in severe snow conditions – see Annex 10 to this Regulation.



- 2.56. Class C2 tyres: Tyres conforming to Regulation No. 54 and identified by a load capacity index in single formation lower or equal to 121 and a speed category symbol higher or equal to "N";
- 2.57. Class C3 tyres: Tyres conforming to Regulation No. 54 and identified by:
- (a) A load capacity index in single formation higher or equal to 122 or;
  - (b) A load capacity index in single formation lower or equal to 121 and a speed category symbol lower or equal to "M".
- 2.58. "Professional off-road tyre" is a special use tyre primarily used for service in severe off-road conditions."
- 2.59. "Tread depth" means the depth of the principal grooves."
- 2.59.1. "Principal grooves" means the wide circumferential grooves positioned in the central zone of the tyre tread, which, in the case of passenger and light truck (commercial) tyres, have the treadwear indicators located in the base."
- 2.60. "Void to fill ratio" means the ratio between the area of voids in a reference surface and the area of this reference surface calculated from the mould drawing.

### **3. MARKINGS**

- 3.1. An example of the arrangement of retreaded tyre markings is shown in Annex 3 to this Regulation.
- 3.2. Retreaded tyres shall display on both sidewalls in the case of symmetrical tyres and at least on the outer sidewall in the case of asymmetrical tyres:
- 3.2.1. The retreader's name or the brand name / trademark;
  - 3.2.2. The trade description/commercial name (see paragraph 2. of this Regulation). However, the trade description is not required when it coincides with the brand name/trademark.
  - 3.2.3. The tyre-size designation as defined in paragraph 2.;
  - 3.2.4. An indication of the structure as follows:
    - 3.2.4.1. On diagonal (bias-ply) tyres; no indication, or the letter "D" placed in front of the rim diameter marking;
    - 3.2.4.2. On radial-ply tyres; the letter "R" placed in front of the rim-diameter marking and optionally the word "RADIAL";
    - 3.2.4.3. On bias belted tyres; the letter "B" placed in front of the rim diameter marking and in addition the words "BIAS-BELTED".
  - 3.2.5. The service description comprising:
    - 3.2.5.1. An indication of the tyre's nominal load capacity/capacities in the form of the

load index/indices prescribed in paragraph 2.;

3.2.5.2. An indication of the tyre's nominal speed capability in the form of the speed symbol prescribed in paragraph 2.;

3.2.6. If applicable, one alternative service description, the Unique point, comprising:

3.2.6.1. An indication of the tyres load capacity/capacities in the form of the load index/indices prescribed in paragraph 2.;

3.2.6.2. An indication of the speed capability in the form of the speed symbol prescribed in paragraph 2.;

3.2.7. The word "TUBELESS" if the tyre is designed for use without an inner tube.

3.2.8. The inscription M+S or MS or M.S. or M & S in the case of a snow tyre.

3.2.8.1. The "Alpine" symbol (3-peak-mountain with snowflake) shall be added if the snow tyre is classified as "snow tyre for use in severe snow conditions.

In addition, in case a pre-cured tread is used for the retreading process, the inscription M+S or MS or M.S. or M & S and the "Alpine" symbol shall be marked, at least once, on both sides of the tread shoulder.


In both cases, the "Alpine" symbol ("3-peak-mountain with snowflake") shall conform to the symbol described in Annex 10, Appendix 1.

3.2.9. The date of retreading as follows:

3.2.9.1. Up to 31 December 1999; either as prescribed in paragraph 3.2.9.2. or in the form of a group of three digits, the first two showing the week number and the third, the year of the decade of manufacture. The date code can cover a period of production from the week indicated by the week number up to and including the week number plus three. For example, the marking "253" could indicate a tyre which was retreaded in weeks 25, 26, 27 or 28 of the year 1993.

The date code may be marked on one sidewall only.

3.2.9.2. As from 1 January 2000; in the form of a group of....

3.2.10. In the case of tyres which can be regrooved, the symbol "  " in a circle at least 20 mm diameter, or the word "REGROOVABLE", moulded into or on to each sidewall.

3.2.11. An indication, by the means of the "PSI" index, of the inflation pressure to be adopted for the load/speed endurance tests, as explained in Annex 7, Appendix 2 to this Regulation.

This indication may be placed on one sidewall only.

- 3.2.12. The term "RETREAD". At the request of the retreader, the same term in other languages may also be added.
- 3.2.13. The inscription "MPT" (or alternatively "ML" or "ET") and/or "POR" if the tyre is classified in the category of use "special".
- ET means Extra Tread, ML stands for Mining and Logging, MPT means Multi-Purpose Truck and POR means Professional Off-Road.
- 3.2.14. Tyres retreaded using the "bead to bead" process as defined in paragraph 2.42.3., or any process in which the sidewall material is renewed, shall have the identification referred to in paragraph 2.26.4., placed only immediately after the rim diameter marking referred to in paragraph 2.26.3.
- 3.2.15. The prefix "LT" or the suffix "C" or "LT" following the rim diameter marking referred to in paragraph 2.26.3. and, if applicable, after the tyre to rim fitment configuration symbol referred to in paragraph 2.26.4. or the suffix "LT" after the service description
- 3.2.15.1. This marking is optional in the case of tyres fitted on 5° drop centre rims, suitable for single and dual fitment, having a load index in single fitment equal to or less than 121 and intended for the equipment of motor vehicles.
- 3.2.15.2. This marking is mandatory in the case of tyres fitted on 5° drop centre rims, suitable for single fitment only, having a load index equal to or greater than 122 and intended for the equipment of motor vehicles.
- 3.2.16. The suffix "CP" following the rim diameter marking referred to in paragraph 2.26.3. and, if applicable, after the tyre to rim configuration symbol referred to in paragraph 2.26.4. This marking is mandatory in the case of tyres fitted on 5° drop centre rims, having a load index in single fitment equal to or less than 121 and specifically designed for the equipment of motor caravans.
- 3.2.17. The inscription "FRT" (free rolling tyre) in the case of tyres designed for the equipment of trailer axles and axles of motor vehicles other than front steer and drive axles.
- 3.2.18. The inscription "TRACTION" if the tyre is classified as traction;<sup>10</sup>
- 3.3. Prior to approval tyres shall exhibit a free space sufficiently large to accommodate an approval mark as referred to in paragraph 5.8. and as shown in Annex 2 to this Regulation.
- 3.4. Following approval, the markings referred to in paragraph 5.8. and as shown in Annex 2 to this Regulation shall be affixed in the free space referred to in paragraph 3.3. This marking may be affixed to one sidewall only.

- 3.5. The markings referred to in paragraph 3.2. and the approval mark prescribed in paragraphs 3.4. and 5.8. shall be clearly legible and indelible. They shall be raised above or sunk below the tyre surface or shall be permanently marked on to the tyre.
- 3.5.1. [Reserved]
- 3.5.2. In the case that the date of retreading as defined in paragraph 3.2.9. is not moulded, it shall be applied not later than 5 working days after the completion of the retreading process at the facility concerned.
- 3.6. As far as any of the original manufacturer's specifications are still legible after the tyres have been retreaded, they shall be regarded as specifications of the retreader for the retreaded tyre. If these original specifications do not apply after retreading they shall be completely removed.
- 3.7. The original "E" or "e" approval mark and approval number and any other subsequent retreading production unit's approval mark and number, if no longer applicable, shall be removed.

## **4. APPLICATION FOR APPROVAL**

The following procedures are applicable to the approval of a tyre retreading production unit:

- 4.1. The application for approval of a retreading production unit shall be submitted by the retreader or by his duly accredited representative. It shall specify:
- 4.1.1. An outline of the structure of the company producing the retreaded tyres;
- 4.1.2. A brief description of the quality management system, which ensures the effective control of the tyre retreading procedures to meet the requirements of this Regulation.
- 4.1.3. The brand name(s)/trademark(s) to be applied to the retreaded tyres produced.
- 4.1.4. The trade description(s)/commercial name(s) (see paragraph 2.) which could be applied to the retreaded tyres produced."
- 4.1.5. The following information in relation to the range of tyres to be retreaded:

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<sup>10</sup> Minimum height of marking: refer to dimension C in Annex 3 of this Regulation.

- 4.1.5.1. The range of tyre sizes;
- 4.1.5.2. The structure of tyres (diagonal or bias ply, bias-belted or radial);
- 4.1.5.3. The category of use of tyres (normal, snow or special tyres);
- 4.1.5.3.1. For snow tyres the list of tyres having to fulfil the requirements of paragraph 7.2.
- 4.1.5.3.1.1. For tyres retreaded by using either pre-cured or mould cure tread material with a tread pattern covered by paragraph 6.4.4.1. the list shall clearly identify the tyres in order to make the relevant link with the list(s) quoted in paragraph 6.4.4.1. b).

Tyre Size Designation, Load indexes, Speed symbol	TM1	TM2	TM3
215/75 R 17.5 126/124 M	TPM1/TPR1, TR1/TL1	-	TPM2/TPR2, TR2/L2
235/75 R 17.5 132/130 M	TPM1/TPR1, TR1/TL1	-	-
265/70 R 17.5 138/136 M	-	TPM3/TPR3, TR3/TL3	TPM4/TPR4, TR4/TL4
245/70 R 19.5 136/134 M	-	-	-
12 R 22.5 152/148 K	-	TPM5/TPR5, TR5/TL5	-

Note:

TM: Identification of the Tread Manufacturer

TPM: Identification of the Tread Pattern by the tread Manufacturer

TPR: Identification of the Tread Pattern by the Retreader if different of TPM

TR: Number of the test report

TL: Reference of the list linked to the test report.

- 4.1.5.3.1.2. For tyres retreaded by using either mould cure or pre-cured tread material with the same major features including tread pattern(s) as a new tyre type and covered by paragraph 6.4.4.2. , the list shall clearly identify the tyres in order to make the relevant link with the list(s) quoted in paragraph 6.4.4.2. a).
- 4.1.5.3.1.3. For tyres retreaded by using mould cure tread material covered by paragraph 6.4.4.3. the list shall clearly identify the tyres in order to make the relevant link with the list(s) quoted in paragraph 6.4.4.3. b).
- 4.1.5.4. the system of retreading and the method of application of the new materials to be used, as defined in paragraphs 2.42. and 2.46.;
- 4.1.5.5. the maximum speed symbol of the tyres to be retreaded;

- 4.1.5.6. the maximum load index of the tyres to be retreaded;
- 4.1.5.7. the nominated International Tyre Standard to which the range of tyres conform.
- 4.2. The application for approval shall be accompanied by:
  - 4.2.1. Details of the major features, including the tread pattern, with respect to the effects on the snow grip performance of the range of tyre sizes listed as required by paragraph 4.1.5.3.1. This may be by means of descriptions supplemented by drawings and/or photographs which must be sufficient to allow the type approval authority or technical service to determine whether any subsequent changes to the major features will adversely affect the tyre performance. The effects of changes to minor details of tyre construction on tyre performances will be evident and determined during checks on conformity of production;
- 4.3. At the request of the Type Approval Authority, the Retreader shall submit samples of tyres for test or copies of test reports from the technical services, communicated as given in paragraph 12. of this Regulation.

## **5. APPROVAL**

- 5.1. To retread tyres requires the approval of the retreading production unit by the approval authorities in accordance with the requirements of this Regulation. The Approval Authority shall take the necessary measures as described in this Regulation in order to ensure that the tyres retreaded in the respective production unit will meet with the requirements stated in this Regulation. The retread production unit shall be fully responsible for ensuring that the retreaded tyres will meet the requirements of this Regulation and that they will perform adequately in normal use.
- 5.2. In addition to the normal requirements for the initial assessment of the tyre retreading production unit, the Approval Authority shall be satisfied that the procedures, operation, instructions and specification documentation provided by material suppliers are in a language readily understood by the tyre retreading production unit operatives.
- 5.3. The Approval Authority shall ensure that the procedures and operations documentation for each production unit contains specifications, appropriate to the repair materials and processes used, of the limits of repairable damage or penetrations to the tyre carcass, whether such damage is existing or is caused during the processes of preparation for retreading.
- 5.4. Before granting approval the authority must be satisfied that retreaded tyres conform to this Regulation and that the tests have been successfully carried out:
  - (a) On at least five and not necessarily more than 20 samples of retreaded tyres representative of the range of tyres produced by the

- retreading production unit when prescribed according to paragraphs 6.5. and 6.6.1. and;
- (b) On at least one sample of retreaded tyres, of each pattern covered by paragraph 6.4.4.3., representative of the range of tyres produced by the retreading production unit when prescribed according to paragraph 6.6.2.\* In case of paragraphs 6.4.4.1. and 6.4.4.2., the Type Approval Authority might request a test of compliance for the retreaded tyre. Testing of sampled sizes may be confined to a worst case selection\*, at the discretion of the Type Approval Authority or designated Technical Service.
- 5.5. In the case of each failure being recorded during tests, two further samples of the same specification tyre shall be tested. If either or both of these second two samples fail, then a final submission of two samples shall be tested. If either one or both of the final two samples fail, then the application for approval of the retreading production unit shall be rejected.
- 5.6. If all the requirements of this Regulation are met, then approval shall be granted and an approval number shall be assigned to each retreading production unit approved. The first two digits of this number shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The approval number shall be preceded by "109R" signifying that the approval applies to a tyre retreaded as prescribed in this Regulation.
- The same authority shall not assign the same number to another production unit covered by this Regulation.
- 5.7. Notice of approval or of extension, refusal or withdrawal of approval or of production definitely discontinued pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement applying this Regulation, by means of a form conforming to the model in Annex 1 to this Regulation.
- 5.8. There shall be affixed conspicuously to every retreaded tyre conforming to this Regulation, in the space referred to in paragraph 3.3. and in addition to the markings prescribed in paragraph 3.2., an international approval mark consisting of:
- 5.8.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which granted approval 8/; and

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8/ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Yugoslavia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 Azerbaijan, 40 for The former Yugoslav

- 5.8.2. An approval number as described in paragraph 5.6.
- 5.9. Annex 2 to this Regulation gives an example of the arrangements of the approval mark.

## **6. REQUIREMENTS**

- 6.1. Tyres shall not be accepted for first retread unless they have been type approved and bear either an "E" or "e" mark.
- 6.2. Conditions before retreading
- 6.2.1. Tyres shall be clean and dry before inspection.
- 6.2.2. Before buffing, each tyre shall be thoroughly examined both internally and externally to ensure its suitability for retreading.
- 6.2.3. Tyres where damage is visible which has resulted from overload or underinflation shall not be retreaded.
- 6.2.4. Tyres showing any of the following damage shall not be accepted for retreading:
- 6.2.4.1. General
- (a) non repairable rubber cracking extending through to the carcass;
  - (b) carcass break up;
  - (c) appreciable oil or chemical attack;
  - (d) damaged or broken bead core;
  - (e) previous repairs of damage outside specified injury limits - see paragraph 5.3.

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Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective UNECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for Republic of South Africa, 48 for New Zealand, 49 for Cyprus, 50 for Malta, 51 for Republic of Korea, 52 for Malaysia, 53 for Thailand, 54 and 55 (vacant), 56 for Montenegro, 57 (vacant) and 58 for Tunisia. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.



6.2.4.2. Conditions outside specified limits of repairability - see paragraph 5.3:

- (a) carcass penetrations or damage after preparation for repair;
- (b) multiple damage too close together;
- (c) substantial deterioration of inner liner;
- (d) bead damage;
- (e) exposed carcass cords;
- (f) loose cords;
- (g) belt ply separation;
- (h) permanently deformed or kinked (steel) carcass cords;
- (i) circumferential cracking above the bead;
- (j) corroded steel cord or bead wire.

6.3. Preparation

- 6.3.1. After buffing, and before the application of new material, each tyre shall be thoroughly re-examined, at least externally, to ensure its continued suitability for retreading.
- 6.3.2. The entire surface to which new material is to be applied shall have been prepared without overheating. The buffed surface texture shall not contain deep buffing lacerations or loose material.
- 6.3.3. Where precured material is to be used the contours of the prepared area shall meet the requirements of the material manufacturer.
- 6.3.4. Damage caused during buffing must not exceed defined limits of repair, see paragraph 5.3., and must be repaired.
- 6.3.5. Buffing damage to diagonal ply tyres shall not extend beyond the outermost carcass ply in the crown area. It shall be assumed that the first ply encountered is a carcass ply unless a breaker can be positively identified. If a breaker is fitted, localized damage is permissible.
- 6.3.6. Localized buffing damage to the belt of radial tyres is permissible. For larger damage it is permissible for the complete belt or sections of the belt to be replaced. Where a protective breaker is fitted, and can be positively identified as such, if it is damaged it is permissible to remove it and it need not be renewed.
- 6.3.7. Exposed steel parts shall be treated as soon as possible with appropriate

material as defined by the material manufacturer of that appropriate material.

#### 6.4. Retreading

6.4.1. The retreader must ensure that either the material manufacturer or the supplier of repair materials, including patches, is responsible for the following:

- (a) defining method(s) of application and storage, if requested by the retreader, in the national language of the country in which the materials are to be used;
- (b) defining limits of damage for which the materials are designed, if requested by the retreader, in the national language of the country in which the materials are to be used;
- (c) ensuring that reinforced patches for tyres, if correctly applied in carcass repairs, are suitable for the purpose;
- (d) Ensuring that the patches are capable of withstanding twice the maximum inflation pressure as given by the original tyre manufacturer;
- (e) ensuring the suitability of any other repair materials for the service intended.

6.4.2. The retreader shall be responsible for the correct application of the repair material and for ensuring that the repair is free from any defects which may affect the satisfactory service life of the tyre.

6.4.3. The area surrounding a reinforced repair to a sidewall or shoulder of a radial ply tyre may bulge slightly when the tyre is fitted and inflated to the recommended operating pressure. Reinforced repair materials with physical properties that restrict the height of the bulge to not more than 4 mm shall be used.

6.4.4. The retreader shall ensure that either the material manufacturer or the supplier of tread and sidewall material issues specifications concerning the conditions of storage and use of the material in order to guarantee the material's qualities. If requested by the retreader, this information shall be in the national language of the country in which the materials are to be used.

6.4.4.1. For tyres retreaded by using pre-cured tread material(s) or an identical tread pattern design in a mould cure product with a tread pattern not covered by paragraph 6.4.4.2. having to fulfil the requirements of paragraph 7.2.\* the retreader shall ensure that the material manufacturer(s) or the material supplier(s) of the pre-cured tread(s) provides to the Type Approval Authority (TAA) and the Technical Service issuing the approval according to this Regulation and optionally to the retreader:

- (a) A copy of the test report(s) as in Annex 10, Appendix 2 and/or 3 of the representative tyre size(s) (see definition in paragraph 2.) demonstrating compliance of the pre-cured tread(s) to the requirements of paragraph 7.2.

- (b) The list(s) of tyre sizes to which it can be applied for the retreading process and validated by the same designated Technical Service and TAA which issued the test report(s) requested in paragraph 6.4.4.1. (a). The list(s) shall include at least the tyres defined in paragraph 4.1.5.3.1.1.
- (c) A copy of the measures taken to ensure the conformity of production. These measures shall include test results demonstrating that the minimum levels of the snow performances required in paragraph 7.2.1 will be maintained and demonstrating periodically the compliance with the requirement defined in paragraph 9.2.3. or 9.4.3.

6.4.4.2. For tyres retreaded by using either mould cure or pre-cured tread material(s) with the same major features including tread pattern(s) as a new tyre type approved according to UN Regulation No. 117 having fulfilled the requirements about minimum snow performance in severe snow conditions, the retreader shall ensure that the manufacturer of the new tyre type provides to the Type Approval Authority (and the Technical Service) issuing the approval according to this UN Regulation and optionally to the retreader:

- (a) A copy of the UN Regulation No. 117 certificate(s) and a copy of the compliance of the new tyre to the minimum snow performance in severe snow conditions;
- (b) The list(s) of tyre sizes to which it can be applied for the retreading process and validated by the same designated Technical Service\*\* and/or Type Approval Authority that issued the UN Regulation No. 117 certificate(s). The list(s) shall include at least the tyres defined in paragraph 4.1.5.3.1.2.;
- (c) The drawing(s) of the tread pattern(s) covered by the UN Regulation No 117 certificate(s) including the major features with respect to the snow performance;
- (d) A copy of the last report of the Conformity of Production as required in UN Regulation No. 117 and demonstrating periodically the compliance with the requirement defined in paragraph 9.2.4. or 9.4.4.

6.4.4.3. For tyres retreaded by using mould cure tread material(s) and design(s) not covered by paragraphs 6.4.4.1. or 6.4.4.2., having to fulfil the requirements of paragraph 7.2.\*, the retreader shall provide to the Type Approval Authority (TAA) and the Technical Service issuing the approval according to this Regulation:

- (a) A copy of the test report(s) as in Annex 10, Appendix 2 and/or 3 of the representative tyre size(s) (see definition in paragraph 2.) demonstrating compliance of the mould cure tread(s) to the requirements of paragraph 7.2.;
- (b) The list(s) of tyre sizes to which it can be applied for the retreading process and validated by the same designated Technical Service and TAA which issued the test report(s) requested in paragraph 6.4.4.3. (a). The list(s) shall include at least the tyres defined in paragraph 4.1.5.3.1.3.;

- (c) A copy of the measures taken to ensure the conformity of production. These measures shall include test results demonstrating that the minimum levels of the snow performances required in paragraph 7.2.1. will be maintained and demonstrating periodically the compliance with the requirement defined in paragraph 9.2.2. or 9.4.2.;
- (d) The drawing(s) of the tread pattern(s) including the major features with respect to the snow performance.

6.4.5. The retreader must ensure that the repair material and/or compound is documented in a manufacturer's or supplier's certificate. The material compound must be suitable for the intended use of the tyre.

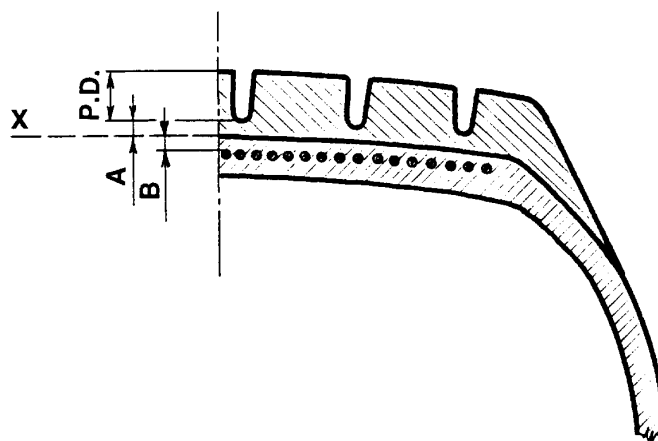
6.4.6. The processed tyre shall be cured as soon as possible after the completion of all repairs and building-up operations and at the latest according to the material manufacturer's specifications.

6.4.7. The tyre shall be cured for the length of time and at the temperature and pressure, appropriate to, and specified for, the materials and processing equipment used. The dimensions of the mould must be appropriate to the thickness of the new material and the size of the buffed tyre.

6.4.8. The thickness of original material after buffing and the average thickness of any new material under the tread pattern after retreading shall be as given in paragraphs 6.4.8.1. and 6.4.8.2.

6.4.8.1. For radial ply tyres (mm):

$3 \leq (A+B) \leq 13$	(minimum 3.0mm; maximum 13.0 mm)
$A \geq 2$	(minimum 2.0 mm)
$B \geq 0$	(minimum 0.0 mm)



P.D.	=	Pattern depth
X	=	Buff line
A	=	Average thickness of new material under pattern
B	=	Minimum thickness of original material above belt after buffing

6.4.8.2. For diagonal (Bias-ply) tyres:

The thickness of original material above the breaker shall be  $\geq 0.80$  mm;

The average thickness of new material above the buffed casing line shall be  $\geq 2.00$  mm;

The combined thickness of original and new material beneath the base of the grooves of the tread pattern shall be  $\geq 3.00$  mm and  $\leq 13.00$  mm.

6.4.9. The service description of a retreaded tyre shall not show either a higher speed symbol or a higher load index than that of the original, first life, tyre unless approval has been granted to the manufacturer of the original, first life, tyre for that same carcass to be used at the revised service description.

Information that an original, first life, carcass has been upgraded in this way shall be made freely available by an Approval Authority to any retreading production unit and shall be communicated to other parties to the 1958 Agreement (see Article 5 of the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the basis of these Prescriptions - document E/ECE/324-E/ECE/TRANS/505/Rev.2).

The standard form shown in Annex 9 to Regulation No. 54 shall be used to communicate this information.

6.4.10. Upgrading of the service description as given in paragraph 6.4.9. shall be permitted:

- (a) for the first retread of an original, first life tyre.;
- (b) for a used casing, if the traceability of the carcasses to be retreaded is guaranteed. The speed symbol or load index used for retreading shall then not exceed the conditions mentioned in the standard form in Annex 9 of UN Regulation No. 54 for these carcasses.
- (c) for a used casing, if the traceability of the carcasses to be retreaded is not guaranteed till the original, first life, tyre, the speed symbol or the load index shall then not be raised above that shown on the used casing.

The retreader shall demonstrate to the approval authority the traceability of retreaded carcasses.

6.5. Inspection

6.5.1. After curing, whilst a degree of heat is retained in a tyre, each retreaded tyre shall be examined to ensure that it is free from any apparent defects. During or after retreading, the tyre shall be inflated to at least 150 kPa (1.5 bar) for examination. When the tyre presents a visible defect, it has to be subjected to a specific examination to determine the appropriate action on the tyre. Other methods more adapted than visual inspection which do not require tyre

inflation can also be used with the agreement of the Approval Authority.

- 6.5.2. Before, during or after retreading the tyre shall be checked at least once for the integrity of its structure by means of a suitable inspection method.
- 6.5.3. For the purposes of quality control a number of retreaded tyres shall be subjected to destructive or non destructive testing or examination. The quantity of tyres checked and the results shall be recorded.
- 6.5.4. After retreading, the dimensions of the retreaded tyre, when measured in accordance with Annex 6 to this Regulation, must conform either to dimensions calculated according to the procedures in paragraph 7. or to those given in Annex5 to this Regulation. Note that:
  - (a) the maximum outer diameter of a retreaded tyre may be up to 1.5 per cent greater than the maximum outer diameter of the same tyre size designation permitted by Regulation No. 54;
  - (b) and the maximum section width of a radial retreaded tyre may be up to 1.5 per cent greater than the maximum section width of the same tyre size designation permitted by Regulation No. 54.
- 6.6. Performance tests
  - 6.6.1. Load/speed endurance test:
    - 6.6.1.1 Tyres retreaded to comply with this Regulation shall be capable of meeting the load/speed endurance test as specified in Annex 7 to this Regulation.
    - 6.6.1.2. A retreaded tyre which after undergoing the load/speed endurance test does not exhibit any tread separation, ply separation, cord separation, chunking or broken cords shall be deemed to have passed the test.
    - 6.6.1.3. The outer diameter of the tyre, measured six hours after the load/speed endurance test, must not differ by more than  $\pm 3.5$  per cent from the outer diameter as measured before the test.
  - 6.6.2. Snow test
    - 6.6.2.1. Retreated Snow Tyres for use in severe snow conditions to comply with this regulation shall be capable of meeting snow performance test as specified in Annex 10 to this Regulation.

## 7. SPECIFICATIONS

7.1. Tyres retreaded to comply with this Regulation shall conform to the following dimensions:

7.1.1. Section width:

7.1.1.1. The section width shall be calculated by the following formula:

$$S = S_1 + K (A - A_1)$$

where:

S : is the actual section width rounded to the nearest millimetre and measured on the test rim;

S<sub>1</sub>: is the value of the 'Design Section Width', referred to the measuring rim, as quoted in the International Tyre Standard specified by the retreader for the tyre size in question;

A : is the width of the test rim in millimetres;

A<sub>1</sub>: is the width in millimetres of the measuring rim as quoted in the International Tyre Standard specified by the retreader for the tyre size in question;

K : is a factor and shall be taken to equal 0.4.

7.1.1.1.1 In the case of tyres identified by the tyre to rim fitment configuration symbol "A" (see paragraph 2.26.4.1.) the factor "K" shall be 0.6.

7.1.2. Outer diameter:

7.1.2.1. The theoretical outer diameter of a retreaded tyre shall be calculated by the following formula:

$$D = d + 2H$$

where:

D: is the theoretical outer diameter in millimetres;

d: is the conventional number defined in paragraph 2.26. in millimetres;

H: is nominal section height rounded to the nearest millimetre and is equal to S<sub>n</sub> multiplied by 0.01 R<sub>a</sub>

where:

- $S_n$ : is the nominal section width in millimetres;  
 $R_a$ : is the nominal aspect ratio.

All of the above symbols are as quoted in the tyre size designation as shown on the sidewall of the tyre in conformity with the requirements of paragraph 3.2.3. and as defined in paragraph 2.26.

- 7.1.2.2. However, for tyres whose designation is given in the first column of the tables in 5 to Regulation No. 54, the outer diameter shall be that given in those tables.
- 7.1.2.3. In the case of tyres identified by the tyre to rim fitment configuration symbol "A" (see paragraph 2.26.4.), the outer diameter shall be that specified in the tyre size designation shown on the sidewall of the tyre.
- 7.1.3. Method of measuring retreaded tyres:
- 7.1.3.1. The dimensions of retreaded tyres shall be measured in accordance with the procedures given in Annex 6 to this Regulation.
- 7.1.4. Section width specifications:
- 7.1.4.1. The actual overall width may be less than the section width or widths determined in paragraph 7.1.
- 7.1.4.2. It may exceed the value by 5.5 per cent in the case of radial-ply tyres and 8 per cent in the case of diagonal (bias-ply) tyres. However, for tyres intended for dual mounting (twinning) listed in column A of the following table, the overall width of the tyre may exceed the value determined pursuant to paragraph 7.1.1. above taking into account the tolerances listed in column B. Other different specific tolerances are listed in Annex 5 Part II in footnotes of the relevant tables. The respective limits shall be rounded to the nearest millimetre.

A	B
Radial metric tyres with nominal section width exceeding 305 mm and aspect ratio higher than 60	3.5%
Radial tyres listed in Annex 5 Part I with section width exceeding 305 mm	3.5%
Diagonal metric tyres with nominal section width exceeding 305 mm	4%
Diagonal tyres listed in Annex 5 Part I with section width exceeding 305 mm	4%

- 7.1.4.3. In the case of tyres identified by the tyre to rim fitment configuration symbol "A" (see paragraph 2.26.4.), the overall width of the tyre, in the lower area of



the tyre, equals the nominal width of the measuring rim (see paragraph 2.), plus 27 mm.

7.1.4.4. For retreaded C3 radial tyres an additional sidewall protective rubber layer (ASP) may be applied to a maximum of 8 mm greater than the overall width of the same tyre size description permitted by Regulation No. 54 provided that:

- (a) This rubber layer is applied to one sidewall only;
- (b) The sidewall concerned is marked with the wording "ASP" and the wording "OUTSIDE", both markings with a minimal height of 8 mm;
- (c) The maximum allowed speed rating is index J (100 km/h);
- (d) In case of a dual mounting (twinning) only one tyre with ASP is allowed and has to be mounted on the outer wheel position.

7.1.5. Outer diameter specifications

7.1.5.1. The actual outer diameter of a retreaded tyre must not be outside the values of D<sub>min</sub> and D<sub>max</sub> obtained by the following formulae:

$$D_{\min} = d + 2 \cdot H_{\min}$$

$$D_{\max} = 1.015 \cdot [d + 2 \cdot H_{\max}]$$

where

$$H_{\min} = H \cdot a \text{ rounded to the nearest mm}$$

$$H_{\max} = H \cdot b \text{ rounded to the nearest mm}$$

and:

7.1.5.1.1. For sizes not given in the tables in Annex5 to this Regulation, "H" and "d" are as defined in paragraph 7.1.2.1.

7.1.5.1.2 For sizes referred to in paragraph 7.1.2.2. and for tyres identified by the tyre to rim fitment configuration symbol "A" (see paragraph 2.26.4.), the nominal section height "H" is equal to:

$$H = 0.5(D - d), \text{ rounded to the nearest millimetre}$$

where "D" and "d" are as defined in paragraph 7.1.2.1.

7.1.5.1.3. The coefficient "a" = 0.97

## 7.1.5.1.4. The coefficient "b" is:

	Radial tyres	Diagonal (bias-ply) and bias belted tyres
for normal use tyres	1.04	1.07
for special use tyres	1.06	1.09

## 7.1.5.2. For snow tyres the maximum outer diameter (Dmax) calculated in paragraph 7.1.5.1. may be exceeded by not more than 1 per cent.

## 7.2. In order to be classified as a "snow tyre for use in severe snow conditions", the retreaded tyre to comply with this Regulation shall meet the performance requirements of paragraph 7.2.1. The retreaded tyre size shall meet these requirements based on a test method of Annex 10 by which:

- (a) The mean fully developed deceleration ("mfdd") in a braking test;
- (b) Or alternatively an average traction force in a traction test;
- (c) Or alternatively the average acceleration in an acceleration test of a candidate tyre is compared to that of a Standard Reference Test Tyre (SRTT).

The relative performance shall be indicated by a snow grip index.

## 7.2.1. For Class C2 and C3 tyres, the minimum snow grip index value, as calculated in the procedure described in Annex 10 and compared with the respective Standard Reference Test Tyre (SRTT) shall be as follows:

<i>Class of tyre</i>	<i>Snow grip index (brake on snow method) <sup>(a)</sup></i>	<i>Snow grip index (spin traction method) <sup>(b)</sup></i>	<i>Snow grip index (acceleration method) <sup>(c)</sup></i>
	<i>Ref.s = SRTT16C</i>	<i>Ref.s = SRTT16</i>	<i>Ref.s = SRTT19.5, SRTT22.5</i>
C2	1.02	1.10	No
C3	No	No	1.25

<sup>(a)</sup> See paragraph 3 of Annex 10 to this Regulation

<sup>(b)</sup> See paragraph 2 of Annex 10 to this Regulation

<sup>(c)</sup> See paragraph 4 of Annex 10 to this Regulation

## 7.3. In order to be classified as a "traction tyre", a tyre is required to meet the conditions of paragraph 7.3.1. below.

## 7.3.1. The tyre shall have a tread pattern with minimum two circumferential ribs, each containing a minimum of 30 block-like elements, separated by grooves and/or sipe elements the depth of which has to be minimum of one half of the tread depth. The use of an alternative option of a physical test will only apply at a later stage following a further amendment to the Regulation including a reference to an appropriate test methods and limit values.

- 7.4. In order to be classified as a "special use tyre" a tyre shall have a block tread pattern in which the blocks are larger and more widely spaced than for normal tyres and have the following characteristics:
- (a) For C2 tyres: a tread depth  $\geq 11$  mm and void to fill ratio  $\geq 35$  per cent;
  - (b) For C3 tyres: a tread depth  $\geq 16$  mm and void to fill ratio  $\geq 35$  per cent.
- 7.5. In order to be classified as a 'professional off-road tyre', a tyre shall have all of the following characteristics:
- (a) For C2 tyres:
    - (i) A tread depth  $\geq 11$  mm;
    - (ii) A void-to-fill ratio  $\geq 35$  per cent;
    - (iii) A maximum speed rating of  $\leq Q$ .
  - (b) For C3 tyres:
    - (i) A tread depth  $\geq 16$  mm;
    - (ii) A void-to-fill ratio  $\geq 35$  per cent;
    - (iii) A maximum speed rating of  $\leq K$ ."

## 8. MODIFICATIONS TO THE APPROVAL

- 8.1. Every modification concerning a retreading production unit amending any of the information given by the retreading production unit in the Application for Approval, see paragraph 4, shall be notified to the Approval Authority which approved the retreading production unit. That authority may then either:
- 8.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the retreading production unit still meets the requirements; or
  - 8.1.2. Require a further investigation of the approval.
- 8.2. Confirmation of, or refusal of, approval, specifying the modifications, shall be communicated by the procedure specified in paragraph 5.7. to the Parties to the Agreement which apply this Regulation.

## 9. CONFORMITY OF PRODUCTION

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2), with the following requirements:

- 9.1. The retreading production unit approved according to this Regulation shall conform to the requirements set out in paragraph 6;
- 9.2. The holder of the approval shall ensure that, at least the following number of tyres, representative of the range being produced, is checked and tested as prescribed in this Regulation :
  - 9.2.1. 0.01 per cent of the total annual production but in any case not less than 2 and not necessarily more than 10 during each year of production, and spread throughout that year;
  - 9.2.2. At least 1 tyre once every two years in order to verify conformity of the performance of the snow tyres for use in severe snow conditions fulfilling paragraph 6.6.2. and covered by paragraph 6.4.4.3.
  - 9.2.3. At least one tyre once every four years in order to verify conformity of the performance of the snow tyres for use in severe snow conditions fulfilling paragraph 6.6.2. and covered by paragraph 6.4.4.1. The retreader can use the snow performance periodic test results obtained by the tread manufacturer or tread supplier for this purpose.
  - 9.2.4. At least one tyre once every four years in order to verify conformity of the performance of the snow tyres for use in severe snow conditions fulfilling paragraph 6.6.2. and covered by paragraphs 6.4.4.2. The retreader can use the current snow performance periodic test results obtained by the owner of the original UN Regulation No. 117 approval certificate.
- 9.3. If the requirements of paragraph 9.2. are carried out by or under the control of the Approval Authority, the results may be used as part of, or instead of, those prescribed in paragraph 9.4;
- 9.4. The authority which has approved the retreading production unit may at any time verify the conformity control methods applied in each production facility including among others the prescriptions defined in the paragraph 6.4.4.1.(c), 6.4.4.2.(d) and 6.4.4.3.(c). For each production facility, the type Approval Authority shall take samples at random and at least the following number of tyres, representative of the range being produced, shall be checked and tested as prescribed in this Regulation:

- 9.4.1. 0.01 per cent of the total annual production but in any case not less than 2 and not necessarily more than 10 during each and every production year;
- 9.4.2. At least 1 tyre once every two years in order to verify conformity of the performance of the snow tyres for use in severe snow conditions fulfilling paragraph 6.6.2. and covered by paragraph 6.4.4.3.
- 9.4.3. At least one tyre once every four years in order to verify conformity of the performance of the snow tyres for use in severe snow conditions fulfilling paragraph 6.6.2. and covered by paragraphs 6.4.4.1. The retreader can use the snow performance periodic test results obtained by the tread manufacturer or tread supplier for this purpose.
- 9.4.4. At least one tyre once every four years in order to verify conformity of the performance of the snow tyres for use in severe snow conditions fulfilling paragraph 6.6.2. and covered by paragraphs 6.4.4.2. The retreader can use the current snow performance periodic test results obtained by the owner of the original UN Regulation No. 117 approval certificate.
- 9.5. The tests and checks of paragraph 9.4. may replace those required in paragraph 9.2.

## **10. PENALTIES FOR NON-CONFORMITY OF PRODUCTION**

- 10.1. The approval granted in respect of a retreading production unit pursuant to this Regulation may be withdrawn if the requirements of paragraph 9 are not complied with or if the retreading production unit or the retreaded tyres produced by that retreading production unit have failed to meet the requirements prescribed in paragraph 9.
- 10.2. If a Party to the Agreement which applies this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties to the 1958 Agreement applying this Regulation, by means of a communication form conforming to the model shown in Annex1 to this Regulation.

## **11. PRODUCTION DEFINITELY DISCONTINUED**

The authority which granted the approval of the retreading production unit shall be informed if operations and manufacture of retreaded tyres approved within the scope of this Regulation cease. On receipt of this information the authority shall communicate this information to the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model shown in Annex1 to this Regulation.

## **12. Names and addresses of technical services responsible for**

**conducting approval tests, of test laboratories, and of Type Approval Authorities.**

- 12.1. The Contracting Parties to the 1958 Agreement which apply this Regulation shall communicate to the United Nations Secretariat the names and addresses of the technical services responsible for conducting approval tests and, where applicable, of the approved test laboratories and of Type Approval Authorities which grant approval and to which forms certifying approval or extension of approval or refusal of approval or withdrawal of approval or production definitely discontinued, issued in other countries, are to be sent.
- 12.2. The Contracting Parties to the 1958 Agreement which apply this Regulation may designate laboratories of tyre manufacturers or retreading production units as approved test laboratories.
- 12.3. Where a Contracting Party to the 1958 Agreement applies paragraph 12.2. above, it may, if it so desires, be represented at the tests by one or more persons of its choice.

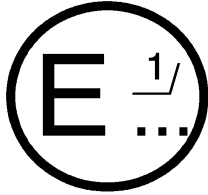
**Annex 1****COMMUNICATION**

(maximum format: A4 (210 x 297 mm))

issued by: Name of the Type Approval Authority: .....

.....

.....



concerning: 2/ APPROVAL GRANTED  
 APPROVAL EXTENDED  
 APPROVAL REFUSED  
 APPROVAL WITHDRAWN  
 PRODUCTION DEFINITELY DISCONTINUED

of a retreading production unit pursuant to UN Regulation No. 109.

Item 1., amend to read:

1. Retreader's name and address:: .....
2. Name and address of retreading production unit: .....  
 .....
3. If applicable, name and address of retreader's representative: .....  
 .....
4. Summarized description as defined in paragraphs 4.1.3., 4.1.4 and 4.1.5. of this Regulation:
- 4.1. Brand name(s)/trademark(s)<sup>3</sup>: .....
- 4.2. Trade description(s)/ Commercial name(s)<sup>3</sup>:.....
- 4.3. Information in relation to the range of tyres as defined in paragraphs 4.1.5. of this Regulation:.....

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<sup>3</sup> A list of brand name(s)/trademark(s) or Trade description(s)/ Commercial name(s) may be annexed to this communication."

## Annex 1

- 5 Technical service and, where applicable, test laboratory approved for purposes of approval or verification of conformity: .....
- 6 Date of report issued by that service: .....
- 7 Number of report issued by that service: .....
- 8 Reason(s) of extension (if applicable): .....
- 9 Any remarks: .....
- 10 Place: .....
- 11 Date: .....
- 12 Signature .....
- 13 Annexed to this communication is a list of documents in the approval file deposited at the Approval Authority which has considered this approval and which can be obtained upon request.

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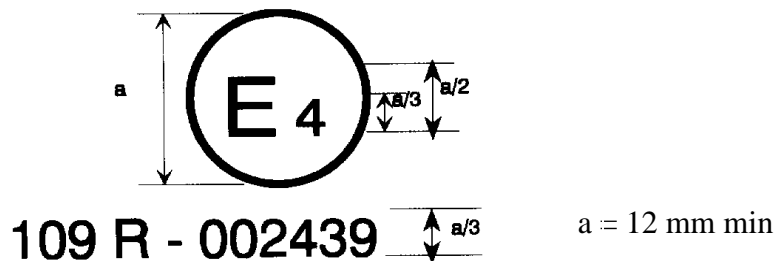
1/ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in the Regulation).

2/ Delete that which does not apply.



## Annex 2

### ARRANGEMENT OF APPROVAL MARK



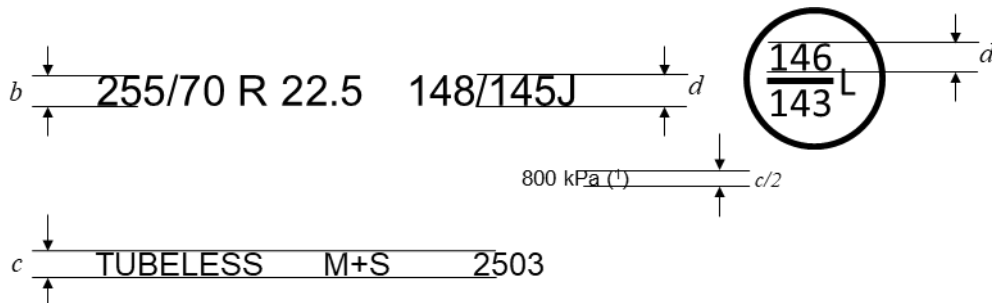
The above approval mark affixed to a retreaded tyre shows that the retreading production unit concerned has been approved in the Netherlands (E4) under approval number 109R002439 meeting the requirements of this Regulation in its original form (00).

The approval number must be placed close to the circle and either above or below the "E" or left or right of that letter. The digits of the approval number must be on the same side of the "E" and face in the same direction. The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

## Annex 3

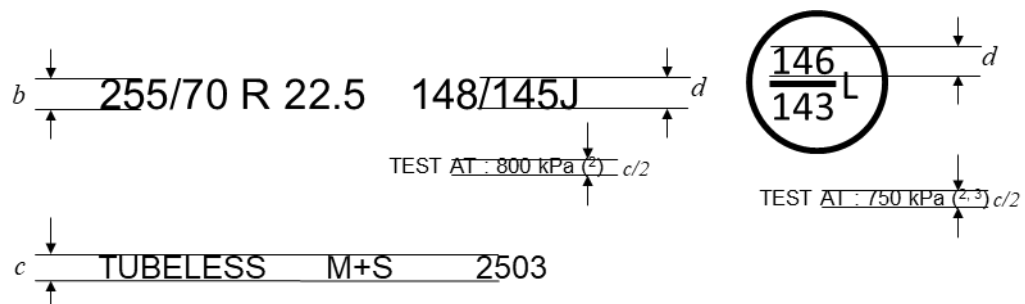
### ARRANGEMENT OF RETREAD TYRE MARKINGS

#### Example 1:



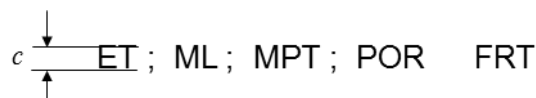
- (<sup>1</sup>) PSI marking instead of kPa is allowed for tyres first type approved before 1 January 2018. The kPa marking may be preceded by "TEST AT : " or, alternatively, by "TEST INFL : " or the symbol "@".

#### Example 2:



- (<sup>2</sup>) "TEST AT : " may be replaced by "TEST INFL : " or the symbol "@" or be omitted.
- (<sup>3</sup>) The indication of a second inflation pressure for the additional service description is optional. If there is no indication, the same test inflation applies to both load/speed combinations.

Dimensional requirements for further markings (<sup>4</sup>):



- (<sup>4</sup>) For "ML" and "MPT" being part of the tyre size designation marking the minimum dimension *b* applies."

## Annex 3

	<i>Minimum heights of markings (mm)</i>
b	6
c	4
d	6

The above example defines a retreaded tyre:

- Having a nominal section width of 295;
- Having a nominal aspect ratio of 80;
- Of radial-ply structure (R);
- Having a nominal rim diameter of 572 mm, for which the code is 22.5;
- Having load capacities of 3550 kg (single) and 3150 kg (twinned or dual), corresponding respectively to the load indices 152 and 148 shown in Annex 4 to this Regulation;
- Having a nominal speed symbol K (reference speed 110 km/h);
- Able to be used at the Unique Point, speed symbol L (reference speed 120 km/h); with a load capacity of 3350 kg (single) and 3000 kg (twinned or dual), corresponding respectively to the load indices 150 and 146 shown in Annex 4 to this Regulation;
- Intended to be used without an inner tube ("TUBELESS") and of Snow type (M+S);
- Retreaded in the weeks 25, 26, 27 or 28 of the year 2003.
- Requiring to be inflated to 800 kPa for both load/speed endurance tests in Example 1 and 800 kPa for the load/speed endurance test according to the main load/speed combination and 750 kPa for the test according to the additional load/speed combination in Example 2.

2. In the particular case of tyres having a tyre to rim fitment configuration "A", the marking shall be in the form of the following example:

235-700 R 450A      where:

235 is the nominal section width in mm

700 is the outer diameter expressed in mm

R is an indication of the structure of the tyre – see paragraph 3.1.3. of this Regulation

450 is the nominal diameter of the rim expressed in mm

A is the tyre to rim fitment configuration.

The marking of the load index, speed category date of manufacture and other markings, shall be as given in example 1 above.

3. The positioning and order of the markings constituting the tyre designation shall be as follows:

- (a) The size designation as defined in paragraph 2. of this Regulation shall

## Annex 3

be grouped as shown in the above examples: 295/80 R 22.5 or 235-700 R 450 A.

- (b) The service description comprising the load index (indices) and the speed symbol(s) shall be placed immediately after the tyre size designation as defined in paragraph 2. of this Regulation.
- (c) The symbol "TUBELESS" and "M+S" may be at a distance from the size-designation symbol.
- (d) The word "RETREAD" may be at a distance from the size-designation symbol.
- (e) If paragraph 3.2.6. of this Regulation is applied, the additional service description (Unique Point), comprising the load indices and speed symbol, shall be shown inside a circle near the nominal service description appearing on the tyre sidewall.
- (f) If there are two indications for the test inflation pressure, they must be placed in such a way that it is clear which pressure indication belongs to which load/speed combination.

**Annex 4****LIST OF LOAD INDICES AND CORRESPONDING LOAD CAPACITIES**

Load index (LI) and load capacity - kg													
LI	kg	LI	kg	LI	kg	LI	kg	LI	kg	LI	kg	I	kg
0	45	40	140	80	450	120	1 400	160	4 500	200	14 000	240	45 000
1	46.2	41	145	81	462	121	1 450	161	4 625	201	14 500	241	46 250
2	47.5	42	150	82	475	122	1 500	162	4 750	202	15 000	242	47 500
3	48.7	43	155	83	487	123	1 550	163	4 875	203	15 500	243	48 750
4	50	44	160	84	500	124	1 600	164	5 000	204	16 000	244	50 000
5	51.5	45	165	85	515	125	1 650	165	5 150	205	16 500	245	51 500
6	53	46	170	86	530	126	1 700	166	5 300	206	17 000	246	53 000
7	54.5	47	175	87	545	127	1 750	167	5 450	207	17 500	247	54 500
8	56	48	180	88	560	128	1 800	168	5 600	208	18 000	248	56 000
9	58	49	185	89	580	129	1 850	169	5 800	209	18 500	249	58 000
10	60	50	190	90	600	130	1 900	170	6 000	210	19 000	250	60 000
11	61.5	51	195	91	615	131	1 950	171	6 150	211	19 500	251	61 500
12	63	52	200	92	630	132	2 000	172	6 300	212	20 000	252	63 000
13	65	53	206	93	650	133	2 060	173	6 500	213	20 600	253	65 000
14	67	54	212	94	670	134	2 120	174	6 700	214	21 200	254	67 000
15	69	55	218	95	690	135	2 180	175	6 900	215	21 800	255	69 000
16	71	56	224	96	710	136	2 240	176	7 100	216	22 400	256	71 000
17	73	57	230	97	730	137	2 300	177	7 300	217	23 000	257	73 000
18	75	58	236	98	750	138	2 360	178	7 500	218	23 600	258	75 000
19	77.5	59	243	99	775	139	2 430	179	7 750	219	24 300	259	77 500
20	80	60	250	100	800	140	2 500	180	8 000	220	25 000	260	80 000
21	82.5	61	257	101	825	141	2 575	181	8 250	221	25 750	261	82 500
22	85	62	265	102	850	142	2 650	182	8 500	222	26 500	262	85 000
23	87.5	63	272	103	875	143	2 725	183	8 750	223	27 250	263	87 500
24	90	64	280	104	900	144	2 800	184	9 000	224	28 000	264	90 000
25	92.5	65	290	105	925	145	2 900	185	9 250	225	29 000	265	92 500
26	95	66	300	106	950	146	3 000	186	9 500	226	30 000	266	95 000
27	97.5	67	307	107	975	147	3 075	187	9 750	227	30 750	267	97 500
28	100	68	315	108	1 000	148	3 150	188	10 000	228	31 500	268	100 000
29	103	69	325	109	1 030	149	3 250	189	10 300	229	32 500	269	103 000
30	106	70	335	110	1 060	150	3 350	190	10 600	230	33 500	270	106 000
31	109	71	345	111	1 090	151	3 450	191	10 900	231	34 500	271	109 000
32	112	72	355	112	1 120	152	3 550	192	11 200	232	35 500	272	112 000
33	115	73	365	113	1 150	153	3 650	193	11 500	233	36 500	273	115 000
34	118	74	375	114	1 180	154	3 750	194	11 800	234	37 500	274	118 000
35	121	75	387	115	1 215	155	3 875	195	12 150	235	38 750	275	121 500
36	125	76	400	116	1 250	156	4 000	196	12 500	236	40 000	276	125 000
37	128	77	412	117	1 285	157	4 125	197	12 850	237	41 250	277	128 500
38	132	78	425	118	1 320	158	4 250	198	13 200	238	42 500	278	132 000
39	136	79	437	119	1 360	159	4 375	199	13 600	239	43 750	279	136 000

## **Annex 5**

### **TYRE SIZE DESIGNATION AND DIMENSIONS**

**(IN ACCORDANCE WITH REGULATION No. 54)**

**FOR THIS INFORMATION REFER TO ANNEX 5 OF REGULATION No. 54**

Note that with reference to paragraph 6.5.4. of this Regulation, the outer diameter of a retreaded tyre, and the section width of a radial retreaded tyre, may in all cases be greater than that shown in the tables in Annex 5 to Regulation No. 54, but by no more than 1.5 per cent.

The overall section width of a retreaded radial tyre with an ASP may in all cases be greater than that shown in the tables of Annex 5 to Regulation No. 54, but by no more than 8 mm.

## **Annex 6**

### **METHOD OF MEASURING TYRES**

1. The tyre shall be mounted on the test rim specified by the retreader and inflated to the nominal inflation pressure quoted in the nominated International Tyre Standard (see paragraph 4.1.4.7. of this Regulation) in relation to the maximum load carrying capacity for that size and load index.
2. The tyre, fitted to the appropriate rim, shall be conditioned to the ambient temperature of the laboratory for at least 24 hr save as otherwise required by paragraph 6.6.3. of this Regulation.
3. The pressure shall be re-adjusted to the value in paragraph 1 of this annex.
4. The overall width shall be measured at six equally spaced points around the tyre, taking account of the thickness of any protective ribs or bands. The highest reading obtained shall be taken as the overall width.
5. The outer diameter shall be calculated from a measurement of the maximum circumference of the inflated tyre.

## Annex 7

### PROCEDURE FOR LOAD/SPEED ENDURANCE TESTS (IN PRINCIPLE IN ACCORDANCE WITH REGULATION No. 54)

1. Preparing the tyre
  - 1.1. Mount a retreaded tyre on the test rim specified by the retreader.
  - 1.2. Use a new inner tube or combination of inner tube, valve and flap (as required) when testing tyres with inner tubes.
  - 1.3. Inflate the tyre to the pressure corresponding to the pressure index as specified in paragraph 3.2.11. of this Regulation.
  - 1.4. Condition the tyre and wheel assembly at test-room temperature for not less than 3 hours.
  - 1.5. Readjust the tyre pressure to that specified in paragraph 1.3. of this annex.
2. Test Procedure
  - 2.1. Mount the tyre and wheel assembly on the test axle and press it against the outer face of a smooth surfaced power-driven test drum 1.70 m  $\pm$  1 per cent diameter having a surface at least as wide as the tyre tread.
  - 2.2. Apply to the test axle a series of test loads equal to a percentage of the load indicated in Annex 4 to this Regulation, corresponding to the load index indicated on the tyre, and in accordance with the test programme below. Where the tyre has load indices for operation in both single and twin or dual formation the load corresponding to the load index for single operation shall be used for the test.
    - 2.2.1. In the case of tyres with a speed capacity greater than 150 km/h (speed symbol "Q" and above, plus "H") the test procedure shall be as given in paragraph 3. of this annex.
    - 2.2.2. For all other tyres the test procedure is as shown in Appendix 1 to this annex.
  - 2.3. Endurance Test Programme - See also Appendix 1 to this annex.
    - 2.3.1. The tyre pressure shall not be corrected throughout the test and the test load shall be kept constant throughout each of the three test stages.
    - 2.3.2. During the test the temperature of the test room shall be maintained at between 20°C and 30°C unless the tyre manufacturer or retreader agrees to the use of a higher temperature.



## Annex 7

- 2.4. The endurance test programme shall be carried out without interruption.
3. Load/speed test programme for tyres having a speed capability greater than 150 km/h (speed symbol "Q" and above, plus "H").
  - 3.1 This programme applies to :
    - 3.1.1. All tyres having a load index in single fitment equal to or less than 121;
    - 3.1.2. Tyres having a load index in single fitment equal to or greater than 122 and having the additional marking "C" or "LT" referred to in paragraph 3.2.15. of this Regulation.
  - 3.2. The load on the wheel and tyre shall be the following percentage of that corresponding to the load index of the tyre:
    - 3.2.1. 90 per cent when tested on a drum of  $1.70\text{ m} \pm 1$  per cent diameter;
    - 3.2.2. 92 per cent when tested on a drum of  $2.00\text{ m} \pm 1$  per cent diameter.
  - 3.3. The initial phase test speed shall be 20 km/h less than that indicated by the speed symbol for the tyre.
    - 3.3.1. Time taken to reach initial test speed shall be 10 min.
    - 3.3.2. The duration of the first phase shall be 10 min.
  - 3.4. The second phase test speed shall be 10 km/h less than that indicated by the speed symbol for the tyre.
    - 3.4.1. The duration of the second phase shall be 10 min.
  - 3.5. The final phase test speed shall be the speed corresponding to that indicated by the speed symbol for the tyre.
    - 3.5.1. The duration of the final phase shall be 30 min.
  - 3.6. The duration of the entire test shall be 1 hr.
4. Equivalent test method:

If a test method other than that given in paragraphs 2 or 3 of this annex is used, its equivalence must be demonstrated.

**Annex 7 - Appendix 1****ENDURANCE-TEST PROGRAMME**

<i>Load index</i>	<i>Speed symbol</i>	<i>Test-drum speed [km.h<sup>-1</sup>]</i>		<i>Load placed on the wheel as a percentage of the load corresponding to the load index</i>		
		<i>Radial-ply</i>	<i>Diagonal (bias ply) and bias belted</i>	<i>7 h.</i>	<i>16 h.</i>	<i>24 h.</i>
122 or more	F	32	32	66%	84%	101%
	G	40	32			
	J	48	40			
	K	56	48			
	L	64	-			
	M	72	-			
121 or less	F	32	32	70%	88%	106%
	G	40	40			
	J	48	48			
	K	56	56			
	L	64	56	4 h.	6 h.	114%
				75%	97%	
	M	80	64	75%	97%	114%
	N	88	-	75%	97%	114%
	P	96	-	75%	97%	114%

**Notes:**

(1) "Special-use" tyres (see paragraph 2.8. of this Regulation) shall be tested at a speed equal to 85 per cent of the speed prescribed for equivalent normal tyres.

(2) Tyres having a load index equal to or greater than 122, a speed symbol "N" or "P" and the additional markings "C" or "LT" included in the tyre size designation (referred to in paragraph 3.2.15. of this Regulation), shall be tested with the same programme as specified in the above table for tyres having a load index equal to or less than 121..

## Annex 7 - Appendix 2

### RELATIONSHIP BETWEEN THE PRESSURE INDEX AND UNITS OF PRESSURE

Pressure Index ("PSI")	bar	kPa
20	1.4	140
25	1.7	170
30	2.1	210
35	2.4	240
40	2.8	280
45	3.1	310
50	3.4	340
55	3.8	380
60	4.1	410
65	4.5	450
70	4.8	480
75	5.2	520
80	5.5	550
85	5.9	590
90	6.2	620
95	6.6	660
100	6.9	690
105	7.2	720
110	7.6	760
115	7.9	790
120	8.3	830
125	8.6	860
130	9.0	900
135	9.3	930
140	9.7	970
145	10.0	1000
150	10.3	1030
...	...	...

**Annex 8**

**VARIAION OF LOAD CAPACITY WITH SPEED: COMMERCIAL VEHICLE TYRES  
RADIAL AND DIAGONAL PLY  
(IN ACCORDANCE WITH REGULATION No. 54)**

Speed (km/h)	Variation of Load Capacity (%)									
	All load indices				Load indices ≥ 122 <u>1/</u>		Load indices ≤ 121 <u>2/</u>			
	Speed Symbol				Speed Symbol		Speed Symbol			
	F	G	J	K	L	M	L	M	N	P <u>6/</u>
0	+150	+150	+150	+150	+150	+150	+110	+110	+110	+110
5	+110	+110	+110	+110	+110	+110	+ 90	+ 90	+ 90	+ 90
10	+ 80	+ 80	+ 80	+ 80	+ 80	+ 80	+ 75	+ 75	+ 75	+ 75
15	+ 65	+ 65	+ 65	+ 65	+ 65	+ 65	+ 60	+ 60	+ 60	+ 60
20	+ 50	+ 50	+ 50	+ 50	+ 50	+ 50	+ 50	+ 50	+ 50	+ 50
25	+ 35	+ 35	+ 35	+ 35	+ 35	+ 35	+ 42	+ 42	+ 42	+ 42
30	+ 25	+ 25	+ 25	+ 25	+ 25	+ 25	+ 35	+ 35	+ 35	+ 35
35	+ 19	+ 19	+ 19	+ 19	+ 19	+ 19	+ 29	+ 29	+ 29	+ 29
40	+ 15	+ 15	+ 15	+ 15	+ 15	+ 15	+ 25	+ 25	+ 25	+ 25
45	+ 13	+ 13	+ 13	+ 13	+ 13	+ 13	+ 22	+ 22	+ 22	+ 22
50	+ 12	+ 12	+ 12	+ 12	+ 12	+ 12	+ 20	+ 20	+ 20	+ 20
55	+ 11	+ 11	+ 11	+ 11	+ 11	+ 11	+17.5	+17.5	+17.5	+17.5
60	+ 10	+ 10	+ 10	+ 10	+ 10	+ 10	+15.0	+15.0	+15.0	+15.0
65	+7.5	+ 8.5	+8.5	+8.5	+8.5	+ 8.5	+13.5	+13.5	+13.5	+13.5
70	+5.0	+7.0	+7.0	+7.0	+7.0	+7.0	+12.5	+12.5	+12.5	+12.5
75	+2.5	+5.5	+5.5	+5.5	+5.5	+5.5	+11.0	+11.0	+11.0	+11.0
80	0	+4.0	+4.0	+4.0	+4.0	+4.0	+10.0	+10.0	+10.0	+10.0
85	-3	+2.0	+3.0	+3.0	+3.0	+3.0	+8.5	+8.5	+8.5	+8.5
90	-6	0	+2.0	+2.0	+2.0	+2.0	+7.5	+7.5	+7.5	+7.5
95	-10	-2.5	+1.0	+1.0	+1.0	+1.0	+6.5	+6.5	+6.5	+6.5
100	-15	-5	0	0	0	0	+5.0	+5.0	+5.0	+5.0
105		-8	-2	0	0	0	+3.75	+3.75	+3.75	+3.75
110		-13	-4	0	0	0	+2.5	+2.5	+2.5	+2.5
115			-7	-3	0	0	+1.25	+1.25	+1.25	+1.25
120			-12	-7	0	0	0	0	0	0
125						0	-2.5	0	0	0
130						0	-5.0	0	0	0
135							-7.5	-2.5	0	0
140							-10	-5	0	0
145								-7.5	-2.5	0
150								-10.0	-5.0	0
155									-7.5	-2.5
160									-10.0	-5.0

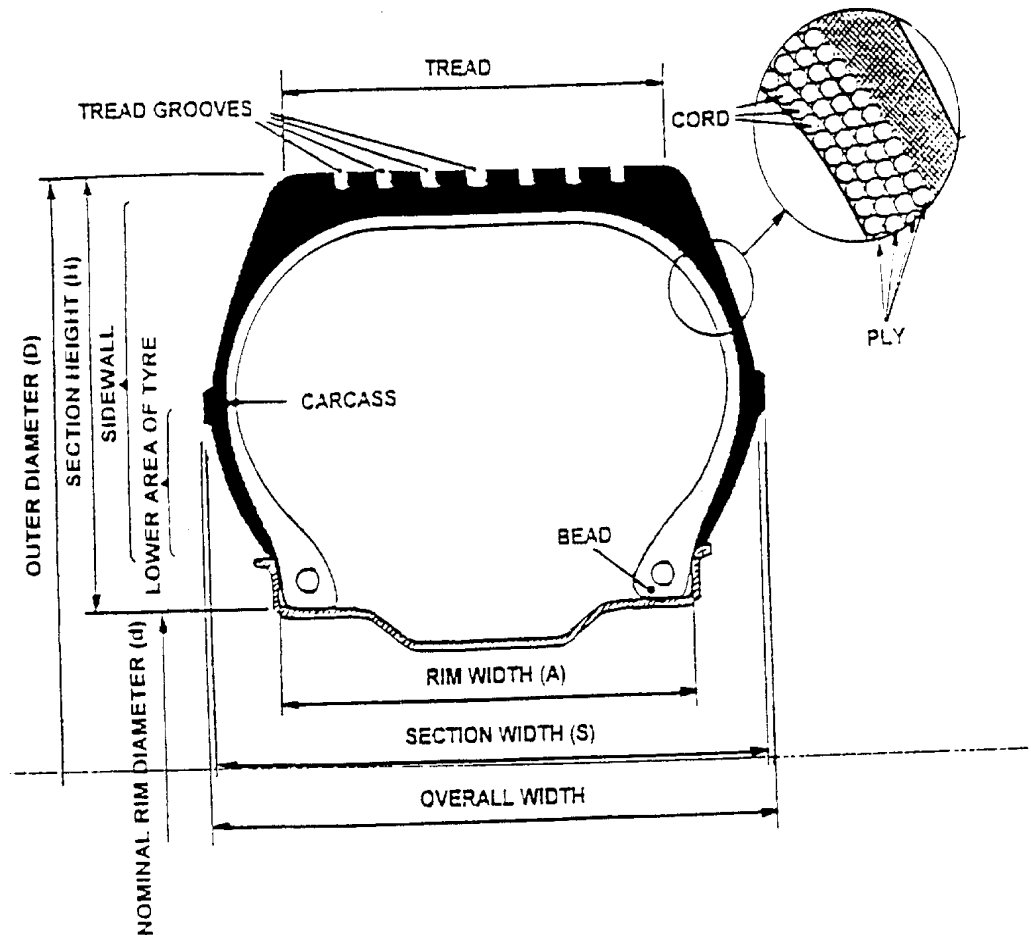
1/ The load indices refer to operation in single formation.

2/ Load variations are not allowed for speeds above 160 km/h. For speed symbols "Q" and above the speed corresponding to the speed symbol specifies the maximum permissible speed for the tyre.

## Annex 9

### EXPLANATORY FIGURE

See paragraph 2 of this Regulation



## Annex 10

### PROCEDURES FOR SNOW PERFORMANCE TESTING RELATIVE TO SNOW TYRE FOR USE IN SEVERE SNOW CONDITIONS

1. Specific definitions for snow test when different from existing ones
  - 1.1. "Test run" means a single pass of a loaded tyre over a given test surface.
  - 1.2. "Braking test" means a series of a specified number of ABS-braking test runs of the same tyre repeated within a short time frame.
  - 1.3. "Traction test" means a series of a specified number of spin-traction test runs according to ASTM standard F1805-20 of the same tyre repeated within a short time frame.
  - 1.4. "Acceleration test" means a series of specified number of traction controlled acceleration test runs of the same tyre repeated within a short timeframe.
2. The test procedure of ASTM standard F1805-20 shall be used to assess snow performance through the traction performance index (TPI) on medium pack snow (the snow compaction index measured with CTI penetrometer<sup>1/</sup> shall be between 70 and 80).
  - 2.1. The test course surface shall be composed of a medium pack snow surface, as characterized in table A2.1 of ASTM standard F1805-20.
  - 2.2. The tyre load for testing shall be as per option 2 in paragraph 11.9.2 of ASTM standard F1805-20. When the SRTT16 is used as reference tyre, it shall be tested with a load of 531 kg at an inflation pressure of 240 kPa (cold).
  - 2.3. The snow grip index (SG) of a candidate tyre T<sub>n</sub> shall be computed as follows:

$$SG(T_n) = f \cdot \frac{TPI}{100}$$

where  $f = 0.987$  when using SRTT16 as reference tyre per ASTM F1805-20, and  $TPI$  denotes the traction performance index as defined in ASTM F1805-20.

3. Braking on snow method for Class C2 tyres
  - 3.1. General conditions
    - 3.1.1. Test course

The braking tests shall be done on a flat test surface of sufficient length and width, with a maximum 2 per cent gradient, covered with packed snow.

The snow surface shall be composed of a hard packed snow base at least 3 cm thick and a surface layer of medium packed and prepared snow about 2 cm thick.

The air temperature, measured about one meter above the ground, shall be between -2 °C and -15 °C; the snow temperature, measured at a depth of about one centimetre, shall be between -4 °C and -15 °C.

It is recommended to avoid direct sunlight, large variations of sunlight or humidity, as well as wind.

The snow compaction index measured with a CTI penetrometer<sup>1</sup> shall be between 75 and 85.

#### 3.1.2. Vehicle

The test shall be conducted with a standard production vehicle in good running order and equipped with an ABS system.

The vehicle used shall be such that the loads on each wheel are appropriate to the tyres being tested. Several different tyre sizes can be tested on the same vehicle.

#### 3.1.3. Tyres

The tyres should be "broken-in" prior to testing to remove spew, compound nodules or flashes resulting from the moulding process. The tyre surface in contact with snow shall be cleaned before performing a test.

Tyres shall be conditioned at the outdoor ambient temperature at least two hours before their mounting for tests. Tyre pressures shall then be adjusted to the values specified for the test.

In case a vehicle cannot accommodate both the reference and candidate tyres, a third tyre ("control" tyre) may be used as an intermediate. First test control vs. reference on another vehicle, then test candidate vs. control on the vehicle.

#### 3.1.4. Load and pressure

##### 3.1.4.1. For C2 tyres, the vehicle load shall be such that the resulting loads on the tyres are between 60 per cent and 100 per cent of the load corresponding to the tyre load index.

The static tyre load on the same axle should not differ by more than 10 per cent.

The inflation pressure is calculated to run at constant deflection:

For a vertical load higher or equal to 75 per cent of the load capacity of the tyre, a constant deflection is applied, hence the test inflation pressure "P<sub>t</sub>" shall be calculated as follows:

$$P_t = P_r \left( \frac{Q_t}{Q_r} \right)^{1.25}$$

Q<sub>r</sub>: is the maximum load associated to the load capacity index of the tyre written on the sidewall.

P<sub>r</sub>: is the reference pressure corresponding to the maximum load capacity Q<sub>r</sub>.

Q<sub>t</sub>: is the static test load of the tyre.

For a vertical load lower than 75 per cent of the load capacity of the tyre, a constant inflation pressure is applied, hence the test inflation pressure P<sub>t</sub> shall be calculated as follows:

---

1 See appendix of ASTM standard F1805-06 for details.

$$P_t = P_r (0.75)^{1.25} = (0.7) P_r$$

$P_r$ : is the reference pressure corresponding to the maximum load capacity  $Q_r$ .

Check the tyre pressure just prior to testing at ambient temperature.

### 3.1.5. Instrumentation

The vehicle shall be fitted with calibrated sensors suitable for measurements in winter. There shall be a data acquisition system to store measurements.

The accuracy of measurement sensors and systems shall be such that the relative uncertainty of the measured or computed mean fully developed decelerations is less than 1 per cent.

### 3.2. Testing sequences

#### 3.2.1. For every candidate tyre and the standard reference tyre, ABS-braking test runs shall be repeated a minimum of 6 times.

The zones where ABS-braking is fully applied shall not overlap.

When a new set of tyres is tested, the runs are performed after shifting aside the vehicle trajectory in order not to brake on the tracks of the previous tyre.

When it is no longer possible not to overlap full ABS-braking zones, the test course shall be re-groomed.

Required sequence:

6 repeats SRTT, then shift aside to test next tyre on fresh surface;

6 repeats Candidate 1, then shift aside;

6 repeats Candidate 2, then shift aside;

6 repeats SRTT, then shift aside.

#### 3.2.2. Order of testing:

If only one candidate tyre is to be evaluated, the order of testing shall be:

R1 - T - R2

Where:

R1: is the initial test of the SRTT, R2 is the repeat test of the SRTT and T is the test of the candidate tyre to be evaluated.

A maximum of two candidate tyres may be tested before repeating the SRTT test, for example:

R1 - T1 - T2 - R2.

The comparative tests of SRTT and candidate tyres shall be repeated on two different days.

### 3.3. Test procedure

#### 3.3.1. Drive the vehicle at a speed not lower than 28 km/h.



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- 3.3.2. When the measuring zone has been reached, the vehicle gear is set into neutral, the brake pedal is depressed sharply by a constant force sufficient to cause operation of the ABS on all wheels of the vehicle and to result in stable deceleration of the vehicle and held down until the speed is lower than 8 km/h.
- 3.3.3. The mean fully developed deceleration between 25 km/h and 10 km/h shall be computed from time, distance, speed, or acceleration measurements.
- 3.4. Data evaluation and presentation of results
- 3.4.1. Parameters to be reported
- 3.4.1.1. For each tyre and each braking test, the arithmetic mean  $\bar{a}$  and corrected sample standard deviation  $\sigma_a$  of the mfdd shall be computed and reported.

The coefficient of variation  $CV_a$  of a tyre braking test shall be computed as:

$$CV_a = 100\% \cdot \frac{\sigma_a}{\bar{a}}$$

with

$$\sigma_a = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (a_i - \bar{a})^2}$$

- 3.4.1.2. Weighted averages  $wa_{SRTT}$  of two successive tests of the SRTT shall be computed taking into account the number of candidate tyres in between:

In the case of the order of testing R1 – T – R2, the weighted average of the SRTT to be used in the comparison of the performance of the candidate tyre shall be taken to be:

$$wa_{SRTT} = \frac{1}{2}(\overline{a_{R1}} + \overline{a_{R2}})$$

Where:

$\overline{a_{Rn}}$  is the arithmetic mean of the mfdd for the n-th test of the SRTT.

In the case of the order of testing R1 – T1 – T2 – R2, the weighted averages  $wa_{SRTT}$  of the SRTT to be used in the comparison of the performance of the candidate tyre shall be taken to be:

$$wa_{SRTT} = \frac{2}{3}\overline{a_{R1}} + \frac{1}{3}\overline{a_{R2}} \text{ for comparison with the candidate tyre T1 and}$$

$$wa_{SRTT} = \frac{1}{3}\overline{a_{R1}} + \frac{2}{3}\overline{a_{R2}} \text{ for comparison with the candidate tyre T2.}$$

- 3.4.1.3. The snow grip index (SG) of a candidate tyre Tn shall be computed as the quotient of the arithmetic mean  $\overline{a_{Tn}}$  of the mfdd of the tyre Tn and the applicable weighted average  $wa_{SRTT}$  of the SRTT:

$$SG(Tn) = \frac{\overline{a_{Tn}}}{wa_{SRTT}}$$

### 3.4.2. Statistical validations

The sets of repeats of measured or computed mfdd for each tyre should be examined for normality, drift, eventual outliers.

The consistency of the arithmetic means  $\bar{a}$  and corrected sample standard deviations  $\sigma_a$  of successive braking tests of SRTT should be examined.

In addition and in order to take in account possible test evolution, the coefficient of validation  $CVal_a(\text{SRTT})$  is calculated on the basis of the average values of any two consecutive groups of the minimum 6 runs of the Standard Reference Test Tyre according to

$$CVal_a(\text{SRTT}) = 100\% \times \left| \frac{\bar{a}_{R2} - \bar{a}_{R1}}{\bar{a}_{R1}} \right|$$

The coefficient of validation  $CVal_a(\text{SRTT})$  shall not differ by more than 5 per cent.

The coefficient of variation  $CV_a$ , as defined in paragraph 3.1.1. of this annex, of any braking test shall be less than 6 per cent.

If those conditions are not met, tests shall be performed again after re-grooming the test course.

3.4.3. In the case where the candidate tyres cannot be fitted to the same vehicle as the SRTT, for example, due to tyre size, inability to achieve required loading and so on, comparison shall be made using intermediate tyres, hereinafter referred to as "control tyres", and two different vehicles. One vehicle shall be capable of being fitted with the SRTT and the control tyre and the other vehicle shall be capable of being fitted with the control tyre and the candidate tyre.

3.4.3.1. The snow grip index of the control tyre relative to the SRTT (SG1) and of the candidate tyre relative to the control tyre (SG2) shall be established using the procedure in paragraphs 3.1. to 3.4.2. above.

The snow grip index of the candidate tyre relative to the SRTT shall be the product of the two resulting snow grip indices that is SG1 x SG2.

3.4.3.2. The ambient conditions shall be comparable. All tests shall be completed within the same day.

3.4.3.3. The same set of control tyres shall be used for comparison with the SRTT and with the candidate tyre and shall be fitted in the same wheel positions.

3.4.3.4. Control tyres that have been used for testing shall subsequently be stored under the same conditions as required for the SRTT.

3.4.3.5. The SRTT and control tyres shall be discarded if there is irregular wear or damage or when the performance appears to have been deteriorated.

4. Acceleration method for Class C3 tyres

4.1. (omitted)

4.2. Methods for measuring Snow Grip index (SG)

Snow performance is based on a test method by which the average acceleration in an acceleration test, of a candidate tyre is compared to that of a standard reference tyre.

The relative performance shall be indicated by a snow grip index.

When tested in accordance with the acceleration test in paragraph 4.7. below, the average acceleration of a candidate snow tyre shall be at least 1.25 compared to one of the two equivalent Standard Reference Test Tyres SRTT19.5 and SRTT22.5.

#### 4.3. Measuring equipment

##### 4.3.1. A sensor suitable for measuring speed and distance covered on snow/ice surface between two speeds must be used.

To measure vehicle speed, a fifth wheel or non-contact speed-measuring system (including radar, GPS ...) shall be used.

##### 4.3.2. The following tolerances shall be respected:

- (a) For speed measurements:  $\pm 1$  per cent (km/h) or 0.5 km/h whichever is greater.
- (b) For distance measurements:  $\pm 1 \times 10^{-1}$  m

##### 4.3.3. A display of the measured speed or the difference between the measured speed and the reference speed for the test is recommended inside the vehicle so that the driver can adjust the speed of the vehicle.

##### 4.3.4. For Acceleration test covered in paragraph 4.7. below, a display of the slip ratio of the driven tyres is recommended inside the vehicle and shall be used in the particular case of paragraph 4.7.2.1.1. below.

The slip ratio is calculated by:

$$\text{Slip Ratio \%} = \left[ \frac{\text{Wheel Speed} - \text{Vehicle Speed}}{\text{Vehicle Speed}} \right] \times 100$$

- (a) Vehicle speed is measured as defined in 4.3.1. above (m/s);
- (b) Wheel speed is calculated on a tyre of the driven axle by measuring its angular velocity and its loaded diameter

$$\text{Wheel Speed} = \pi \times \text{loaded diameter} \times \text{angular speed}$$

Where,  $\pi = 3.1416$  (m/360deg), the loaded diameter (m) and the angular speed (revolution per second = 360 deg/sec).

##### 4.3.5. A data acquisition system can be used for storing the measurements.

#### 4.4. General conditions

##### 4.4.1. Test course

The test shall be done on a flat test surface of sufficient length and width, with a maximum 2 per cent gradient, covered with packed snow.

##### 4.4.1.1. The snow surface shall be composed of a hard packed snow base at least 3 cm thick and a surface layer of medium packed and prepared snow about 2 cm thick.

##### 4.4.1.2. The snow compaction index measured with a CTI penetrometer shall be between 80 and 90. Refer to the appendix of ASTM F1805 for additional details on measuring method.

##### 4.4.1.3. The air temperature, measured about one meter above the ground, shall be between -2 °C and -15 °C; the snow temperature, measured at a depth of about one centimetre, shall be between -4 °C and -15 °C.

Air temperature shall not vary more than 10 deg C during the test.

4.5. Tyres preparation and break-in

4.5.1. Fit the test tyres on rims as per ISO 4209-1 using conventional mounting methods. Ensure proper bead seating by the use of a suitable lubricant. Excessive use of lubricant should be avoided to prevent slipping of the tyre on the wheel rim.

4.5.2. The tyres should be "broken-in" prior to testing to remove spew, compound nodules or flashes resulting from moulding process.

4.5.3. Tyres shall be conditioned at the outdoor ambient temperature at least two hours before their mounting for tests.

They should be placed such that they all have the same ambient temperature prior to testing and be shielded from the sun to avoid excessive heating by solar radiation.

The tyre surface in contact with snow shall be cleaned before performing a test.

Tyre pressures shall then be adjusted to the values specified for the test.

4.6. Testing sequence

If only one candidate tyre is to be evaluated, the order of testing shall be:

R1 - T - R2

Where:

R1 is the initial test of the SRTT, R2 is the repeat test of the SRTT and T is the test of the candidate tyre to be evaluated.

A maximum of 3 candidate tyres may be tested before repeating the SRTT test, for example: R1 - T1 - T2 - T3 - R2.

Recommendations are that the zones where acceleration is fully applied shall not overlap without reworking and when a new set of tyres is tested;

The runs are performed after shifting the vehicle trajectory in order not to accelerate on the tracks of the previous tyre; when it is no longer possible not to overlap full acceleration zones, the test course should be re-groomed.

4.7. Acceleration on snow test procedure for snow grip index of Class C3.

4.7.1. Principle

The test method covers a procedure for measuring the snow grip performance of commercial vehicle tyres during acceleration, using a commercial vehicle having a Traction Control System (TCS, ASR, etc.).

Starting with a defined initial speed, the full throttle is applied to activate the Traction Control System, the Average acceleration is calculated between two defined speeds.

4.7.2. Vehicle

4.7.2.1. The test shall be conducted with a standard two axle commercial vehicle in good running order with:

- (a) Low rear axle weight and an engine powerful enough to maintain the average percentage of slip during the test as required in paragraphs 4.7.5.1. and 4.7.5.2.1. below;

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- (b) A manual gearbox (automatic gearbox with manual shift allowed) having a gear ratio covering the speed range of at least 19 km/h between 4 km/h and 30 km/h;
- (c) Differential lock on driven axle is recommended to improve repeatability;
- (d) A standard commercial system controlling/limiting the slip of the driving axle during acceleration (Traction Control, ASR, TCS, etc.).

4.7.2.1.1. In the particular case where a standard commercial vehicle equipped with a traction control system is not available, a vehicle without Traction Control/ASR/TCS is permitted provided the vehicle is fitted with a system to display the percentage slip as stated in paragraph 4.3.4. and a mandatory differential lock on the driven axle used in accordance with operating procedure. If a differential lock is available it shall be used; if the differential lock, however, is not available, the average slip ratio should be measured on the left and right driven wheel.

4.7.2.2. The permitted modifications are:

- (a) Those allowing to increase the number of tyre sizes capable to be mounted on the vehicle;
- (b) Those permitting to install an automatic activation of the acceleration and the measurements.

Any other modification of the acceleration system is prohibited.

4.7.3. Vehicle fitting

The rear driven axle may be indifferently fitted with 2 or 4 test tyres if respecting the loading by tyre.

The front steer non driven axle is equipped with 2 tyres having a size suitable for the axle load. These 2 front tyres could be maintained along the test.

4.7.4. Load and inflation pressure

4.7.4.1. The static load on each rear driven test tyres must be between 20 per cent and 55 per cent of the tested tyre load capacity written on the sidewall.

The vehicle front steer total static axle load should be between 60 per cent and 160 per cent of the driven rear total axle load.

The static tyre load on the same driven axle should not differ by more than 10 per cent.

4.7.4.2. The driven tyres inflation pressure shall be 70 per cent of the one written on the sidewall. The steer tyres are inflated at nominal sidewall pressure.

If the pressure is not marked on the sidewall, refer to the specified pressure in applicable tyre standards manuals corresponding to maximum load capacity.

4.7.5. Testing runs

- 4.7.5.1. Mount first the set of reference tyres on the vehicle and when on the testing area.

Drive the vehicle at a constant speed between 4 km/h and 11 km/h and the gear ratio capable of covering the speed range of at least 19 km/h for the complete test programme (e.g. R-T1-T2-T3-R).

The recommended gear ratio selected is 3rd or 4th gear and shall give a minimum 10 per cent average slip ratio in the measured range of speed.

- 4.7.5.2. In case of Traction Control System equipped vehicles (already switched "on" before the run) apply full throttle until the vehicle has reached the final speed.

Final speed = Initial speed + 15 km/h

No rearward restraining force shall be applied to the test vehicle.

- 4.7.5.2.1. In the particular case of paragraph 4.7.2.1.1. of this annex where a standard commercial vehicle equipped with a Traction Control system is not available, the driver shall manually maintain the average slip ratio between 10 and 40 per cent (Controlled Slip procedure in place of the Full Slip) within the prescribed range of speeds. If a differential lock is not available, the averaged slip ratio difference between the left and right driven wheel shall not be higher than 8 per cent for each run. All the tyres and runs in the test session are performed with Controlled Slip procedure.

- 4.7.5.3. Measure the distance between the initial speed and the final speed.

- 4.7.5.4. For every candidate tyre and the standard reference tyre, the acceleration test runs shall be repeated a minimum of 6 times and the coefficients of variation  $CV_{AA}$  shall be lower than or equal to 6 per cent.  $CV_{AA}$  shall be calculated for minimum 6 valid runs according to

$$CV_{AA} = 100\% \cdot \frac{\sigma_{AA}}{\overline{AA}}$$

where

$\sigma_{AA} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (AA_i - \overline{AA})^2}$  denotes the corrected sample standard deviation and

$\overline{AA}$  the arithmetic mean of the Average Accelerations ( $AA_i$ ) of  $N$  test runs.

- 4.7.5.5. In case of Traction Control System equipped vehicle, the Average Slip ratio shall be in the range from 10 per cent to 40 per cent (calculated as per paragraph 4.3.4. of this annex).

- 4.7.5.6. Apply testing sequence as defined in paragraph 4.6. above.

- 4.8. Processing of measurement results

- 4.8.1. Calculation of the average acceleration  $AA$

Each time the measurement is repeated, the average acceleration  $AA$  ( $m \cdot s^{-2}$ ) is calculated by:

$$AA = \frac{S_f^2 - S_i^2}{2D}$$

Where  $D$  (m) is the distance covered between the initial speed  $S_i$  ( $m \cdot s^{-1}$ ) and the final speed  $S_f$  ( $m \cdot s^{-1}$ ).

#### 4.8.2. Validation of results

For the candidate tyres:

The coefficient of variation  $CV_{AA}$  of the average acceleration is calculated according to the formula in 4.7.5.4. of this Annex for all the candidate tyres. If one coefficient of variation is greater than 6 per cent, discard the data for this candidate tyre and repeat the test.

For the reference tyre:

If the coefficient of variation  $CV_{AA}$  of the average acceleration calculated according to the formula in 4.7.5.4. of this Annex for each group of min 6 runs of the reference tyre is higher than 6 per cent, discard all data and repeat the test for all tyres (the candidate tyres and the reference tyre).

In addition and in order to take in account possible test evolution, the coefficient of validation  $CVal_{AA}(SRTT)$  is calculated on the basis of the average values of any two consecutive groups of minimum 6 runs of the reference tyre according to

$$CVal_{AA}(SRTT) = 100\% \times \left| \frac{\overline{AA_2} - \overline{AA_1}}{\overline{AA_1}} \right|$$

If the coefficient of validation is greater than 6 per cent, discard the data for all the candidate tyres and repeat the test.

#### 4.8.3. Calculation of the weighted averages

Weighted averages  $wa_{SRTT}$  of the average accelerations of two successive tests of the SRTT are calculated according to Table 1:

Table 1

<i>If the number of sets of candidate tyres between two successive runs of the reference tyre is:</i>	<i>and the set of candidate tyres to be qualified is:</i>	<i>then <math>wa_{SRTT}</math> is calculated by applying the following</i>
1   R – T1 – R	T1	$wa_{SRTT} = \frac{1}{2}(\overline{AA_{R1}} + \overline{AA_{R2}})$
2   R – T1 – T2 – R	T1	$wa_{SRTT} = \frac{2}{3}\overline{AA_{R1}} + \frac{1}{3}\overline{AA_{R2}}$
	T2	$wa_{SRTT} = \frac{1}{3}\overline{AA_{R1}} + \frac{2}{3}\overline{AA_{R2}}$
3   R – T1 – T2 – T3 – R	T1	$wa_{SRTT} = \frac{3}{4}\overline{AA_{R1}} + \frac{1}{4}\overline{AA_{R2}}$
	T2	$wa_{SRTT} = \frac{1}{2}(\overline{AA_{R1}} + \overline{AA_{R2}})$
	T3	$wa_{SRTT} = \frac{1}{4}\overline{AA_{R1}} + \frac{3}{4}\overline{AA_{R2}}$

where  $\overline{AA_{Rn}}$  is the arithmetic mean of the average accelerations in the n-th test of the Standard Reference Test Tyre.

## 4.8.4. Calculation of the relative snow grip index of the tyre

The Snow grip index represents the relative performance of the candidate tyre compared to the reference tyre.

$$SG(T_n) = \frac{\overline{AA_{Tn}}}{wa_{SRTT}}$$

where  $\overline{AA_{Tn}}$  is the arithmetic mean of the average accelerations of the n-th candidate tyre.

## 4.8.5. Calculation of the Slip Ratio

The Slip Ratio can be calculated as the average of Slip ratio as mentioned in paragraph 4.3.4. of this annex or by comparing the average distance referred to in paragraph 4.7.5.3. of this annex of the minimum six runs to the distance of a run done without slip (very low acceleration)

$$\text{Slip Ratio \%} = \left[ \frac{\text{Average distance} - \text{No slip distance}}{\text{No slip distance}} \right] \times 100$$

No slip distance means the wheel distance calculated on a run done with a constant speed or a continuous low acceleration.

## 4.9. Snow grip performance comparison between a candidate tyre and a reference tyre using a control tyre

## 4.9.1. Scope

When the candidate tyre size is significantly different from the reference tyre a direct comparison on the same vehicle may be not possible. This is an approach using an intermediate tyre, hereinafter called the control tyre.

## 4.9.2. Principle of the approach

The principle lies upon the use of a control tyre and 2 different vehicles for the assessment of a candidate tyre in comparison with a reference tyre.

One vehicle can fit the reference tyre and the control tyre, the other the control tyre and the candidate tyre. All conditions are in conformity with paragraph 4.7. above.

The first assessment is a comparison between the control tyre and the reference tyre. The result (Snow grip index 1) is the relative efficiency of the control tyre compared to the reference tyre.

The second assessment is a comparison between the candidate tyre and the control tyre. The result (Snow grip index 2) is the relative efficiency of the candidate tyre compared to the control tyre.

The second assessment is done on the same track as the first one. The air temperature must be in the range of  $\pm 5$  °C of the temperature of the first assessment. The control tyre set is the same set as the set used for the first assessment.

The snow grip performance index of the candidate tyre compared to the reference tyre is deduced by multiplying the relative efficiencies calculated above:

$$\text{Snow Grip Index} = SG1 \times SG2$$



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## 4.9.3. Selection of a set of tyres as a control tyre set

A control tyre set is a group of identical tyres made in the same factory during one week period.

## 4.10. Storage and preservation

Before the first assessment (control tyre / reference tyre), normal storage conditions can be used. It is necessary that all the tyres of a control tyre set have been stored in the same conditions.

As soon as the control tyre set has been assessed in comparison with the reference tyre, specific storage conditions shall be applied for control tyres replacement.

When irregular wear or damage results from tests, or when wear influences the test results, the use of the tyre shall be discontinued.

## Annex 10 - Appendix 1

### Pictogram definition of "Alpine Symbol"



Minimum 15 mm base and 15 mm height when the marking is on the sidewall.

Minimum 10 mm base and 10 mm height in case of marking on the shoulder of a pre- cured tread.

Above drawing not to scale.

## Annex 10 - Appendix 2

### Test reports and test data for C2 tyres

#### *Part 1 - Report*

1. Type Approval Authority or Technical Service:.....
2. Name and address of the Retreader: .....
3. Test report No.: .....
4. Brand name and trade description:
5. Tyre class: .....
6. Category of use: .....
7. Snow grip index SG
- 7.1. Test procedure and SRTT used .....
8. Comments (if any): .....
9. Date: .....
10. Signature: .....
11. Signature of the technical service:
12. Signature of the Type Approval Authority:

#### *Part 2 - Test data*

1. Date of test: .....
2. Location of test track: .....
- 2.1. Test track characteristics:

	<i>At start of tests</i>	<i>At end of tests</i>	<i>Specification</i>
Weather			
Ambient temperature			-2 °C to -15 °C
Snow temperature			-4 °C to -15 °C
CTI index			75 to 85
Other			

3. Test vehicle (make, model and type, year): .....

## 4. Test tyre details and data:

	<i>SRTT (1<sup>st</sup> test)</i>	<i>Candidate 1</i>	<i>Candidate 2</i>	<i>SRTT (2<sup>nd</sup> test)</i>
Brand name				
Trade Description/ commercial name				
Tyre size designation				
Service description				
Test rim width code				
Reference (test) inflation pressure <sup>(1)</sup> (kPa)				
Tyre loads F/R (kg)				
Tyre Loads F/R (% of load associated to LI <sup>(2)</sup> )				
Tyre pressure F/R(kPa)				

5. Test results: mean fully developed decelerations ( $\text{m} \cdot \text{s}^{-2}$ ) / traction coefficient<sup>(3)</sup>

<i>Run number</i>	<i>Specification</i>	<i>SRTT (1<sup>st</sup> test)</i>	<i>Candidate 1</i>	<i>Candidate 2</i>	<i>SRTT (2<sup>nd</sup> test)</i>
1					
2					
3					
4					
5					
6					
Mean					
Standard deviation					
Coefficient of variation	$CV_a \leq 6 \%$				
Coefficient of Validation	$CVal_a(\text{SRTT}) \leq 5 \%$				
SRTT weighted average					
Factor $f$					
Snow grip index		1.00			

(1) for C2 tyres, corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 3.1. of this Regulation

(2) For C2 tyres, refer to single load

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- <sup>(3)</sup> Strike out what does not apply.

## Annex 10 - Appendix 3

### Test reports and test data for C3 tyres

#### *Part 1 - Report*

1. Type Approval Authority or Technical Service: .....
2. Name and address of the Retreader: .....
3. Test report No.: .....
4. Brand name and trade description .....
5. Tyre class: .....
6. Category of use: .....
7. Snow grip index relative to SRTT according to paragraph 7.2.1.
- 7.1. Test procedure and SRTT used .....
8. Comments (if any): .....
9. Date: .....
10. Signature: .....
11. Signature of the technical service: .....
12. Signature of the Type Approval Authority: .....

#### *Part 2 - Test data*

1. Date of test: .....
2. Location of test track: .....
- 2.1. Test track characteristics:

	<i>At start of tests</i>	<i>At end of tests</i>	<i>Specification</i>
Weather			
Ambient temperature			-2 °C to -15 °C
Snow temperature			-4 °C to -15 °C
CTI index			80 to 90
Other			

3. Test vehicle (make, model and type, year): .....
4. Test tyre details and data: .....

## Annex 10

	<i>SRTT (1<sup>st</sup> test)</i>	<i>Candidate 1</i>	<i>Candidate 2</i>	<i>Candidate 3</i>	<i>SRTT (2<sup>nd</sup> test)</i>
Brand name					
Trade Description/ commercial name					
Tyre size designation					
Service description					
Test rim width code					
Reference (test) inflation pressure <sup>(1)</sup> (kPa)					
Tyre loads F/R (kg)					
Tyre Loads F/R (% of load associated to LI <sup>(2)</sup> )					
Tyre pressure F/R(kPa)					

5. Test results: mean fully developed decelerations ( $\text{m} \cdot \text{s}^{-2}$ ) coefficient.

<i>Run number</i>	<i>Specification</i>	<i>SRTT (1<sup>st</sup> test)</i>	<i>Candidate 1</i>	<i>Candidate 2</i>	<i>Candidate 3</i>	<i>SRTT (2<sup>nd</sup> test)</i>
1						
2						
3						
4						
5						
6						
Mean						
Standard deviation						
Coefficient of variation	$CV_a \leq 6 \%$					
Coefficient of Validation	$CVal_a(\text{SRTT}) \leq 6 \%$					
SRTT weighted average						
Snow grip index		1.00				

<sup>(1)</sup> Corresponding to the indication of the inflation pressure marked on the sidewall as required by paragraph 4.1. of this Regulation.

<sup>(2)</sup> Refer to single load.