Submitted by the experts of the Informal Group on Tyre GTR

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Global Technical Regulation

HARMONISED PROVISIONS CONCERNING PNEUMATIC RADIAL TYRES FOR PASSENGER AND LIGHT TRUCK (COMMERCIAL) VEHICLES

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I. STATEMENT OF TECHNICAL RATIONALE AND JUSTIFICATION

A. INTRODUCTION

1. The objective of this proposal is to establish a global technical regulation (gtr) for new radial pneumatic tyres equipping passenger cars and light vehicles up to 4536 kg (10,000 pounds) under the 1998 Agreement. The official bases of this harmonised set of requirements are the Regulations 30, and 54 and 117 annexed to the 1958 Agreement, as well as the FMVSS 139 requirements established in the USA under the direction of the National Highway Traffic Safety Administration (NHTSA). Regulations from GSO (Gulf

States Organization), India and China, although not officially registered in the compendium of regulations for the tyre gtr, were also analysed and requirements from them were considered in this gtr insofar as they were not already covered by one of the regulations from UN ECE and USA. In addition, parts of FMVSS 109 and 119 were copied directly into this gtr, since they are applicable to certain tyres for light vehicles (LT).

2. Many countries throughout the world have already introduced regulations concerning pneumatic tyres. Many of the existing regulations are based on the four primary ones mentioned above. However, many differences in test conditions and regulatory marking requirements require tyre manufacturers to produce almost identical products but with market specific variations to meet local market requirements – including slight variations on sidewall marking provisions.

3. This first version of the gtr for tyres harmonises the requirements for passenger car tyres. Work is on-going to define the technical specification for the harmonisation of tyres with the designations LT or C which are primarily fitted on light commercial vehicles.

B. BACKGROUND OF TYRE REGULATIONS

4. Radial pneumatic tyres for passenger cars and light vehicles are increasingly becoming worldwide products, expected to be used anywhere in the world when mounted as original equipment on new vehicles which are themselves marketed on a global basis. This globalisation creates significant opportunities for manufacturers to deliver better and more cost efficient products but also requires harmonisation of the technical provisions at a global level to avoid increasing manufacturing costs.

5. Although testing requirements for different regulations used around the world are often substantially similar, slight variations in test procedures oblige tyre manufacturers to test the same object for the same performance characteristic under slightly different conditions, without any significant improvement in the final product.

6. Marking requirements are also variable around the world, and the same tyre may need several different approval marks to be marketed in a truly worldwide fashion. Any harmonisation of such markings should continue to be a priority, as it would clarify the administrative identity of the tyre and facilitate the management of production moulds.

C. PROCEDURAL BACKGROUND AND DEVELOPMENT OF THE GLOBAL TECHNICAL REGULATION

7. This gtr was developed by the GRRF informal working group (the Tyre gtr working group).

8. The work on this gtr began informally in December of 2004 with a meeting in Paris. As required by the 1998 Agreement, a formal proposal for the establishment of a tyre gtr was proposed to the Executive Committee (AC.3) by the technical sponsor, France. At the 140th session of WP.29 on 14 November 2006, the French proposal was approved as a gtr project by AC.3. That proposal is ECE/TRANS/WP.29/2006/139.

9. Subsequent to that approval, the informal tyre gtr working group met on numerous occasions. In addition to 3 unofficial meetings held between December 2004 and

November 2006, another 10 meetings were scheduled in conjunction with the GRRF meetings and a further two interim meetings were held in Brussels in July 2007 and July 2009.

10. In 2009 at the request of the informal working group, AC.3 approved the gtr should be developed in 2 phases; the initial phase being dedicated to harmonising requirements for passenger car tyres only, and requirements for light trucks tyres, which carry a C or LT designation, to be harmonised before the end of 2014 as a second step. In the interim the existing requirements for C or LT tyres (albeit non-harmonised) are included in the first stage of the gtr for completeness. The current document reflects that decision and contains only harmonised requirements for PC tyres, with the LT/C requirements remaining to be harmonised.

11. Tests or requirements for radial passenger car tyres required extensive harmonisation during the course of the informal working group's mandate. These newly harmonised tests or requirements are:

    (a) High speed test
    (b) Physical dimensions test
    (c) Required markings

12. Several other test requirements for radial passenger car tyres existed only in one of the existing regulations and needed no harmonisation. These tests were simply included as direct copies in the gtr for tyres. In particular, no harmonisation was required for:

    (a) Endurance test
    (b) Low pressure endurance test
    (c) Bead unseating test
    (d) Strength test
    (e) Rolling sound emission test
    (f) [Rolling resistance test]
    (g) Wet grip test
    (h) Run flat test

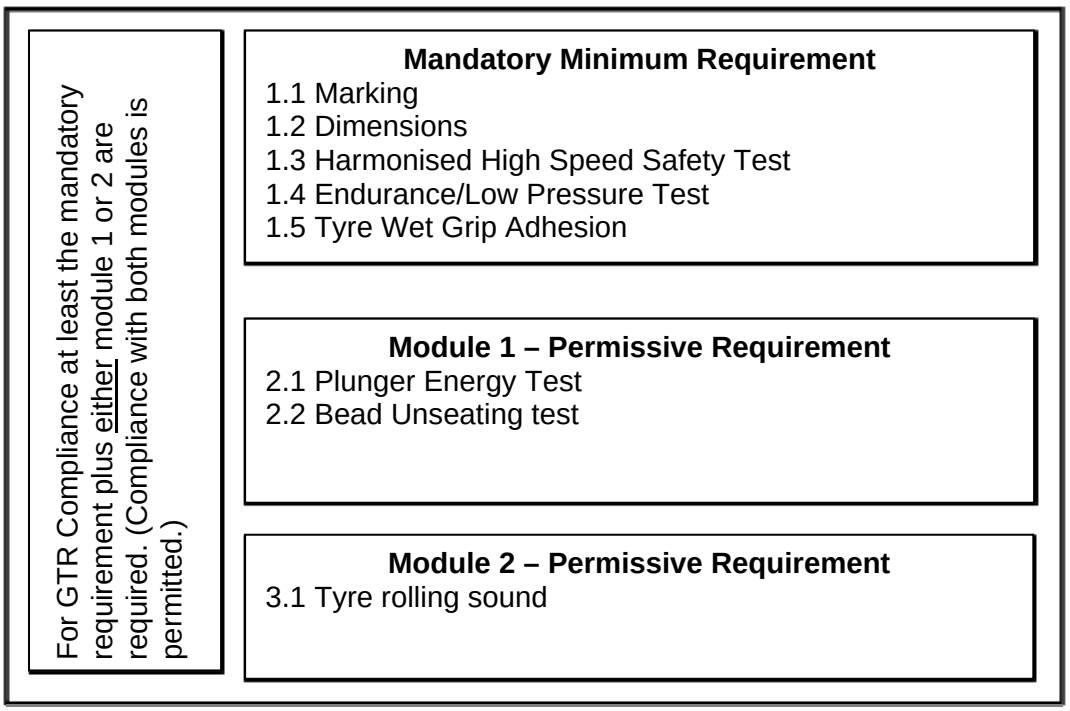
13. Harmonizing the high speed test posed a significant challenge in that the two existing tests were quite different from each other and based on different principles. One was designed to ensure that a tyre would perform adequately at speeds well above a national speed limit, but the test requirements were not related to any speed symbol indicated on the tyre itself. The other required that a tyre pass a test at its highest rated speed. Taking into account the long experience of the FMVSS standards in the USA and in countries applying UN Regulation 30, and the huge amount of tests results corresponding to these two testing procedures, it was decided to base harmonisation on a combination of the two existing test procedures rather than develop a wholly new harmonised test procedure. The harmonisation work was based on a determination of which test was more onerous for tyres of different speed symbols, and using the best test procedure.

14. At the meeting of the ad hoc working group in September 2006, 3 different scenarios for the high speed test harmonisation were discussed. One of the options considered was to use the FVMSS 139 high speed test for tyres with a speed rating equivalent to the symbol of "S" and below (less than or equal to 180 km/h), and the Regulation 30 test for speed symbols above "S" (greater than 180 km/h). At that meeting there was a general consensus

by the Contracting Parties that this proposal could be considered as a starting point, but it would require significant further work in order to demonstrate the validity of the proposal. The tyre industry presented a theoretical method to determine, for each speed symbol, the test which is the most severe and to validate that the equivalence point (the speed symbol for which both tests are equally severe) between the two tests is reached at a specific speed symbol. Over the following year the tyre industry gathered data to demonstrate this concept. Six tyre manufacturers supplied data, and in total, 704 tyres were tested using both tests. All the tyres were tested above and beyond the normal high speed test requirements, and the number of steps that each tyre was able to withstand above the regulatory limit were counted. The ratio of the number of steps above the limit (SAL) for the FMVSS 139 test, divided by the number of steps above the limit for the UN ECE R30 test was used to evaluate the data. Based on this extensive set of data it was determined that the FMVSS 139 high speed test was more severe for tyres with speed symbol of S and below (less than or equal to 180 km/h). The UN ECE R30 high speed test was more severe for tyres with speed symbols of T (190 km/h) and above.
To validate this concept further, work was undertaken on a smaller sample of tyres to determine the temperature increase during the different tests. In all cases, it was demonstrated that for T rated tyres and above, greater energy input was required (as determined by the increase in the contained air temperature) during the UN ECE Regulation 30 test than from the FMVSS 139 test. This data was also independently confirmed by one of the Contracting Parties. Since the increase in temperature of a tyre should be directly related to the amount of energy supplied during the test, a higher internal tyre temperature at the end of a test indicates a higher degree of severity. At the meeting in September 2008, it was agreed to use the UN ECE R30 test for tyres with speed symbols of T (190 km/h) and above, and to use the FMVSS 139 high speed test for all lower speed symbols (180 km/h and below).

15. The physical dimensions test was less difficult to harmonise from a technical point of view, because of the elementary simplicity of determining the outside diameter and width of a tyre in its inflated state to ensure interchangeability between tyres marked with the same size designation. A small but not insignificant gain has been achieved by harmonizing the measuring of the tyre's width at four points around the circumference.

16. After the inventory of different tests for passenger car tyres existing in the world had been made, it appeared that some of these tests might be harmonised on a worldwide level, while some of them appeared to have a more regional application. In order to take this situation into account, the technical sponsor of the tyre gtr proposed to organize the different tests into three modules:



This modular structure was described in the document ECE/TRANS/WP.29/2006/139 that was provided to AC.3 as the formal request of authorisation to develop the gtr, and accepted by the contracting parties.

17. The informal working group developing the GTR pursued the modular approach. As the group continued to develop the modular approach so a wider appreciation among contracting parties of the application of modules emerged. This prompted proposals for a less prescriptive approach to some of the individual elements included in the mandatory module. The informal group considered alternatives to deliver the requirements of contracting parties while retaining the original modular approach but could not find a sufficiently robust solution. As a result the group proposes a revised structure centred upon a "General Module" plus two options (Options 1 & 2). These are described in the table.

Passenger Car Tyres		
	Test Name	Paragraphs
Mandatory Module	Marking and treadwear indicators	3.2; 3.3 & 3.4.
	Physical dimensions	3.5.
	High speed test	3.11.
	Endurance test	3.9.
	Low pressure test	3.10.
	Wet grip test	3.12.
	Run Flat test	3.13.
Option 1	Strength test	3.6.
	Bead unseating test	3.7.
Option 2	Rolling sound emissions	3.8.

18. In this initial version of the gtr for tyres, the harmonised requirements apply only to tyres for passenger cars. The module concept does not apply to LT/C tyres and the following table describes the test applicable to these tyres.

LT/C Tyres	C type tyres	LT type tyres
Test Name	Paragraphs related to UN ECE Reg. 54	Paragraphs related to FMVSS 139
Marking and treadwear indicators	3.2. and 3.3. and 3.4.	3.2. and 3.3. and 3.4.
Physical dimensions	3.21.	3.20.
High speed test	3.16.	3.19.
Endurance test	3.16.	3.17.
Low pressure test	None	3.18.
Wet grip test	None	None
Run Flat test	None	None
Strength test	None	3.14.
Bead unseating test	None	3.15.
Rolling sound emissions	3.8.	None

19. In the case of required markings, it was possible to eliminate some that had become unnecessary over the years, such as the words Radial and Tubeless. Indeed over 90% of passenger car tyres and LT/C tyres sold worldwide are radial and tubeless construction and so continuing to mark tyres is unnecessary. In addition, a change was made in the way the Tyre Identification Number (TIN) will be used in combination with other markings.

20. The Tyre Identification Number (TIN) format is based on USA NHTSA's plan to change the currently assigned 2 digit plant codes to 3 digits. A symbol, the number "1" for example, will be reserved to precede all current 2-digit codes, and be used exclusively for existing plant codes. The "1" would only be used as the prefix for existing 2-digit codes, and not be used as the leading digit for any new 3-digit codes. USA NHTSA will continue to assign global plant codes and the necessary information to obtain such a code is contained with the gtr.

21. The aim of the tyre gtr is to introduce the universal worldwide harmonised requirements to tyres included into the scope of the gtr. In accordance with the provisions of the 1998 Agreement, once the GTR is adopted those contracting parties voting in favour of its adoption will start the process of transposing those requirements into their national legislation. In the interests of moving rapidly towards creating a "Global tyre" approach the informal group suggests that contracting parties transpose the GTR requirements in a flexible way to permit tyres complying with the full requirements access to as many markets as possible.

22. Consideration was given to harmonise the approval markings (both type approval and self-certification markings) and discussions on this issue was elevated to WP29 and AC3 meetings. It was concluded as not possible currently to adopt a harmonised approval marking since the compliance assessment procedures are not yet harmonised worldwide. So

this gtr contains no administrative provisions on approval markings. In the absence of a harmonised marking, the contracting parties retain the option to assign markings to tyres, especially markings for a “Global tyre”, and these can be introduced within their national / regional compliance assessment systems.

23. It is anticipated the contracting parties to the 1958 Agreement will incorporate the GTR provisions into regulations within that legal framework. This will include applying suitable tyre marking and so help provide for market recognition between the contracting parties. This development might encourage wider recognition of harmonised markings and thus further the move towards a single global marking where tyres meet the full requirements established by this gtr.

D. TECHNICAL AND ECONOMIC FEASIBILITY

24. The tyre gtr has been developed by drawing on the experience of many stakeholders, including regulatory authorities, type approval authorities, tyre and vehicle manufacturers and technical consultants. The gtr has been built upon the experience of many organizations and individuals with expertise in the area of tyres for passenger cars and light trucks or light commercial vehicles.

25. The tyre gtr has been designed to update and improve upon existing regulations, and the requirements are based on existing concepts in different Contracting Parties' present regulations.

26. Since this gtr is based on existing requirements and some harmonised tests, no economic or technical feasibility study was deemed necessary. When transposing this gtr into national legislation, contracting parties are invited to consider the economic feasibility of the gtr in the context of their country.

E. ANTICIPATED BENEFITS

27. The principal economic benefit of this regulation will be a reduction in the variety of tests for the same or substantially similar requirements.

28. Depending on how different Contracting Parties implement this gtr, there may be benefits due to the way the approval markings are treated. Tyre mould design and fabrication might be rationalized, with associated reductions in production costs.

29. Safety benefits resulting from the transposition of the gtr in the national legislations depend on the previous level of the national regulations.

F. POTENTIAL COST EFFECTIVENESS

30. It is not possible to assess, at this moment, the total costs linked to the gtr. On one hand, there are more tests in the gtr than in the existing national or international regulations; on the other hand the harmonisation of the regulation will reduce the global cost of type approval in the variety of countries which will apply the gtr through that administration procedure.

31. Safety benefits are anticipated, but it is not yet possible to assess them in terms of reduction of number of accidents and victims. So the potential cost effectiveness cannot be evaluated.

II. TEXT OF THE REGULATION

1. SCOPE

This global technical regulation covers new radial pneumatic tyres designed primarily for vehicles in category 1 and 2, all with a mass limit of 4,536 kg, as defined in the Special Resolution Number 1. 1/

It does not apply to:
- T-Type temporary use spare tyres;
- Tyres having a nominal rim diameter code ≤ 8 (or ≤ 203 mm);
- Special tyres (ST) for trailers in highway service.
- LT or C Tyres with tread-depth of greater than or equal to 14.3 mm (18/32 in). (Data to be provided by RMA to justify)

2. DEFINITIONS

For the purpose of this regulation the following definitions apply:

2.1 “Adhesion on wet surfaces” means the relative braking performance, on a wet surface, of a test vehicle equipped with the candidate tyre in comparison to that of the same test vehicle with a reference tyre (SRTT)

2.2 "Basic tyre functions" means the nominal capability of an inflated tyre in supporting a given load up to a given speed and transmitting the driving, the steering and the braking forces to the ground on which it runs;

2.3 "Bead" means the part of the tyre which is of such shape and structure as to fit the wheel rim and hold the tyre on it;

2.4 "Bead separation" means a breakdown of the bond between components in the tyre bead area;

2.5 "Brand name, Trade name or Trade mark" means an identification applied to the tyre which may be the name or mark of the manufacturer or of a customer for whom the manufacturer is producing tyres for subsequent re-sale (that is, "Own Branding");

2.6 "Carcass" means that part of the pneumatic tyre structure other than the tread and sidewall rubber, which, when inflated, bears the load;

2.7 "Chunking" means the breaking away of pieces of the tread or sidewall;

2.8 "Class C1 tyres" means tyres designed primarily for vehicles of Category 1-1 of Special Resolution N° 1 ;

2.9 "Class C2 tyres" means tyres designed primarily for vehicles of Categories 1-2 and 2 of Special Resolution N° 1 with a load index in single formation ≤ 121 and the speed symbol ≥ "N";

1/ Document TRANS/WP29/1045.

2.10 "Class C3 tyres" means tyres designed primarily for vehicles of Category 2 of Special Resolution N° 1 with a load index in single formation ≤ 121 and the speed symbol ≤ "M", or with a load index in single formation ≥ 122;

2.11 "Cord" means the strands or filaments of material forming the plies of the tyre structure;

2.12 "Cord separation" means the parting of cords from adjacent rubber compounds;

2.13 "CP tyre" means a commercial vehicle tyre for service on motor caravans.

2.14 "Cracking" means any parting within the tread, sidewall or inner liner of the tyre which may or may not extend to cord material;

2.15 "Deflected section height" is the difference between the deflected radius, measured from the centre of the rim to the surface of the drum, and one half the nominal rim diameter as defined in ISO 4000-1:2010;

2.16 "Flat tyre running mode" describes the state of the tyre, essentially maintaining its structural integrity, while operating at an inflation pressure between 0 and 70 kPa, for runflat tyres or systems;

2.17 "Inner liner" means the layer of rubber forming the inside surface of a tubeless tyre that contains the inflating medium within the tyre;

2.18 "Intended outboard sidewall" means the sidewall that contains a whitewall, bears white lettering, or bears manufacturer or model name moulding that is higher or deeper than that on the other sidewall of the tyre;

2.19 "Light Load tyre (LL)" means a tyre designed for loads lower than the standard load (SL) version;

2.20 "Light Truck (Commercial) tyre" means a tyre of a group prescribed in the Light Truck or "C" Commercial tyre section of the standards manuals of the organisations shown in Appendix 10.

2.21 "Load index" means one or two numbers which indicate the load the tyre can carry in single or in single and dual operation at the speed corresponding to the associated speed category. A type of pneumatic tyre can have either one or two sets of load indices. The list of these indices and their corresponding loads is given in Appendix 2;

2.22 "Load capacity variation with speed" means an authorized variation of the reference mass, as indicated by the load index, based on the actual in-use speed in comparison with the capabilities indicated by the service description (see Appendix 5);

2.23 "Load range" means a letter (B, C, D, or E) used to identify a given LT size tyre with its load classification and inflation limits;

2.24 "Maximum application load capacity" means the maximum mass a tyre can support in a specific application, and is dependent on the speed symbol of the tyre, the maximum design speed of the vehicle on which the tyre is fitted, the inflation pressure and the camber

angle of the wheels of the vehicle;

2.25 "Maximum load rating" means the Load index;

2.26 "Maximum permissible inflation pressure" means the maximum cold inflation pressure to which the tyre may be inflated.

2.27 "Measuring rim" means an actual rim of specified width as defined by one of the standards organizations as specified in Appendix 10, on which the tyre is fitted for measuring the physical dimensions;

2.28 "Nominal aspect ratio (profile)" means the ratio of the nominal section height to the nominal section width expressed as a percentage in a multiple of 5 (ending in 0 or 5);

2.29 "Nominal section width" shall be indicated in millimetres, and this part of the designation shall end in either the number zero or five, so that in any single series of tyres with the same nominal aspect ratio, the values shall all end in "0" or they shall all end in "5";

2.30 "Open splice" means any parting at any junction of tread, sidewall, or inner liner that extends to cord material;

2.31 "Outer diameter" means the overall diameter of an inflated new tyre;

2.32 "Overall width" means the linear distance between the outsides of the sidewalls of an inflated pneumatic tyre, including elevations due to labelling (marking), decorations, and/or protective bands or ribs;

2.33 "Passenger tyre" means a tyre of a group prescribed in the passenger tyre section of the standards manuals from one of the organisations shown in Appendix 10.;

2.34 "Ply" means a layer of rubber-coated parallel cords;

2.35 "Ply separation" means a parting of adjacent plies;

2.36 "Pneumatic tyre" means a form of tyre comprising a reinforced flexible envelope which is either provided with, or forms in conjunction with the wheel upon which it is mounted, a continuous, closed, essentially toroidal chamber containing a gas, (usually air), or gas and a liquid, which is intended to be used at a pressure greater than atmospheric pressure. A pneumatic tyre may be classified as a passenger tyre (see "passenger tyre" above), or a light truck (commercial) tyre, (see "light truck (commercial) tyre" above), depending on the service duty conditions required for any specific application;

2.37 "Principal grooves" means the wide 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;

2.38 "PSI index" is a code identifying the inflation pressure which may be used during testing of tyres as shown in Appendix 4;

2.39 "Radial ply tyre" means a pneumatic tyre structure in which the ply cords that extend to the beads are laid at substantially 90° to the centreline of the tread, the carcass being restrained

by circumferential belts of 2 or more layers of substantially inextensible cord material;

2.40 "Extra Load tyre" means a passenger car tyre designed to operate at higher loads and at higher inflation pressures than the corresponding standard load tyre;

2.41 "Rim" means that part of the wheel forming the support for the tyre and on which the tyre beads are seated;

2.42 "Rim protector" means a feature (for example: a protruding circumferential rubber rib) incorporated into the lower sidewall area of the tyre which is intended to protect the rim flange from damage";

2.43 "Run flat tyre" or "Self-supporting tyre" describes a pneumatic tyre structure provided with any technical solutions (for example, reinforced sidewalls, etc.) allowing the pneumatic tyre, mounted on the appropriate wheel and in the absence of any supplementary component, to supply the vehicle with the basic tyre functions, at least, at a speed of 80km/h (50mph) and a distance of 80km when operating in flat tyre running mode.

2.44 "Run flat system" or "Extended mobility system" describes an assembly or specified functionally dependant components, including a tyre, which together provide the specified performance granting conditions for the vehicle with at least basic tyre functions, at a speed of 80 km/h (50 mph) and a distance of 80 km (50 miles) when operating in flat tyre running mode.

2.45 "Secondary grooves" means the supplementary grooves of the tread pattern which may disappear in the course of the tyre's life;

2.46 "Section height" means a distance equal to half the difference between the outer diameter of the tyre and the nominal rim diameter;

2.47 "Section width" means the linear distance between the outside of the sidewalls of an inflated pneumatic tyre, excluding elevations due to labelling (marking), decoration or protective band or ribs;

2.48 "Service description" means the association of the load index or indices with a speed symbol (for example, 91H or 121/119S);

2.49 "Sidewall" means that portion of a tyre between the tread and the bead;

2.50 "Sidewall separation" means the parting of the rubber compound from the cord material in the sidewall;

2.51 "Snow tyre" means a tyre whose tread pattern and whose structure are designed to enhance traction in mud and fresh or melting snow and performance better than that of an ordinary (road-type) tyre. The tread pattern of a snow tyre generally consists of groove (rib) and/or solid-block elements more widely spaced than on an ordinary (road-type) tyre. These tyres are labelled on at least one sidewall with the letters "M" and "S" (e.g., MS, M/S, M&S, M+S, etc.); Note: The definitions of "Snow tyre" and "Snow tyre for use in severe snow conditions" will be reviewed after GRRF decides which definitions to use in R117.

2.52 "Snow tyre for use in severe snow conditions" distinguished by a three-peaked mountain

snowflake (alpine) symbol on the sidewall next to the M+S mark. Together, these marks indicate snow traction performance relative to ASTM E1136-10 standard reference test tyre (SRTT). An example of the symbol is shown below;

2.53 "Special use tyre" means a tyre intended for mixed use, both on and/or off road or for other special service duty;

2.54 "Speed symbol" means the letter code which defines the maximum speed which the tyre can sustain, (see appendix 1 to this regulation);

2.55 “Standard reference test tyre (SRTT)” means a tyre that is produced, controlled and stored in accordance with the American Society for Testing and Materials (ASTM) Standard E 1136-93 (re-approved 1998).

2.56 "Structure" means the technical characteristics of the tyre’s carcass (for example: radial, bias-belted, bias ply, etc.);

2.57 "Temporary use spare tyre" means a tyre different from a tyre fitted to a vehicle for normal driving conditions, and intended only for temporary use under restricted driving conditions.

2.58 "Test rim" means the rim on which a tyre is fitted for testing and which may be any rim listed in industry standards as appropriate for use with that tyre;

2.59 "Theoretical rim" means a rim width calculated by multiplying the nominal section width by a specific, industry standardized, coefficient depending upon the aspect ratio of the tyre;

2.60 "Tread" means that part of a tyre that comes into contact with the road;

2.61 "Tread groove" means the space between two adjacent ribs or blocks in the tread pattern;

2.62 "Tread pattern" means the geometric arrangement of blocks, ribs and grooves of the tread;

2.63 "Tread separation" means the pulling away of the tread from the tyre carcass;

2.64 "Tread wear indicators (TWI)" means the projections within the principal grooves designed to give a visual indication of the wear of the tread;

2.65 "Tubeless tyre" means a tyre specifically designed for fitting to appropriate wheel rims without an inner tube;

2.66 "T-type temporary use spare tyre" means a type of temporary use spare tyre designed for use at inflation pressures higher than those established for standard and reinforced tyres;

2.67 "Tyre size designation" means a combination of letters, numbers and symbols which uniquely identify the size and structure of the tyre as set out in one of the standards of the organisations listed in Appendix 10 or in the tables in Appendix 7 to this gtr.

3. REQUIREMENTS

3.1 Plant Code Registration

3.1.1. Each tyre manufacturer of new pneumatic tyres shall apply in writing to the following address for registration and allocation of a manufacturer plant code identification symbol:

Office of Vehicle Safety Compliance,
National Highway Traffic Safety Administration,
1200 New Jersey Avenue, SE,
Washington, DC 20590
USA

3.1.2. The tyre manufacturer requesting a plant code assignment shall identify itself as the tyre manufacturer and declare the following information in the application and shall inform the NHTSA of any changes to the information:

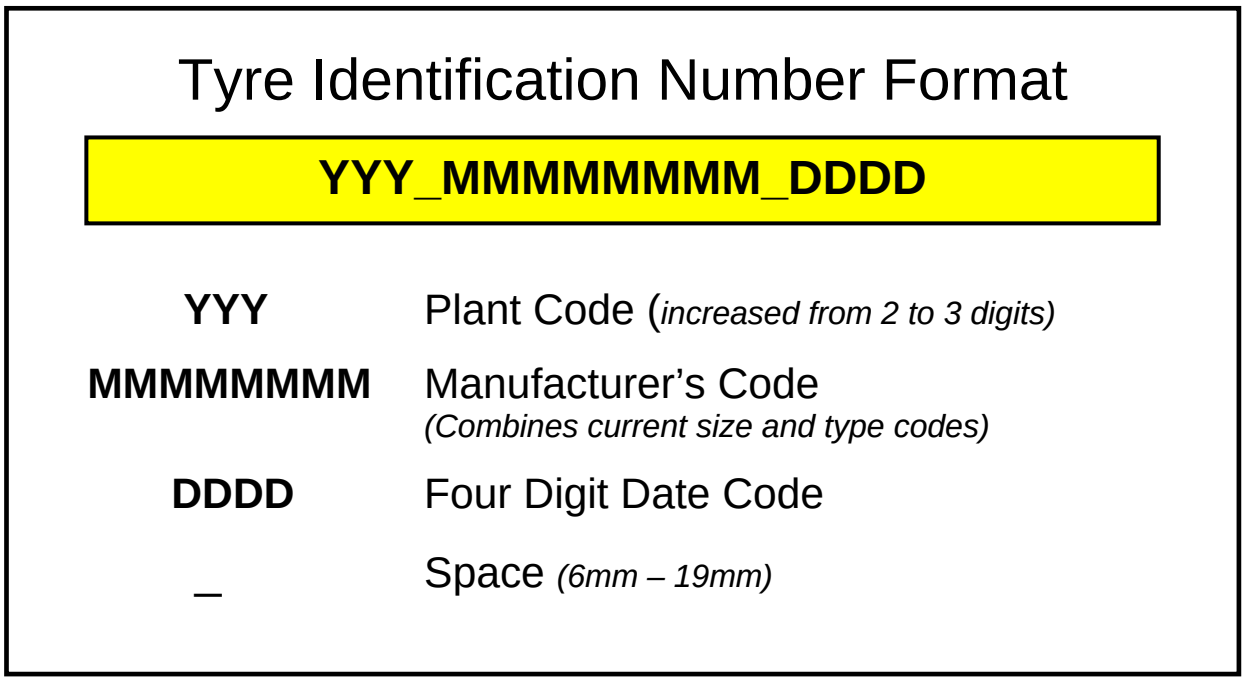
3.1.2.1. The name or other designation identifying the applicant, and its main office address;
Question for NHTSA: Is a formal representative in the US required or not?

3.1.2.2. The name, or other identifying designation, of each individual plant operated by the manufacturer and the address of each plant, if applicable;

3.1.2.3. The type of tyres manufactured at each plant, e.g., pneumatic tyres for passenger cars, buses, trucks or motorcycles; pneumatic retreaded tyres; or non-pneumatic retreaded tyres; or non-pneumatic tyre assemblies.

3.2 Marking

3.2.1. Tyre Identification Number Format



3.2.1.1. The **"YYY"** is the universal plant code for place of manufacture of the tyre.

3.2.1.2. The **"MMMMMMMM"** is an 8 digit manufacturer's code. Within the tyre identification number format, this will be an 8 digit required field, but the content is up to the tyre manufacturer.

3.2.1.3. The **"DDDD"** represents the week and year of manufacture, also known as the date code. The first two symbols must identify the week of the year by using "01" for the first full calendar week in each year, "02" for the second full calendar week, and so on. The calendar week runs from Sunday through the following Saturday. The final week of each year shall include not more than 6 days of the following year. The third and fourth symbols must identify the year. Example: 0110 means the first week of 2010.

3.2.1.4. The "_" is a space of not less than 6 mm or greater than 19 mm.

3.2.1.5. The Tyre Identification Number shall be located on the intended outboard sidewall of the tyre, and positioned between the bead and 50% of the distance from the bead to the tread. On the other sidewall of the tyre either a tyre identification number or a partial tyre identification number is required. The partial tyre identification number is comprised of all characters except the date code. If the tyre has no intended outboard sidewall, the complete tyre identification number shall be placed on one sidewall, and a partial or complete tyre identification number shall be placed on the other sidewall.

3.2.1.6. The content of the manufacturer's code is optional, but the data field is not.

3.2.1.7. The symbols to be used in the tyre identification number format are A, B, C, D, E, F, H, J, K, L, M, N, P, R, T, U, V, W, X, Y, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

3.2.1.8. The symbols that shall not be used are G, I, O, Q, S, and Z.

3.3 Other Sidewall Markings

3.3.1. Unless otherwise stated, the following information, together with any other markings required by provisions in annexes to this regulation, shall be legibly and permanently moulded into or onto the sidewall(s):

3.3.1.1. in the case of asymmetric tyres on the intended outboard sidewall as viewed when the tyre is fitted to the vehicle;

3.3.1.2. in either case, on at least one sidewall, the required markings shall be in a position on the sidewall where they are least susceptible to being "scrubbed" away during use;

3.3.1.2.1. The brand name or the trade name or trade mark, in characters not less than 4 mm high;

3.3.1.2.2. The country of manufacture in characters not less than 2 mm high;

3.3.1.2.3. The tyre size designation in characters not less than 6 mm high comprising:

3.3.1.2.3.1. an indication of the tyre structure;

3.3.1.2.3.1.1. R for radial construction;

3.3.1.2.3.1.2. RF for radial run flat tyre;

3.3.1.2.3.2. The service description (load index and speed symbol);

3.3.1.2.3.3. An identification of the tyre to rim fitment configuration when it differs from the standard configuration.

3.3.1.2.3.4. In the case of LT and C type tyres, the words "Load Range" or "LR" followed by the letter designating the tyre load range "B, C, D, or E".

3.3.2. Each tyre must be labelled on the other side (from that directed in 3.2.1.5. above) with the same tyre identification number except for the date code and, at the discretion of the manufacturer, any optional code on the other sidewall.

3.3.3. For tyres suitable for speed in excess of 300 km/h, the letter "R" placed in front of the rim diameter code symbol marking shall be replaced by "ZR" and the tyre shall be marked, in parentheses, with a service description consisting of the speed symbol "Y" and a corresponding load index, for example, 245/45ZR17 (95 Y). Note: the actual maximum tyre load capacity and speed capability shall be stated in the tyre manufacturer's technical literature and made available to the public.

3.3.4. For passenger car tyres, each tyre must be labelled with its maximum permissible inflation pressure in kPa (psi) and must be labelled with its maximum load rating in kilograms (lbs).

3.3.5. In the case of LT or C type tyres, the maximum load rating and corresponding inflation pressure of the tyre, shown as follows:

"Max load single ___kg (___lb) at ___kPa (___psi) cold"

"Max load dual ___kg (___lb) at ___kPa (___psi) cold"

For LT and C type tyres rated for single fitment only, mark as follows:

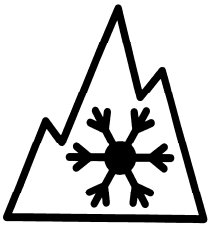
"Max load ___kg (___lb) at ___kPa (___psi) cold"

3.3.6. The inscription “EXTRA LOAD” or “XL” for extra load tyres, or the inscription “LL” or “LIGHT LOAD” for light load tyres, if applicable, in characters not less than 4 mm high;

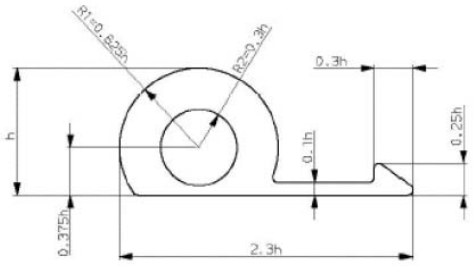
3.3.7. The word “TUBETYPE”, if applicable, in characters not less than 4 mm high;

3.3.8. The inscription "M+S", "M.S.", "M&S", "M-S", or "M/S", in characters not less than 4 mm high, if the tyre is a snow tyre.

3.3.9. The three-peaked mountain snowflake symbol which identifies a tyre that is an M+S marked snow tyre, and is also intended for use in severe snow conditions, and meets snow performance requirements. The symbol must have a minimum base of 15 mm and a minimum height of 15 mm and must contain three peaks with the middle peak being the tallest. Inside the mountain, there must be a six-sided snowflake having a minimum height of one-half the tallest peak. An example is shown below, and is to be placed adjacent to the M+S type designation.



3.3.10. The symbol below if the tyre is a "run flat" or "self-supporting" tyre, and run flat performance requirements are met as per paragraph 3.13., where "h" is at least 12 mm.



3.3.11. In the case of LT or C type tyres, an indication, by the "PSI" index, of the inflation pressure to be adopted for the load/speed endurance tests. A table showing the relationship among “PSI” and “kPa” units can be found in Appendix 4.

3.3.12. In the case of LT or C type tyres, the inscription "ET" or "ML" or "MPT" for "Special use tyres"

3.3.12.1. ET = Extra Tread

3.3.12.2. ML = Mining and Logging tyre used in intermittent highway service.

3.3.12.3. MPT = Multi Purpose Truck tyres

3.3.13. In the case of LT or C type tyres, the prefix “LT” before the tyre size designation, or the suffix "C" or "LT" after the rim diameter marking referred to in Appendix 3, and, if applicable, after the tyre to rim fitment configuration referred to in paragraph 3.3.1.2.3.3.

3.3.14. In the case of LT or C type tyres, the suffix "CP" after the rim diameter marking referred to in paragraph Appendix 3 and, if applicable, after the tyre to rim fitment configuration referred to in paragraph 3.3.1.2.3.3. This marking is mandatory in the case of tyres fitted on 5° drop centre rims, having a load index in single lower or equal to 121 and specifically designed for the equipment of motor caravans.

3.4 Treadwear Indicators

3.4.1. Except as noted below, each passenger tyre and each LT/C tyre shall have at least six transverse rows of treadwear indicators, approximately equally spaced around the circumference of the tyre and situated in the principal grooves of the tread.

3.4.2. For passenger car tyres designed for mounting on rims of nominal rim diameter code 12 or less, not less than three transverse rows of treadwear indicators is acceptable.

3.4.3. The height of each treadwear indicator shall be 1.6 mm, + 0.6, - 0.0 mm.

3.5 Physical Dimensions of Passenger Car Tyres

3.5.1. The following paragraphs describe in detail the requirements for determining the physical dimensions of pneumatic tyres for approval according to this regulation. The characteristics to be determined are the overall width, and the outside diameter. If these characteristics are within the specified tolerances, the physical dimensions of the tyre are acceptable.

3.5.2. Definitions (see paragraph 2 of this gtr for detailed definitions of various terms)

3.5.2.1. The overall width of the tyre is defined as the average of four measurements of its width at the widest point, including any markings or protective ribs.

3.5.2.2. There is no defined theoretical overall width of standard tyres. It is a measured characteristic, not a calculated one.

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

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

where:

S is the theoretical section width expressed in mm;

S_1 is the nominal section width (in mm) as shown on the side wall of the tyre in the designation of the tyre as prescribed;

A is the width (expressed in mm) of the measuring rim, as shown by the manufacturer in the descriptive note; 1/

A_1 is the width (expressed in mm) of the theoretical rim.

A_1 shall be taken to equal S_1 multiplied by the factor x, as specified in the international standard ISO 4209-1, and K shall be taken to equal 0.4.

3.5.4. Outer diameter of tyre

The outer diameter of the tyre shall be calculated by the following formula:

D = d + 2H, where:

D is the outer diameter in millimetres,

1/ When the conventional number is given by codes, the value in millimetres is obtained by multiplying the code number by 25.4.

d is the rim diameter in millimetres; 2/

H is the nominal section height in millimetres, equal to:

$H = 0.01\ S_1 * Ra$

S_1 is the nominal section width in millimetres, and Ra is the nominal aspect ratio,

all as shown on the sidewall of the tyre in the tyre size designation.

3.5.5. Physical Dimensions Measurement Method

3.5.5.1. Mount the tyre on one of the approved rims mentioned in the appropriate Standards Manual.

3.5.5.2. Adjust the pressure to that specified in the table below:

Physical Dimensions Test Tyre Inflation Pressures	Tyre Application	Test Pressure (kPa)
	Standard Load, Light Load	180
	Extra Load	220

3.5.5.3. Condition the tyre, mounted on its rim, at the ambient room temperature between 18°C and 38°C for not less than 24 hours.

3.5.5.4. Re-adjust the pressure to that specified in the table above.

3.5.5.5. Measure the overall width at four equally spaced points around the tyre, taking the thickness of protective ribs or bands into account. The reported value will be the average of the four measurements rounded to the nearest millimetre.

3.5.5.6. Determine the outer diameter by measuring the maximum circumference, dividing the result by 3.1416 and rounding to the nearest millimetre.

3.5.5.7. Determine the height of the treadwear indicators by measuring the difference between the total depth of the tread groove in the vicinity of the treadwear indicator and the depth to the top of the treadwear indicator. Repeat this measurement for at least one treadwear indicator in each row (minimum of 6 or 3, depending on the rim diameter; a row is the linear sequence of treadwear indicators positioned radially across the tread from one side to the other). At least one treadwear indicator in each principal groove shall be measured (the principal grooves are the wide grooves positioned circumferentially around the tread). Record all of the individual values rounded to the nearest tenth of a millimetre.

3.5.6. Physical Dimension Requirements

2/ When the conventional number is given by codes, the value in millimetres is obtained by multiplying the code number by 25.4.

3.5.6.1. Overall width

3.5.6.1.1. The tyre overall width may exceed the theoretical section width defined in paragraph 3.5.3. above by 4%.

3.5.6.1.2. In addition, if the tyre has rim protectors (see definition in paragraph 2), the figure as increased by the above tolerance may be exceeded by 8 mm.

3.5.6.2. Outer diameter

3.5.6.2.1. The outer diameter of a tyre must not be outside the values Dmin and Dmax obtained from the following formulae:

Dmin = d + (2H x a)
Dmax = d + (2H x b)

Where the coefficients "a" and "b" are:
coefficient "a" = 0.97
coefficient "b" = 1.04 for normal (road type) and 1.06 for Special use tyres

For snow tyres the maximum overall diameter (Dmax) may be exceeded by 1%.

3.5.7. Figure 1: Drawing of normal tyre showing rim diameter (d), outside diameter (D), section height (H) and section width (S) and the rim width (A).

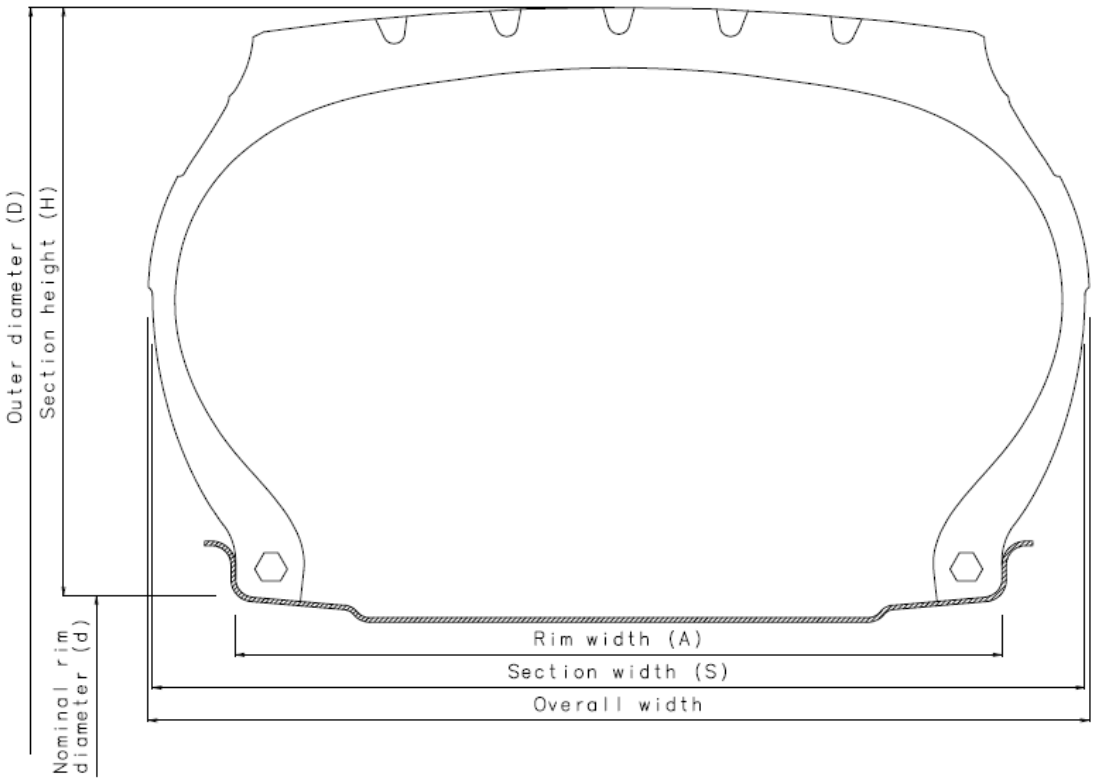


Figure 1: Drawing of a normal tyre showing various dimensions

3.5.8. For other tyre sizes for which dimensions cannot be calculated, the dimensions including allowance for growth in service, shall comply with those given in standards publications of the organizations listed in Appendix 10 and which were current either at the date of manufacture of the tyre or at any later date.

3.6 Strength Test for Passenger Car Tyres

3.6.1. Each tyre shall meet the requirements for minimum breaking energy specified in the table below.

Nominal Section Width	Units	Standard Load or Light Load tyres	Extra Load tyres
Below 160 mm	Joules	220	441
	inch-pounds	1,950	3,900
160 mm or above	Joules	294	588
	in-pounds	2,600	5,200

3.6.2. Strength Test Procedure

3.6.2.1. Mount the tyre on a test rim and inflate it to the test inflation pressure specified in the table below:

Strength Test Tyre Inflation Pressures	Tyre Application	Test Pressure (kPa)
	Standard Load, Light Load	180
	Extra Load	220

3.6.2.2. Condition the wheel and tyre assembly for at least three hours at the temperature of the test room;

3.6.2.3. Re-adjust the tyre pressure to that specified in the previous table above (3.6.2.1.);

3.6.2.4. Force a 19 mm (3/4 inch) diameter cylindrical steel plunger with a hemispherical end perpendicularly into the tread rib as near to the centerline as possible, avoiding penetration into the tread groove, at the rate of 50 mm (2 inches) per minute;

3.6.2.5. Record the force and penetration at five test points equally spaced around the circumference of the tyre. If the tyre fails to break before plunger is stopped on reaching the rim, then the required minimum breaking energy is deemed to have been achieved at that point. Need NHTSA agreement.

3.6.2.6. The breaking energy, W, in Joules, shall be calculated from:

$$W = ((F \times P)/2) \times 10^{-3} \text{ (joules)}$$

Where:

W = Energy in Joules

F = Force in Newtons applied to the plunger
P = Penetration of the plunger in mm

or

W = (FxP)/2

Where:

W = Energy in inch-pounds;
F = Force in pounds; and
P = Penetration in inches.

3.6.2.7. Determine the breaking energy value for the tyre by computing the average of the five values obtained.

3.6.2.8. In the case of tubeless tyres, an inner tube may be provided to ensure the retention of the inflation pressure throughout the test provided that such inner tube does not adversely affect the test.

3.7 Tubeless Tyre Bead Unseating Resistance Test for Passenger Car Tyres

3.7.1. Requirements

The following requirements apply to all radial ply tyres with rim diameter code greater than or equal to 10 using the blocks referred to in the test procedure described in this section. Confirm with NHTSA.

3.7.1.1. Each tubeless tyre shall meet the requirements for minimum force, in Newtons, for bead unseating resistance, specified in one of the tables below.

3.7.1.2. For tubeless radial ply tyres the applied force required to unseat the tyre bead at the point of contact, in relation to the nominal section width of the tyre, shall not be less than:

Nominal Section Width S (mm)	Minimum Force (N)
S < 160	6 670
160 ≤ S < 205	8 890
S ≥ 205	11 120

Nominal Section Width S (code)	Minimum Force (N)
S < 6.00	6 670
6.00 ≤ S < 8.00	8 890
S ≥ 8.00	11 120

3.7.2. Preparation of tyre

3.7.2.1. Wash the tyre and dry it at the beads. Mount it without lubricant or adhesive on a clean, painted test rim. The rim contour shall be one of those specified for the fitment of the test

tyre.

3.7.2.2. Inflate the tyre to the pressure specified in the table shown below:

Bead Unseating Resistance Test Pressures	Tyre Application	Test Pressure kPa
	Standard Load, Light Load	180
	Extra Load	220

3.7.3. Test Procedure

3.7.3.1. Mount the assembly on a fixture as shown in Figure 2, below, and force the bead unseating block shown in Figure 3 or Figure 4 against the tyre sidewall as required by the geometry of the fixture.

3.7.3.2. Position the bead unseating block against the tyre sidewall at a horizontal distance "A" as shown in Figure 2 and Table 1, below.

3.7.3.3. Apply a force through the block to the tyre outer sidewall at a rate of 50 mm/min $\pm$ 2.5 mm/min.

3.7.3.4. Increase the force until the bead unseats or until the prescribed value shown in paragraph 3.7.1.2. is reached.

3.7.3.5. Repeat the test at least four times at places approximately equally spaced around the tyre circumference.

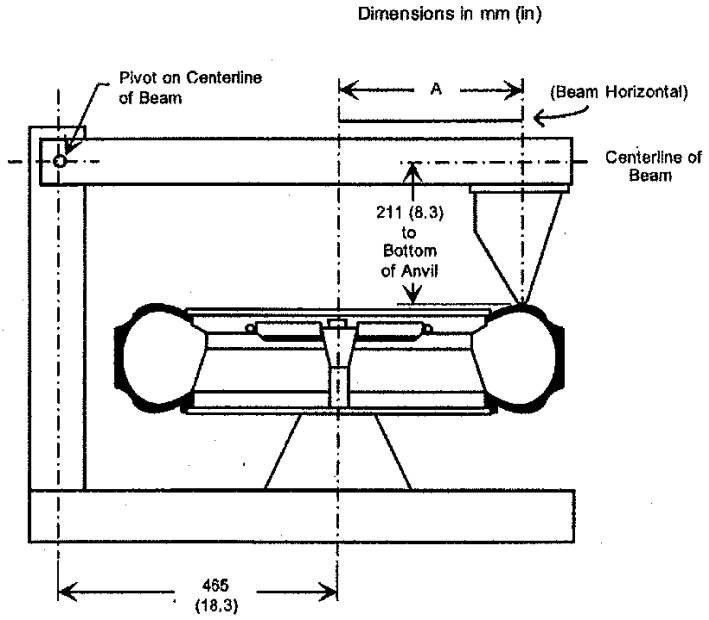


Figure 2 :
Bead unseating fixture

Table of A dimension for different rim codes		
Rim code	**mm**	**Inches**
20	345	13.50
19	330	13.00
18	318	12.50
17	305	12.00
16	292	11.50
15	279	11.00
14	267	10.50
13	254	10.00
12	241	9.50
11	229	9.00
10	216	8.50
320	216	8.50
340	229	9.00
345	235	9.25
365	248	9.75
370	254	10.00
390	279	11.00
415	292	11.50

Table 1: List of "A" Dimensions

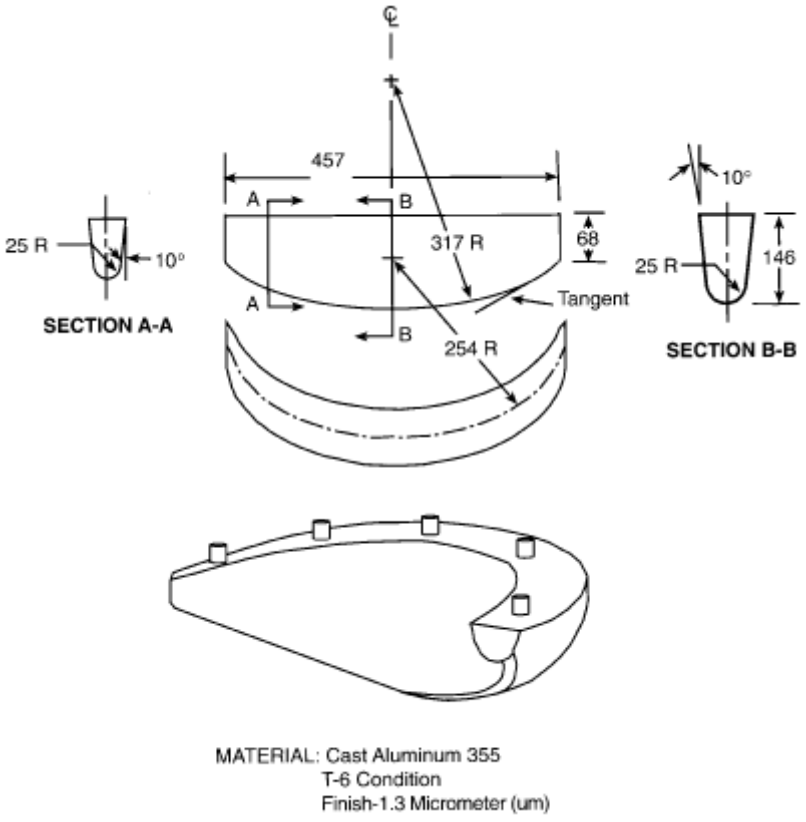


Figure 3: Bead Unseating Block

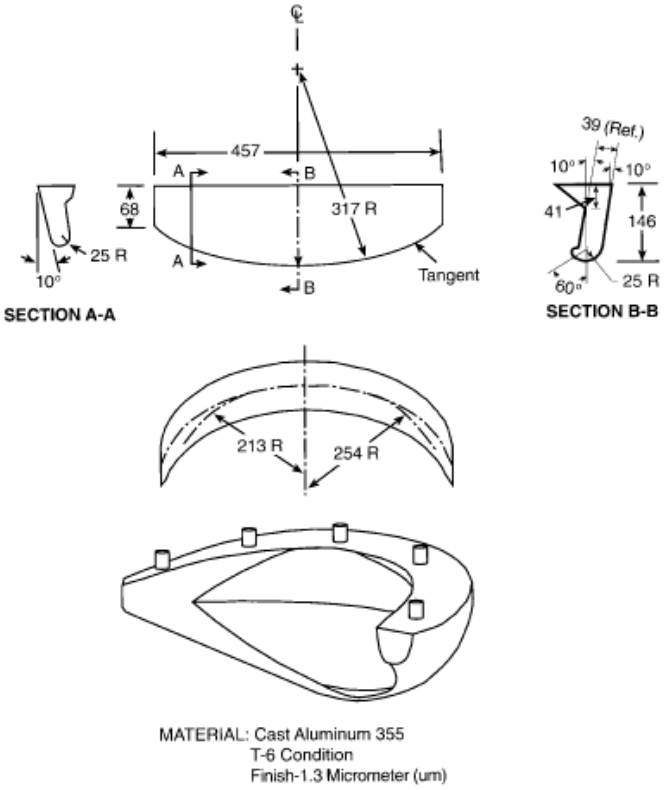


Figure 4: Bead Unseating Block

3.8 Tyre Rolling Sound Emission Test

3.8.1. Requirements

For tyres which are included within the scope of this gtr, except those with rim diameter code greater than or equal to 25 (635mm), the rolling sound emission value shall not exceed the values given below for tyres of classes C1, C2 and C3, with reference to the categories of use and, where relevant, the nominal section widths, given in the definitions section in paragraph 2 of this gtr.

Class C1 tyres

Nominal Section Width	Limit dB(A)
185 and lower	70
Over 185 up to 245	71
Over 245 up to 275	72
Over 275	74
The above limits shall be increased by 1dB(A) for snow tyres for use in severe snow conditions[1], extra load tyres or any combination of these classifications.	

Class C2 tyres

Category of use	Limit dB(A)
Normal	72
Snow*	73
Special	74
* Snow tyres for use in severe snow conditions	

Class C3 tyres

Category of use	Limit dB(A)
Normal	73
Snow*	74
Special	75
*Snow tyres for use in severe snow conditions	

3.8.2. Coast-by Test Method for Measuring Tyre Rolling Sound Emission

The presented method contains specifications on measuring instruments, measurement conditions and the measurement method, in order to obtain the sound level of a set of

1 (editorial note) 'Snow tyre for use in severe snow conditions' is currently defined in the gtr text. However, this definition could be further refined, if desired, by adopting the new snow tyre definition in UNECE Regulation 117, including the test procedure contained in Annex 7 to that Regulation.

tyres mounted on a test vehicle rolling on a specified road surface. The maximum sound pressure level is to be recorded, when the test vehicle is coasting, by remote-field microphones; the final result for a reference speed is obtained from a linear regression analysis. Such test results cannot be related to tyre rolling sound measured during acceleration under power or deceleration under braking.

3.8.2.1. Measuring instruments

3.8.2.2. Acoustic measurements

The sound level meter or the equivalent measuring system, including the windscreen recommended by the manufacturer shall meet or exceed the requirements of Type 1 instruments in accordance with IEC 60651:1979/A1:1993, second edition.

The measurements shall be made using the frequency weighting A, and the time weighting F.

When using a system that includes a periodic monitoring of the A-weighted sound level, a reading should be made at a time interval not greater than 30 ms.

3.8.2.3. Calibration

At the beginning and at the end of every measurement session, the entire measurement system shall be checked by means of a sound calibrator that fulfils the requirements for sound calibrators of at least precision Class 1 according to IEC 60942:1988. Without any further adjustment the difference between the readings of two consecutive checks shall be less than or equal to 0.5 dB. If this value is exceeded, the results of the measurements obtained after the previous satisfactory check shall be discarded.

3.8.2.4. Compliance with requirements

The compliance of the sound calibration device with the requirements of IEC 60942:1988 shall be verified once a year and the compliance of the instrumentation system with the requirements of IEC 60651:1979/A1:1993, second edition shall be verified at least every two years, by a laboratory which is authorized to perform calibrations traceable to the appropriate standards.

3.8.2.5. Positioning of the microphone

The microphone (or microphones) must be located at a distance of 7.5 ± 0.05 m from track reference line CC' (Figure 7) and 1.2 ± 0.02 m above the ground. Its axis of maximum sensitivity must be horizontal and perpendicular to the path of the vehicle (line CC').

3.8.3. Speed measurements

The vehicle speed shall be measured with instruments with accuracy of ± 1 km/h or better when the front end of the vehicle has reached line PP' (Figure 7).

3.8.4. Temperature measurements

Measurements of air as well as test surface temperature are mandatory.

The temperature measuring devices shall be accurate within ± 1 °C.

3.8.4.1. Air temperature

The temperature sensor is to be positioned in an unobstructed location close to the microphone in such a way that it is exposed to the airflow and protected from direct solar radiation. The latter may be achieved by any shading screen or similar device. The sensor should be positioned at a height of 1.2 ± 0.1 m above the test surface level, to minimize the influence of the test surface thermal radiation at low airflows.

3.8.4.2. Test surface temperature

The temperature sensor is to be positioned in a location where the temperature measured is representative of the temperature in the wheel tracks, without interfering with the sound measurement.
If an instrument with a contact temperature sensor is used, heat-conductive paste shall be applied between the surface and the sensor to ensure adequate thermal contact.

If a radiation thermometer (pyrometer) is used, the height should be chosen to ensure that a measuring spot with a diameter of ≥ 0.1 m is covered.

3.8.5. Wind measurement

The device must be capable of measuring the wind speed with a tolerance of ± 1 m/s. The wind shall be measured at microphone height. The wind direction with reference to the driving direction shall be recorded.

3.8.6. Conditions of measurement

3.8.6.1. Test site

The test site must consist of a central section surrounded by a substantially flat test area. The measuring section must be level; the test surface must be dry and clean for all measurements. The test surface shall not be artificially cooled during or prior the testing.

The test track must be such that the conditions of a free sound field between the sound source and the microphone are attained to within 1 dB(A). These conditions shall be deemed to be met if there are no large sound reflecting objects such as fences, rocks, bridges or building within 50 m of the centre of the measuring section. The surface of the test track and the dimensions of the test site shall be in accordance with Appendix 5 of this gtr.

A central part of at least 10 m radius shall be free of powdery snow, tall grass, loose soil, cinders or the like. There must be no obstacle, which could affect the sound field within the vicinity of the microphone and no persons shall stand between the microphone and the sound source. The operator carrying out the measurements and any observers attending the measurements must position themselves so as not to affect the readings of the measuring

instruments.

3.8.6.2. Meteorological conditions

Measurements shall not be made under poor atmospheric conditions. It must be ensured that the results are not affected by gusts of wind. Testing shall not be performed if the wind speed at the microphone height exceeds 5 m/s.

Measurements shall not be made if the air temperature is below 5 °C or above 40 °C or the test surface temperature is below 5 °C or above 50 °C.

3.8.6.3. Ambient noise

3.8.6.3.1. The background sound level (including any wind noise) shall be at least 10 dB(A) less than the measured tyre rolling sound emission. A suitable windscreen may be fitted to the microphone provided that account is taken of its effect on the sensitivity and directional characteristics of the microphone.

3.8.6.3.2. Any measurement affected by a sound peak which appears to be unrelated to the characteristics of the general sound level of tyres, shall be ignored.

3.8.6.4. Test vehicle requirements

3.8.6.4.1. General

The test vehicle shall be a motor vehicle and be fitted with four single tyres on just two axles.

3.8.6.4.2. Vehicle load

The vehicle must be loaded such as to comply with the test tyre loads as specified in paragraph 3.8.6.5.2. below.

3.8.6.4.3. Wheelbase

The wheelbase between the two axles fitted with the test tyres shall for Class C1 be less than 3.50 m and for Class C2 and Class C3 tyres be less than 5 m.

3.8.6.4.4. Measures to minimize vehicle influence on sound level measurements

To ensure that tyre rolling sound is not significantly affected by the test vehicle design the following requirements and recommendations are given.

3.8.6.4.5. Requirements:

(a) Spray suppression flaps or other extra device to suppress spray shall not be fitted;

(b) Addition or retention of elements in the immediate vicinity of the rims and tyres, which may screen the emitted sound, is not permitted;

(c) Wheel alignment (toe in, camber and caster) shall be in full accordance with the vehicle manufacturer's recommendations;

(d) Additional sound absorbing material may not be mounted in the wheel housings or under the underbody;

(e) Suspension shall be in such a condition that it does not result in an abnormal reduction in ground clearance when the vehicle is loaded in accordance with the testing requirement. If available, body level regulation systems shall be adjusted to give a ground clearance during testing which is normal for unladen condition.

3.8.6.4.6. Recommendations to avoid parasitic noise:

(a) Removal or modification on the vehicle that may contribute to the background noise of the vehicle is recommended. Any removals or modifications shall be recorded in the test report;

(b) During testing it should be ascertained that brakes are not poorly released, causing brake noise;

(c) It should be ascertained that electric cooling fans are not operating;

(d) Windows and sliding roof of the vehicle shall be closed during testing.

3.8.6.5. Tyres

3.8.6.5.1. General

Four identical tyres shall be fitted on the test vehicle. In the case of tyres with a load index in excess of 121 and without any dual fitting indication, two of these tyres of the same type and range must be fitted to the rear axle of the test vehicle; the front axle must be fitted with tyres of size suitable for the axle load and planed down to the minimum depth in order to minimize the influence of tyre/road contact noise while maintaining a sufficient level of safety. Winter tyres that in certain Contracting Parties may be equipped with studs intended to enhance friction shall be tested without this equipment. Tyres with special fitting requirements shall be tested in accordance with these requirements (e.g. rotation direction). The tyres must have full tread depth before being run-in.

Tyres are to be tested on rims permitted by the tyre manufacturer.

3.8.6.5.2. Tyre loads

The test load Q_t for each tyre on the test vehicle shall be 50 to 90 per cent of the reference load Q_r, but the average test load $Q_{t,avr}$ of all tyres shall be 75 ± 5 per cent of the reference load Q_r.

For all tyres the reference load Q_r corresponds to the maximum mass associated with the load index of the tyre. In the case where the load index is constituted by two numbers divided by a slash (/), reference shall be made to the first number.

3.8.6.5.3. Tyre inflation pressure

Each tyre fitted on the test vehicle shall have a test pressure P_t not higher than the reference pressure P_r and within the interval:

$$P_r \cdot \left(\frac{Q_t}{Q_r}\right)^{1.25} \leq P_t \leq 1.1\, P_r \cdot \left(\frac{Q_t}{Q_r}\right)^{1.25}$$

For Class C2 and Class C3 the reference pressure P_r is the pressure corresponding to the pressure index marked on the sidewall.

For Class C1 the reference pressure is P_r = 250 kPa for "standard" tyres and 290 kPa for "reinforced" tyres; the minimum test pressure shall be P_t = 150 kPa.

3.8.6.5.4. Preparations prior to testing

The tyres shall be "run-in" prior to testing to remove compound nodules or other tyre pattern characteristics resulting from the moulding process. This will normally require the equivalent of about 100 km of normal use on the road.

The tyres fitted to the test vehicle shall rotate in the same direction as when they were run-in.

Prior to testing tyres shall be warmed up by running under test conditions.

3.8.6.6. Method of testing

3.8.6.6.1. General conditions

For all measurements the vehicle must be driven in a straight line over the measuring section (AA' to BB') in such a way that the median longitudinal plane of the vehicle is as close as possible to the line CC'.

When the front end of the test vehicle has reached the line AA', the vehicle's driver must have put the gear selector on neutral position and switched off the engine. If abnormal noise (e.g. ventilator, self-ignition) is emitted by the test vehicle during the measurement, the test must be disregarded.

3.8.6.6.2. Nature and number of measurements

The maximum sound level expressed in A-weighted decibels (dB(A)) shall be measured to the first decimal place as the vehicle is coasting between lines AA' and BB' (Figure 7 - front end of the vehicle on line AA', rear end of the vehicle on line BB'). This value will constitute the result of the measurement.

At least four measurements shall be made on each side of the test vehicle at test speeds lower than the reference speed specified in paragraph 3.8.6.8. and at least four measurements at test speeds higher than the reference speed. The speeds shall be approximately equally spaced over the speed range specified in paragraph 3.8.6.6.3.

3.8.6.6.3. Test speed range

The test vehicle speeds shall be within the range:

(a) From 70 to 90 km/h for Class C1 and Class C2 tyres;

(b) From 60 to 80 km/h for Class C3 tyres.

3.8.6.7. Interpretation of results

The measurement shall be invalid if an abnormal discrepancy between the values is recorded (see paragraph 3.8.6.3.2 above).

3.8.6.8. Determination of test result

The reference speed V_{ref} used to determine the final result shall be:

(a) 80 km/h for Class C1 and Class C2 tyres;

(b) 70 km/h for Class C3 tyres.

3.8.6.9. Regression analysis of rolling sound measurements

The tyre-road rolling sound level L_R in dB(A) is determined by a regression analysis according to:

$$L_R = \overline{L} - a \cdot \overline{v}$$

where:

$\overline{L}$ is the mean value of the rolling sound levels L_i, measured in dB(A):

$$\overline{L} = \frac{1}{n}\sum_{i=1}^{n} L_i$$

n is the measurement number ($n \geq 16$),

$\overline{v}$ is the mean value of logarithms of speeds v_i:

$$\overline{v} = \frac{1}{n}\sum_{i=1}^{n} v_i \quad \text{with} \quad v_i = \lg\left(v_i / v_{ref}\right)$$

"a" is the slope of the regression line in dB(A):

$$a = \frac{\sum_{i=1}^{n}\left(v_i - \overline{v}\right)\left(L_i - \overline{L}\right)}{\sum_{i=1}^{n}\left(v_i - \overline{v}\right)^2}$$

3.8.6.10. Temperature correction

For Class C1 and Class C2 tyres, the final result shall be normalized to a test surface reference temperature ϑ_{ref} by applying a temperature correction, according to the following:

$$L_R(\vartheta_{ref}) = L_R(\vartheta) + K(\vartheta_{ref} - \vartheta)$$

where ϑ = the measured test surface temperature,
ϑ_{ref} = 20 °C,

For Class C1 tyres, the coefficient K is -0.03 db(A)/°C, when $\vartheta > \vartheta_{ref}$ and -0.06 dB(A)/°C when $\vartheta < \vartheta_{ref.}$

For Class C2 tyres, the coefficient K is -0.02 dB(A)/°C.

If the measured test surface temperature does not change more than 5 °C within all measurements necessary for the determination of the sound level of one set of tyres, the temperature correction may be made only on the final reported tyre rolling sound level as indicated above, utilizing the arithmetic mean value of the measured temperatures. Otherwise each measured sound level L_i shall be corrected, utilizing the temperature at the time of the sound recording.

3.8.6.11. In order to take account of any measuring instrument inaccuracies, the results according to paragraph 3.8.6.10. shall be reduced by 1 dB(A).

3.8.6.12. The final result, the temperature corrected tyre rolling sound level $L_R(\vartheta_{ref})$ in dB(A), shall be rounded down to the nearest lower whole value.

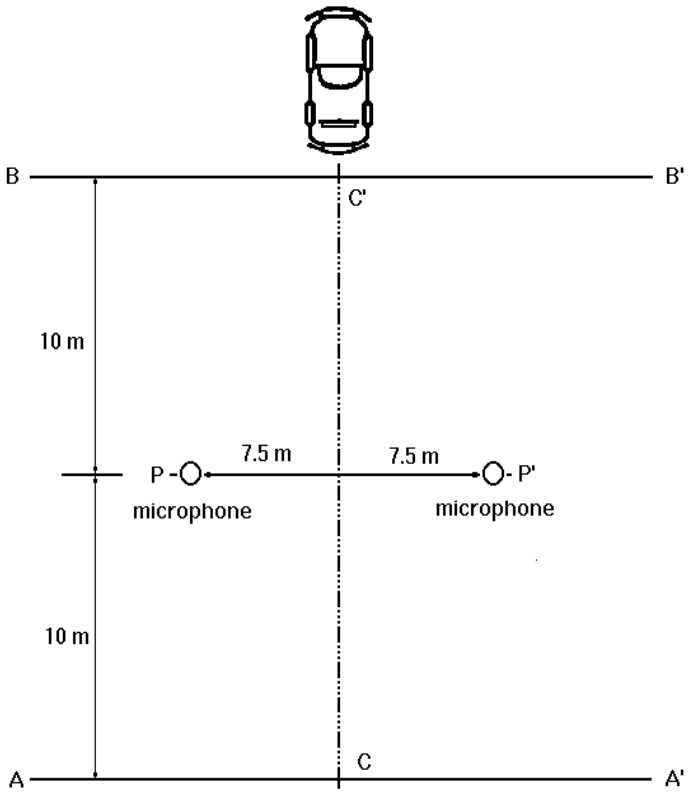


Figure 7. Microphone positions for the measurement

3.8.7. Test Report – Appendix 8 shows the test report that shall be used in the case of type approval. The same test report may also be used for self-certification if desired.

3.9 Endurance Test for passenger car tyres

3.9.0. Requirements

3.9.0.1. The following requirements shall be met by all passenger car tyres when tested in accordance with the procedures described in paragraphs 3.9.2. and 3.9.3. below.

3.9.0.2. There shall be no visible evidence of tread, sidewall, ply, cord, inner liner, belt or bead separation, chunking, open splices, cracking or broken cords.

3.9.0.3. The tyre pressure, when measured at any time between 15 minutes and 25 minutes after the end of the test, shall not be less than 95% of the initial pressure specified in paragraph 3.9.2.

3.9.1. Preparation of Tyre
Mount the tyre on a test rim and inflate it to the pressure specified in the table below.

Endurance Test Tyre Inflation Pressures	Tyre Application	Test Pressure (kPa)
	Standard Load, Light Load	180
	Extra Load	220

3.9.1.1. Condition the assembly at 35 ± 3°C for not less than 3 hours.

3.9.1.2. Readjust the pressure to the value specified in the table in paragraph 3.9.2 immediately before testing.

3.9.2. Test Procedure

3.9.2.1. Mount the assembly on a test axle and apply a load as given in paragraph 3.9.3.3 below to load it against the outer face of a smooth wheel having a diameter of 1.7 m ± 1%.

3.9.2.2. During the test the ambient temperature, at a distance of not less than 150 mm and not more than 1 m from the tyre, is maintained at 35 ± 3°C.

3.9.2.3. Conduct the test, without interruptions, at not less than 120 km/h (110 km/h for snow tyres marked with the three-peaked mountain-snowflake symbol) test speed with loads and test periods not less than those shown in the table below:

Passenger car tyres

Test period	Duration	Load as a percentage of tyre maximum load capacity
1	4 h	85%
2	6 h	90%
3	24 h	100%

3.9.2.4. Throughout the test the inflation pressure shall not be corrected and the test loads shall be kept constant at the value corresponding to each test period.

3.9.2.5. Allow the tyre to cool for one hour after running the tyre for the time specified in the table above, measure its inflation pressure. Inspect the tyre externally on the test rim for the conditions specified in section 3.9.1 above.

3.10 Low Inflation Pressure Performance Test for Passenger Car Tyres

3.10.1. Requirements

The following requirements shall be met by tyres when tested in accordance with the procedure given in paragraph 3.10.3 below.

3.10.1.1. There shall be no visible evidence of tread, sidewall, ply, cord, inner liner, belt or bead separation, chunking, open splices, cracking or broken cords.

3.10.1.2. The tyre pressure, when measured at any time between 15 minutes and 25 minutes after the end of the test, shall not be less than 95% of the initial pressure specified in paragraph 3.10.2. below.

3.10.2. Preparation of tyre

This test is conducted following completion of the tyre endurance test using the same tyre and rim assembly tested in accordance with section 3.9. above, with the tyre deflated to the following pressures show in the table below:

Low Inflation Pressure Performance test
Inflation Pressure Chart for Passenger Car Tyres

Low Inflation Pressure Performance Pressures	Tyre Application	Test Pressure kPa
Passenger Car Tyres	Standard Load, Light Load	140
	Extra Load	160

3.10.2.1. After the tyre is deflated to the appropriate test pressure in paragraph 3.10.2. at the completion of the endurance test, condition the assembly at 35 ± 3 °C for not less than 2 hours.

3.10.2.2. Before or after mounting the assembly on a test axle, readjust the tyre pressure to that specified in the table in paragraph 3.10.2.

3.10.3. Test Procedure

3.10.3.1. The test is conducted for ninety minutes at the end of the test specified in section 4.8, continuous and uninterrupted, at a speed of 120 km/h.

3.10.3.2. Press the assembly against the outer face of a test drum with a diameter of 1.7 m ±1%.

3.10.3.3. Apply to the test axle a load equal to 100% of the tyre's maximum load rating.

3.10.3.4. Throughout the test, the inflation pressure is not corrected and the test load is maintained at the initial level.

3.10.3.5. During the test, the ambient temperature, at a distance of not less than 150 mm and not more than 1 m from the tyre, is maintained at 35 ± 3°C.

3.10.3.6. Allow the tyre to cool for one hour. Measure its inflation pressure. Then deflate the tyre, remove it from the test rim, and inspect it for the conditions specified in paragraph 3.10.1.1 above.

3.11 High Speed Performance Test for Passenger Car Tyres

3.11.1. Requirements; When the tyre is tested in accordance with paragraphs 3.11.3 or 3.11.5.;

3.11.1.1. There shall be no visible evidence of tread, sidewall, ply, cord, inner liner, belt or bead separation, chunking, open splices, cracking or broken cords. For tyres tested at a speed of 300 km/h (speed symbol “Y”) or above, superficial blistering in the tyre tread due to localized heat build-up in the test drum is acceptable.

3.11.1.2. The tyre pressure, when measured at any time between 15 minutes and 25 minutes after the end of the test, shall not be less than 95% of the initial pressure.

3.11.1.3. The outer diameter of the tyre, measured two hours after the load/speed performance test, must not differ by more than ± 3.5% from the outer diameter as measured before the test.

3.11.1.4. For tyres identified by means of letter code "ZR" within the size designation and suitable for speeds over 300 km/h, the above high speed test is carried out on one tyre at the load and speed conditions marked on the tyre. Another load/speed test must be carried out on a second sample of the same tyre type at the load and speed conditions specified as maximum by the tyre manufacturer. The second test may be carried out on the same tyre sample if the tyre manufacturer agrees.

3.11.2. Preparation of the Tyres With Speed Symbols "F" to “S” as specified in Appendix 1

3.11.2.1. Mount the tyre on a test rim and inflate it to the appropriate pressure specified in the table below:

Inflation Pressure and test load

	Inflation Pressure, kPa		
Speed Symbol	Standard Load tyres, Light Load tyres	Extra Load tyres	Test Load in kg
L, M, N, P, Q, R, S	220	260	85% of the load index

3.11.2.2. Condition the assembly at 35 ± 3°C for not less than three hours.

3.11.2.3. Before or after mounting the assembly on a test axle, readjust the tyre pressure to that specified in the table above in 3.11.2.1.

3.11.3. Test procedure for tyres with speed symbols "F" to “S” as specified in Appendix 1

3.11.3.1. Press the assembly against the outer face of a test drum with a diameter of 1.7 m ± 1%.

3.11.3.2. Apply to the test axle a load equal to 85% of the tyre’s maximum load carrying capacity.

3.11.3.3. Break-in the tyre by running it for 2 hours at 80 km/h.

3.11.3.4. Allow the tyre to cool to 38° C and readjust inflation pressure to applicable pressure in table in 3.11.2.1 above immediately before the test.

3.11.3.5. Throughout the test, the inflation pressure is not corrected and the test load is maintained at the value applied in paragraph 3.11.2.1.

3.11.3.6. During the test, the ambient temperature, measured at a distance of not less than 150 mm and not more than 1 m from the tyre, shall be maintained at 35 ± 3°C.

3.11.3.7. The test is conducted, continuously and uninterrupted, for ninety minutes through three thirty-minute consecutive test stages at the following speeds: 140, 150, and 160 km/h.

3.11.3.8. Allow the tyre to cool for between 15 minutes and 25 minutes. Measure its inflation pressure. Then, deflate the tyre, remove it from the test rim, and inspect it for the conditions specified in paragraph 3.11.1.1. above.

3.11.4. Preparation of tyres with speed symbols “T” to "Y" as specified in Appendix 1

3.11.4.1. Mount a new tyre on the test rim specified by the manufacturer as the “measuring rim and test rim”.

3.11.4.2. Inflate it to the appropriate pressure as given (in kPa) in the table below:

Inflation pressure and test load

	Inflation Pressure, kPa		
Speed Symbol	Standard Load tyres, Light Load tyres	Extra Load tyres	Test Load
T, U, H	280	320	80% of the load index
V	300	340	73% of the load index
W	320	360	68% of the load index
Y	320	360	68% of the load index

3.11.4.3. Condition the tyre and wheel assembly at test room temperature for not less than three hours.

3.11.4.4. Re-adjust the tyre pressure to that specified in paragraph 3.11.4.2 above.

3.11.5. Test procedure for tyres with speed symbols “T” to "Y" as specified in Appendix 1

3.11.5.1. Press the assembly against the outer face of 1.7 m ± 1% or 2.0 m ± 1% test drum.

3.11.5.2. Depending upon the speed symbol applicable to the tyre, apply to the test axle, a load equal to that shown in the table in paragraph 3.11.4. above.

3.11.5.3. Throughout the test the tyre pressure shall not be corrected and the test load shall be kept

constant.

3.11.5.4. During the test the temperature in the test-room shall be maintained at between 20° and 30° C or at a higher temperature if the manufacturer desires to increase test severity.

3.11.5.5. Carry the test through, without interruptions as follows, in relation to the tyre's speed symbol:

3.11.5.6. The initial test speed (ITS) is equal to the tyre's speed symbol,

- less 40 km/h on a 1.70 m $\pm$ 1% drum, or
- less 30 km/h on a 2.0 m $\pm$ 1% drum.

3.11.6. For tyres of speed symbols "T" to "W" as specified in Appendix 1;

3.11.6.1. Accelerate the equipment at a constant rate such that the initial test speed (ITS) is reached at the end of 10 minutes from start-up.

- then, at the ITS for 10 minutes.
- then, at the ITS plus 10 km/h for 10 minutes.
- then, at the ITS plus 20 km/h for 10 minutes.
- then, at the ITS plus 30 km/h for 20 minutes;

3.11.6.2. For tyres of speed symbol "Y": Accelerate the equipment at a constant rate such that the initial test speed (ITS) is reached at the end of 10 minutes from start-up.

- then, at the ITS for 20 minutes.
- then, at the ITS plus 10 km/h for 10 minutes.
- then, at the ITS plus 20 km/h for 10 minutes.
- then, at the ITS plus 30 km/h for 10 minutes.

3.11.7. For tyres with "ZR" in the size designation intended for use at speeds greater than 300 km/h;

3.11.7.1. Test the tyre at the load and inflation for a speed symbol "Y" tyre according to the procedures specified above in paragraphs 3.11.4.2. and 3.11.6.2. above.

3.11.7.2. Test a further sample of the same type according to:

Inflate the tyre to 320 kPa for standard load or light load tyres and 360 kPa for extra load tyres. Apply a load to the test axle that is equal to 80% of the load capacity specified by the tyre manufacturer. Accelerate the equipment at a constant rate such that the rated speed of the tyre is reached at the end of 10 minutes from the start-up. Then test at the rated speed for 5 minutes.

3.12 Test for Adhesion Performance on Wet Surfaces

3.12.1. Requirements

Passenger car tyres (Class C1 tyres) shall meet the following requirements:

Category of use	Wet grip index (G)
snow tyre with a speed symbol ("Q" or below) indicating a maximum permissible speed not greater than 160 km/h	≥ 0.9
snow tyre with a speed symbol ("R" and above) indicating a maximum permissible speed greater than 160 km/h	≥ 1.0
normal (road type) tyre	≥ 1.1

3.12.2. General Test Conditions

3.12.2.1. Track characteristics

3.12.2.1.1. The track shall have a dense asphalt surface with a gradient in any direction not exceeding 2 per cent. It shall be of uniform age, composition, and wear and shall be free of loose material or foreign deposits. The maximum chipping size shall be 10 mm (tolerances permitted from 8 mm to 13 mm) and the sand depth measured as specified in ASTM standard E 965-96 (2006) shall be 0.7 ± 0.3 mm.

The surface friction value for the wetted track shall be established by one or other of the following methods:

3.12.2.1.1.1. Standard reference test tyre (SRTT) method
When tested using the SRTT and the method given in paragraph 3.12.3.1. the average peak brake force coefficient (pbfc) shall be between 0.6 and 0.8. The measured values shall be corrected for the effects of temperature as follows:

$$pbfc = pbfc\ (measured) + 0.015(t - 20)$$

where “t” is the wetted track surface temperature in degrees Celsius.
The test shall be conducted using the lanes and length of the track to be used for the wet grip test;

3.12.2.1.1.2. British pendulum number (BPN) method
The averaged British pendulum number (BPN) of the wetted track, measured in accordance with the procedure given in the ASTM standard E 303-93 (2008) and using the pad as specified in ASTM standard E 501-08, shall be between 40 and 60 after temperature correction. Unless temperature correction recommendations are indicated by the pendulum manufacturer, the following formula can be used:

$$BPN = BPN\ (measured\ value) + 0.34 * t - 0.0018 * t^2 - 6.1$$

where “t” is the wetted track surface temperature in degrees Celsius.

In the lanes of the track to be used during the wet grip tests, the BPN shall be

measured at intervals of 10 m along the length of the lanes. The BPN shall be measured 5 times at each point and the coefficient of variation of the BPN averages shall not exceed by 10 per cent.

3.12.2.1.2. It shall be established prior to testing that the characteristics of the test track comply with paragraph 3.12.2.1. on the basis of evidence produced in test reports.

3.12.2.2. Wetting conditions

The surface may be wetted from the track-side or by a wetting system incorporated into the test vehicle or the trailer.
If a track-side system is used, the test surface shall be wetted for at least half an hour prior to testing in order to equalize the surface temperature and water temperature. It is recommended that track-side wetting be continuously applied throughout testing.
The water depth shall be between 0.5 and 1.5 mm.

3.12.2.3. The wind conditions shall not interfere with wetting of the surface (wind-shields are permitted).

The wetted surface temperature shall be between 5 °C and 35 °C and shall not vary during the test by more than 10 °C.

3.12.3. Test Procedures

The comparative wet grip performance shall be established using either:
a) A trailer or special purpose tyre evaluation vehicle; or
b) A standard production passenger carrying vehicle of Category 1-1 vehicle as defined in Special Resolution N° 1. 1/

3.12.3.1. Trailer or special purpose tyre evaluation vehicle procedure

3.12.3.1.1. The trailer, together with the towing vehicle, or the tyre evaluation vehicle shall comply with the following requirements :

3.12.3.1.1.1. Be capable of exceeding the upper limit for the test speed of 67 km/h and of maintaining the test speed requirement of 65 ± 2 km/h at the maximum level of application of braking forces;

3.12.3.1.1.2. Be equipped with an axle providing one test position having an hydraulic brake and actuation system that can be operated from the towing vehicle if applicable. The braking system shall be capable of providing sufficient braking torque to achieve the peak brake force coefficient over the range of tyre sizes and tyre loads to be tested;

3.12.3.1.1.3. Be capable of maintaining longitudinal alignment (toe) and camber of the test wheel and tyre assembly throughout the test within ± 0.5° of the static figures achieved at the test tyre loaded condition;

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3.12.3.1.1.4. In the case of a trailer, the mechanical coupling device between the towing vehicle and trailer shall be such that, when the towing vehicle and trailer are coupled together, the drawbar, or part of the drawbar, of a trailer that incorporates the braking force measurement sensing is horizontal or slopes downwards from rear to front at a maximum angle of 5 º. The longitudinal distance from the centre line of the articulation point of the coupling (hitch) to the transverse centre line of the axle of the trailer shall be at least ten times the coupling (hitch) height;

3.12.3.1.1.5. In the case of vehicles that incorporate a track wetting system, the water delivery nozzle(s) shall be such that the resulting water film is of uniform section extending at least 25 mm beyond the width of the tyre contact patch. The nozzle(s) shall be directed downwards at an angle of 20° to 30° and shall contact the track surface between 250 mm and 450 mm in front of the centre of the tyre contact patch. The height of the nozzle(s) shall be 25 mm or the minimum to avoid any obstacles on the track surface without exceeding a maximum of 100 mm. Water delivery rate shall ensure a water depth of 0.5 mm to 1.5 mm and shall be consistent throughout the test to within ± 10 per cent. Note that a typical rate for testing at 65 km/h will be 18 litres per second per metre of wetted track surface width.

The system shall be able to deliver the water such that the tyre, and track surface in front of the tyre, is wetted before the start of braking and throughout the duration of the test.

3.12.3.1.2. Test Procedure for trailer or special purpose vehicle

3.12.3.1.2.1. The test tyre shall be trimmed to remove any moulding protrusions that are likely to affect the test.

3.12.3.1.2.2. The test tyre shall be mounted on the test rim declared by the tyre manufacturer in the approval application and shall be inflated to 180 kPa in the case of the SRTT and standard load tyre or 220 kPa in the case of an extra load tyre.

3.12.3.1.2.3. The tyre shall be conditioned for a minimum of two hours adjacent to the test track such that it is stabilized at the ambient temperature of the test track area. The tyre(s) shall not be exposed to direct sunshine during conditioning.

3.12.3.1.2.4. The tyre shall be loaded to :

a) Between 445 kg and 508 kg in the case of the SRTT; and

b) Between 70 per cent and 80 per cent of the load value corresponding to the load index of the tyre in any other case.

3.12.3.1.2.5. Shortly before testing, the track shall be conditioned by carrying out at least ten braking tests on the part of the track to be used for the performance test programme but using a tyre not involved in that programme.

3.12.3.1.2.6. Immediately prior to testing, the tyre inflation pressure shall be checked and reset, if necessary, to the values given in paragraph 3.12.3.

3.12.3.1.2.7. The test speed shall be between 63 km/h and 67 km/h and shall be maintained between these limits throughout the test run.

3.12.3.1.2.8. The direction of the test shall be the same for each set of tests and shall be the same for the test tyre as that used for the SRTT with which its performance is to be compared.

3.12.3.1.2.9. The brakes of the test wheel assembly shall be applied such that peak braking force is achieved within 0.2 s and 0.5 s of brake application.

3.12.3.1.2.10. In the case of a new tyre, two test runs shall be carried out to condition the tyre. These tests may be used to check the operation of the recording equipment but the results shall not be taken into account in the performance assessment.

3.12.3.1.2.11. For the evaluation of the performance of any tyre compared with that of the SRTT, the braking test shall be carried out from the same point and in the same lane of the test track.

3.12.3.1.2.12. 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 three candidate tyres may be tested before repeating the SRTT test, for example:
R1–T1 – T2 – T3 – R2

3.12.3.1.2.13. The average value of peak brake force coefficient (pbfc) shall be calculated over at least six valid results.

For results to be considered to be valid, the coefficient of variation as determined by the standard deviation divided by the average result, expressed as a percentage, shall be within 5 percent. If this cannot be achieved with the repeat testing of the SRTT, the evaluation of the candidate tyre(s) shall be discarded and the entire order of testing shall be repeated.

3.12.3.1.2.14. Using the value of the average pbfc for each series of test runs:

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

(R1 + R2)/2

where:

R1 is the average pbfc for the first series of test runs of the SRTT and R2 is the average pbfc for the second series of test runs of the SRTT.

In the case of the order of testing R1 – T1 – T2 – R2, the pbfc of the SRTT shall be taken to be:

2/3 R1 + 1/3 R2 for comparison with the candidate tyre T1 and

1/3 R1 + 2/3 R2 for comparison with the candidate tyre T2

In the case of the order of testing R1 – T1 – T2 – T3 – R2, the pbfc of the SRTT shall be taken to be:

3/4 R1 + 1/4 R2 for comparison with the candidate tyre T1

(R1 + R2)/2 for comparison with the candidate tyre T2 and

1/4 R1 + 3/4 R2 for comparison with the candidate tyre T3

3.12.3.1.2.15. The wet grip index (G) shall be calculated as:

$$G = \frac{\text{pbfc of candidate tyre}}{\text{pbfc of SRTT}}$$

3.12.3.2. Standard vehicle procedure

3.12.3.2.1. The vehicle shall be a standard Category 1-1 vehicle as defined in Special Resolution N° 1, 1/ capable of a minimum speed of 90 km/h and equipped with an anti-lock braking system (ABS).

3.12.3.2.1.1. The vehicle shall not be modified except:

(a) To allow the fitting of an increased range of wheel and tyre sizes;

(b) To allow mechanical (including hydraulic, electrical or pneumatic) operation of the service brake control. The system may be operated automatically by signals from devices incorporated in, or adjacent to, the track.

3.12.3.2.2. Test procedure using standard vehicle

3.12.3.2.2.1. The test tyres shall be trimmed to remove any moulding protrusions that are likely to affect the test

3.12.3.2.2.2. The test tyre shall be mounted on the test rim declared by the tyre

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manufacturer in the approval application and shall be inflated to 220 kPa in all cases.

3.12.3.2.2.3. The tyre shall be conditioned for a minimum of two hours adjacent to the test track such that it is stabilized at the ambient temperature of the test track area. The tyre(s) shall not be exposed to direct sunshine during conditioning

3.12.3.2.2.4. The static load on the tyre shall be:

(a) Between 381 kg and 572 kg in the case of the SRTT; and

(b) Between 60 per cent and 90 per cent of the load value corresponding to the load index of the tyre in any other case.

The variation in load on tyres on the same axle shall be such that the load borne by the more lightly loaded tyre shall not be less than 90 per cent of that of the tyre bearing the greater load.

3.12.3.2.2.5. Shortly before testing, the track shall be conditioned by carrying out at least ten braking tests from 90 km/h to 20 km/h on the part of the track to be used for the performance test programme but using tyres not involved in that programme.

3.12.3.2.2.6. Immediately prior to testing, the tyre inflation pressure shall be checked and reset, if necessary, to the values given in paragraph 3.12.3.2.2.2.

3.12.3.2.2.7. Starting from an initial speed of between 87 km/h and 83 km/h, 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 prior to the speed being reduced to 80 km/h, shall be applied to the service brake control and this force shall be maintained until the vehicle has been brought to rest.

The braking test shall be carried out with the clutch of a manual transmission disengaged or with the selector of an automatic transmission in the neutral position.

3.12.3.2.2.8. The direction of the test shall be the same for each set of tests and shall be the same for the candidate test tyre as that used for the SRTT with which its performance is to be compared.

3.12.3.2.2.9. In the case of new tyres, two test runs shall be carried out to condition the tyres. These tests may be used to check the operation of the recording equipment but the results shall not be taken into account in the performance assessment.

3.12.3.2.2.10. For the evaluation of the performance of any tyre compared with that of the SRTT, the braking test shall be carried out from the same point and in the same lane of the test track.

3.12.3.2.2.11. 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 three candidate tyres may be tested before repeating the SRTT test, for example:

R1–T1 – T2 – T3 - R2

3.12.3.2.2.12. The mean fully developed deceleration (mfdd) between 80 km/h and 20 km/h shall be calculated for at least three valid results in the case of the SRTT and 6 valid results in the case of the candidate tyres.

The mean fully developed deceleration (mfdd) is given by:

mfdd = 231.48 / S

where:

S is the measured stopping distance in metres between 80 km/h and 20 km/h.

For results to be considered to be valid, the coefficient of variation as determined by the standard deviation divided by the average result, expressed as a percentage, shall be within 3 per cent. If this is cannot achieved with the repeat testing of the SRTT, the evaluation of the candidate tyre(s) shall be discarded and the entire order of testing shall be repeated.

The average of the calculated values of mfdd shall be determined for each series of test runs.

3.12.3.2.2.13. Using the value of the average mfdd for each series of test runs:

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

(R1 + R2)/2

where:

R1 is the average mfdd for the first series of test runs of the SRTT and R2 is the average mfdd for the second series of test runs of the SRTT

In the case of the order of testing R1 – T1 – T2 – R2, the mfdd of the SRTT shall be taken to be:

2/3 R1 + 1/3 R2 for comparison with the candidate tyre T1 and

1/3 R1 + 2/3 R2 for comparison with the candidate tyre T2

In the case of the order of testing R1 – T1 – T2 – T3 – R2, the mfdd of the SRTT shall be taken to be:

3/4 R1 + 1/4 R2 for comparison with the candidate tyre T1

(R1 + R2)/2 for comparison with the candidate tyre T2 and

1/4 R1 + 3/4 R2 for comparison with the candidate tyre T3

3.12.3.2.2.14. The wet grip index (G) shall be calculated as:

$$G = \frac{\text{average mfdd of candidate tyre}}{\text{mfdd of SRTT}}$$

3.12.3.2.2.15. 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.

3.12.3.2.2.15.1. The wet grip index of the control tyre relative to the SRTT (G1) and of the candidate tyre relative to the control tyre (G2) shall be established using the procedure in paragraphs 3.12.3.2.2.1 to 3.12.3.2.2.15.

The wet grip index of the candidate tyre relative to the SRTT shall be the product of the two resulting wet grip indices, that is G1 x G2.

3.12.3.2.2.15.2. The track, and the portion of the track, shall be the same for all of the tests and the ambient conditions shall be comparable, for example, the surface temperature of the wetted track shall be within ± 5 °C. All tests shall be completed within the same day.

3.12.3.2.2.15.3. 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.

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

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

3.12.4. Test Report – Appendix 9 shows the test report that shall be used in the case of type approval. The same test report may also be used for self-certification if desired.

3.13 Procedure to assess the flat tyre running mode of run flat tyres

For run flat tyres identified by means of letter code "RF" within the size designation a load/speed test must be carried out as specified in paragraph 3.13.1 below.

A run flat tyre tested in accordance with paragraph 3.13.1. shall be deemed to have passed the test if the tread remains connected to the two sidewalls and the deflected section height does not alter by a value greater than 20% when compared to the deflected section height at the start of the test.

3.13.1. Test Procedure

3.13.1.1. Mount a new tyre on the test rim specified by the manufacturer.

3.13.1.2. Condition the tyre at 35 ± 3°C and 250 kPa for three hours.

3.13.1.3. Remove the valve core and wait until the tyre deflates completely.

3.13.1.4. Mount the tyre-and-wheel assembly to a test axle and press it against the outer surface of a smooth wheel 1.70 m ± 1 per cent or 2.0 m ± 1 per cent in diameter.

3.13.1.5. Apply to the test axle a load equal to 65 percent of the maximum load rating corresponding to the load index of the tyre.

3.13.1.6. At the start of the test, measure the deflected section height (Z1).

3.13.1.7. During the test the temperature of the test room must be maintained at 35 ± 3°C.

3.13.1.8. Carry the test through, without interruption in conformity with the following particulars:

3.13.1.9.

Time taken to pass from zero speed to constant test speed: 5 minutes;

Test speed: 80 km/h; Duration of test at the test speed: 60 minutes.

3.13.1.10. At the end of the test, measure the deflected section height (Z2).

3.13.1.11. Calculate the change in percent of the deflected section height compared to the deflected section height at the start of the test as ((Z1 – Z2) / Z1) x 100.

3.14 Strength Test for LT/C Tyres

3.14.1. Requirements

When tested according to the procedure described in this section, LT/C tyres must have an average strength of not less than the values shown in the table below:

Load Range	Minimum breaking energy	
	Joules (J)	Inch-pounds (in-lbs)
B	293	2600

C	361	3200
D	514	4550
E	576	5100

3.14.2. Preparation of tyre

Mount the tyre on a model rim assembly and inflate it to the pressure corresponding to the maximum load, or maximum dual load where there is both a single and dual load marked on the tyre. If the tyre is tubeless, a tube may be inserted to prevent loss of air during the test in the event of puncture.

Condition it at room temperature for at least 3 hours and readjust the inflation pressure if necessary.

3.14.3. Test Procedure

3.14.3.1. Force a 19.05 mm (0.75 inch) diameter cylindrical steel plunger with a hemispherical end perpendicularly into the tread rib as near to the centreline as possible, avoiding penetration into the tread groove, at the rate of 50 mm (2 inches) per minute.

3.14.3.2. Record the force and penetration at five test points equally spaced around the circumference of the tyre. If the tyre fails to break before the plunger is stopped by reaching the rim, record the force and penetration as the rim is reached and use these values in 3.14.3.3.

3.14.3.3. Compute the breaking energy for each test point by means of one of the two following formulas:

$W= ((F\times P)/2)\times 10^{-3}$ (joules)

Where:

W= Energy, in joules;

F= Force, in Newtons; and

P= Penetration, in mm; or

$W= ((F\times P)/2)$

Where:

W= Energy, in inch-pounds;

F= Force, in pounds; and

P= Penetration, in inches

3.14.3.4. Determine the breaking energy value for the tyre by computing the average of the five values obtained in accordance with 3.14.3.3.

3.15 Tubeless Tyre Bead Unseating Resistance Test for LT/C Tyres with rim codes of 10 or greater

3.15.1. Requirements

When a tubeless LT/C tyre is tested in accordance with the procedure described in this section, the applied force required to unseat the tyre bead at the point of contact shall be not less than:

(a) 6,670 N (1,500 pounds) for tyres with a nominal section width of less than 160 mm (6 inches);

(b) 8,890 N (2,000 pounds) for tyres with a nominal section width of 160 mm (6 inches) or more but less than 205 mm (8 inches);

(c) 11,120 N (2,500 pounds) for tyres with a nominal section width of 205 mm (8 inches) or more.

3.15.2. Preparation of tyre-wheel assembly

3.15.2.1. Wash the tyre, dry it at the beads, and mount it without lubrication or adhesives on a clean, painted test rim.

3.15.2.2. Inflate it to the applicable pressure specified in the following table at ambient room temperature:

For LT/C tyres, the maximum permissible inflation pressure to be used for the bead unseating test is as follows:

Load Range C	260 kPa
Load Range D	340 kPa
Load Range E	410 kPa

For LT/C tyres with a nominal cross section greater than 295 mm (11.5 inches), the maximum permissible inflation pressure to be used for the bead unseating test is as follows:

Load Range C	190 kPa
Load Range D	260 kPa
Load Range E	340 kPa

3.15.2.3. Mount the wheel and tyre in a fixture shown in Figure 6, and force the bead unseating block shown in Figure 7 or Figure 8 against the tyre sidewall as required by the geometry of the fixture.

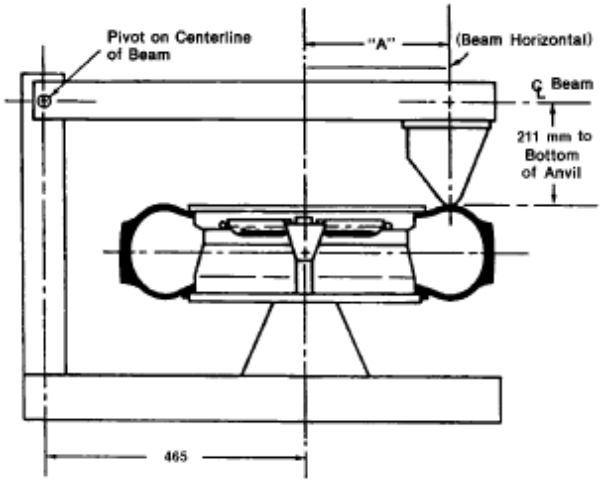


Table of A dimension for different rim codes		
Rim code	**mm**	**Inches**
20	345	13.50
19	330	13.00
18	318	12.50
17	305	12.00
16	292	11.50
15	279	11.00
14	267	10.50
13	254	10.00
12	241	9.50
11	229	9.00
10	216	8.50
320	216	8.50
340	229	9.00
345	235	9.25
365	248	9.75
370	254	10.00
390	279	11.00
415	292	11.50

Figure 6: Bead Unseating Fixture (all dimension in mm) and table of "A" dimensions

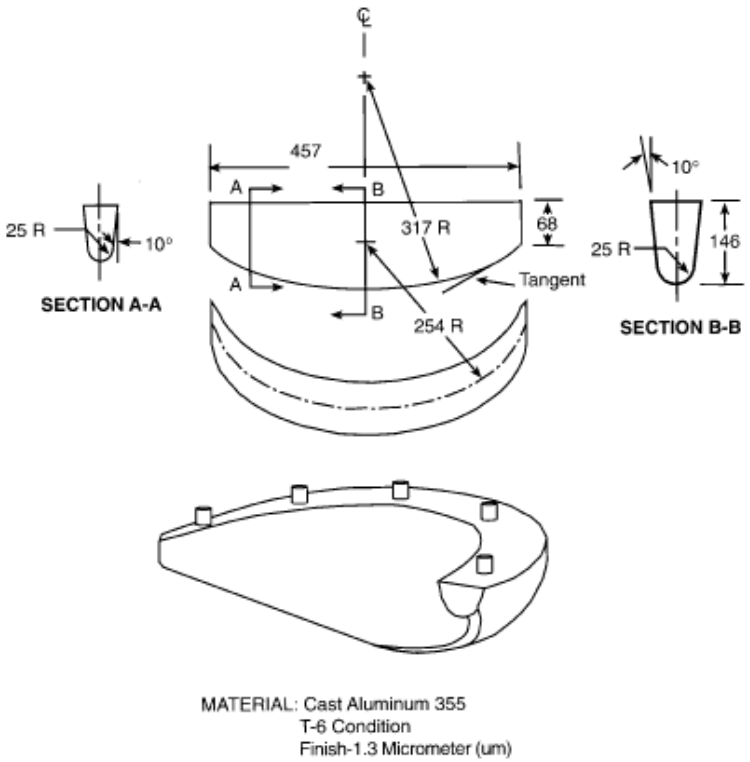


Figure 7: Diagram of Bead Unseating Block (all dimensions in mm)

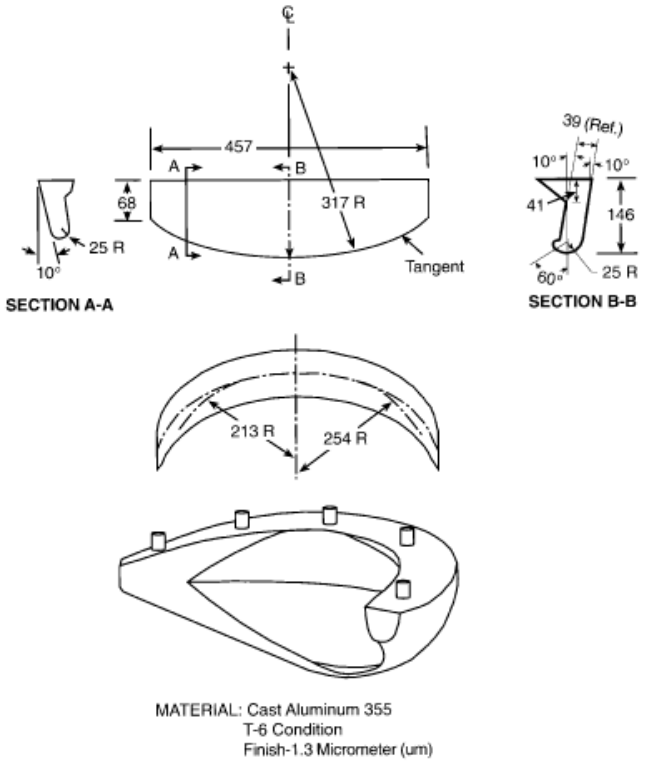


Figure 8: Diagram of Bead Unseating Block (all dimensions in mm)

3.15.3. Test Procedure

3.15.3.1. Apply a load through the block to the tyre's outer sidewall at the distance specified in Figure 6 for the applicable wheel size at a rate of 50 mm (2 inches) per minute, with the load arm substantially parallel to the tyre and rim assembly at the time of engagement.

3.15.3.2. Increase the load until the bead unseats or the applicable value specified in 3.15.1 is reached.

3.15.3.3. Repeat the test at least four places equally spaced around the tyre circumference.

3.15.3.4. Increase the load until the bead unseats or the applicable value specified in 3.15.1 is reached.

3.15.3.5. Repeat the test at least four places equally spaced around the tyre circumference.

3.16 Load/Speed Endurance Test for LT/C Tyres 1/

3.16.1. Requirements

3.16.1.1. Each type of LT/C tyre shall undergo at least one load/speed endurance test carried out by the procedure described below.

3.16.1.2. A LT/C tyre which, after undergoing the endurance test, does not exhibit any tread separation, ply separation, cord separation, chunking or broken cords shall be deemed to have passed the test.

3.16.1.3. The outer diameter of the tyre, measured six hours after the load/speed endurance test, must not differ by more than 3.5 per cent from the outer diameter as measured before the test.

3.16.1.4. If the load/speed combination for the tyre is given in the table in Appendix 5, the endurance test prescribed in 3.16. above need not be carried out for load and speed values other than the nominal values.

3.16.1.5. Where application is made for the approval of a type of pneumatic tyre which has a load/speed combination in addition to the one that is subject to the variation of load with speed given in the table in Appendix 5, the endurance test prescribed in paragraph 3.16. above shall also be carried out on a second tyre of the same type at the additional load/speed combination.

3.16.2. Preparing the tyre

3.16.2.1. Mount a new tyre on the test rim specified by the manufacturer.

3.16.2.2. Use a new inner tube or combination of inner tube, valve and flap (as required) when testing tyres with inner tubes.

1/ From UN ECE Regulation 54

3.16.2.3. Inflate the tyre to the pressure corresponding to the pressure index specified by the manufacturer.

3.16.2.4. Condition the tyre-and-wheel assembly at test-room temperature for not less than three hours.

3.16.2.5. Readjust the tyre pressure to that specified in paragraph 3.16.2.3. above.

3.16.3. Test procedure

3.16.3.1. Mount the tyre-and-wheel assembly on the test axle and press it against the outer face of a smooth power-driven test drum 1.70 m ± 1 per cent in diameter having a surface at least as wide as the tyre tread.

3.16.3.2. Apply to the test axle a series of test loads expressed in per cent of the load carrying capacity of the tyre, in accordance with the test programme shown in 3.16.4.7. below. Where the tyre has load indices for both single and twinned utilization, the reference load for single utilization shall be taken as the basis for the test loads.

3.16.3.3. In the case of tyres with a speed symbol Q and above, test procedures are as specified in paragraph 3.16.4.

3.16.3.3.1. For all other tyre types, the endurance test programme is shown in paragraph 3.16.4.7.

3.16.3.4. The tyre pressure must not be corrected throughout the test and the test load must be kept constant throughout each of the three test stages.

3.16.3.5. During the test the temperature in the test-room must be maintained at between 20°C and 30°C or at a higher temperature if the manufacturer so agrees.

3.16.3.6. The endurance-test programme shall be carried out without interruption.

3.16.4. Load/speed test programme for tyre with speed symbol Q and above

3.16.4.1. This programme applies to:

3.16.4.1.1. all tyres marked with load index in single 121 or less.

3.16.4.1.2. tyres marked with load index in single 122 and above and with the additional marking "C", or "LT", referred to in paragraph 3.3.13. of this gtr.

3.16.4.2. Load placed on the wheel as a percentage of the load corresponding to the load index:

3.16.4.2.1. 90% when tested on a test drum 1.70 m ± 1 per cent in diameter;

3.16.4.2.2. 92% when tested on a test drum 2.0 m ± 1 per cent in diameter.

3.16.4.3. Initial test speed: speed corresponding to the speed symbol less 20 km/h;

3.16.4.3.1. Time to reach the initial test speed 10 min.

3.16.4.3.2. Duration of the first step = 10 min.

3.16.4.4. Second test speed: speed corresponding to the speed symbol less 10 km/h;

3.16.4.4.1. Duration of the second step = 10 min.

3.16.4.5. Final test speed: speed corresponding to the speed symbol:

3.16.4.5.1. Duration of the final step = 30 min.

3.16.4.6. Total test duration: 1 h.

3.16.4.7. Endurance test programme

Load index	Tyre speed symbol	Test-drum speed (min^{-1})	Load placed on the wheel as a percentage of the load corresponding to the load index		
			7 h.	16 h.	24 h.
122 or more	F	100	66%	84%	101%
	G	125			
	J	150			
	K	175			
	L	200			
	M	225			
121 or less	F	100			
	G	125			
	J	150			
	K	175			
	L	200	70%	88%	106%
			4 h.	6 h.	
	M	250	75%	97%	114%
	N	275	75%	97%	114%
	P	300	75%	97%	114%

3.17 Endurance Test for LT/C Tyres 1/

3.17.1. Requirements

3.17.1.1. When the tyre is tested in accordance with 3.17.3.:

(a) There shall be no visual evidence of tread, sidewall, ply, cord, belt or bead separation, chunking, open splices, cracking or broken cords.

(b) The tyre pressure, when measured at any time between 15 minutes and 25 minutes after the end of the test, shall not be less than 95% of the initial pressure specified in 3.17.2.1.

3.17.2. Preparation of tyre

3.17.2.1. Mount the tyre on a test rim and inflate it to the pressure specified for the tyre in the following table:

Light truck tyres with a nominal cross section ≤ 295 mm (11.5 inches)	
Tyre application	Test pressure (kPa)

1/ from FMVSS 139

Load Range C	260
Load Range D	340
Load Range E	410
Light truck tyres with a nominal cross section > 295 mm (11.5 inches)	
Load Range C	190
Load Range D	260
Load Range E	340

3.17.2.2. Condition the assembly at 35 ± 3°C for not less than 3 hours.

3.17.2.3. Readjust the pressure to the value specified in 3.17.2.1. immediately before testing.

3.17.3. Test Procedure

3.17.3.1. Mount the assembly on a test axle and press it against the outer face of a smooth wheel having a diameter of 1.70 m ± 1%.

3.17.3.2. During the test, the ambient temperature, at a distance of not less than 150 mm and not more than 1 m from the tyre, is maintained at 35 ± 3°C.

3.17.3.3. Conduct the test, without interruptions, at the test speed of not less than 120 km/h with loads and test periods not less than those shown in the following table. For snow tyres, conduct the test at not less than 110 km/h.

Test period	Duration (hours)	Load as a percentage of tyre maximum load rating
1	4	85
2	6	90
3	24	100

3.17.3.4. Throughout the test, the inflation pressure is not corrected and the test loads are maintained at the value corresponding to each test period, as shown in the table in 3.17.3.3.

3.17.3.5. Allow the tyre to cool for between 15 minutes and 25 minutes after running the tyre for the time specified in the table in 3.17.3.3., measure its inflation pressure. Inspect the tyre externally on the test rim for the conditions specified in 3.17.1.1.

3.18 Low Inflation Pressure Performance Test for LT/C Tyres (from FMVSS 139)

3.18.1. Requirements

3.18.1.1. When the tyre is tested in accordance with 3.18.3.:

(a) There shall be no visual evidence of tread, sidewall, ply, cord, innerliner, belt or bead separation, chunking, open splices, cracking, or broken cords, and

(b) The tyre pressure, when measured at any time between 15 minutes and 25 minutes after the end of the test, shall not be less than 95% of the initial pressure specified in 3.18.2.1.

3.18.2. Preparation of Tyre

3.18.2.1. This test is conducted following completion of the tyre endurance test using the same tyre and rim assembly tested in accordance with 3.17. with the tyre deflated to the following appropriate pressure:

Light truck tyres with a nominal cross section ≤ 295 mm (11.5 inches)	
Tyre application	Test pressure (kPa)
Load Range C	200
Load Range D	260
Load Range E	300
Light truck tyres with a nominal cross section > 295 mm (11.5 inches)	
Load Range C	150
Load Range D	200
Load Range E	260

3.18.2.2. After the tyre is deflated to the appropriate test pressure in 3.18.2.1. at the completion of the endurance test, condition the assembly at 35 ± 3°C for not less than 2 hours.

3.18.2.3. Before or after mounting the assembly on a test axle, readjust the tyre pressure to that specified in 3.18.2.1.

3.18.3. Test Procedure

3.18.3.1. The test is conducted for ninety minutes at the end of the test specified in 3.17., continuous and uninterrupted, at a speed of 120 km/h. For snow tyres, conduct the test at not less than 110 km/h.

3.18.3.2. Press the assembly against the outer face of a test drum with a diameter of 1.70 m ± 1%.

3.18.3.3. Apply to the test axle a load equal to 100% of the tyre's maximum load carrying capacity.

3.18.3.4. Throughout the test, the inflation pressure is not corrected and the test load is maintained at the initial level.

3.18.3.5. During the test, the ambient temperature, at a distance of not less than 150 mm and not more than 1 m from the tyre, is maintained at 35 ± 3°C.

3.18.3.6. Allow the tyre to cool for between 15 minutes and 25 minutes. Measure its inflation pressure. Then, deflate the tyre, remove it from the test rim, and inspect it for the conditions specified in 3.18.1.1.(a).

3.19 High Speed Performance Test for LT/C Tyres 1/

3.19.1. Requirements.

3.19.1.1. When the tyre is tested in accordance with 3.19.3.:

(a) There shall be no visual evidence of tread, sidewall, ply, cord, innerliner, belt or bead separation, chunking, open splices, cracking, or broken cords.

(b) The tyre pressure, when measured at any time between 15 minutes and 25 minutes after the end of the test, shall not be less than 95% of the initial pressure specified in 3.19.2.1

3.19.2. Preparation of tyre

3.19.2.1. Mount the tyre on a test rim and inflate it to the pressure specified for the tyre in the following table:

Light truck tyres with a nominal cross section ≤ 295 mm (11.5 inches)	
Tyre application	Test pressure (kPa)
Load Range C	320
Load Range D	410
Load Range E	500
Light truck tyres with a nominal cross section > 295 mm (11.5 inches)	
Load Range C	230
Load Range D	320
Load Range E	410

3.19.2.2. Condition the assembly at 35 ± 3°C for not less than 3 hours.

3.19.2.3. Before or after mounting the assembly on a test axle, readjust the tyre pressure to that specified in 3.19.1.1.

3.19.3. Test Procedure

1/ from FMVSS 139

3.19.3.1. Press the assembly against the outer face of a test drum with a diameter of 1.70 m ± 1%.

3.19.3.2. Apply to the test axle a load equal to 85% of the tyre's maximum load carrying capacity.

3.19.3.3. Break-in the tyre by running it for 2 hours at 80 km/h.

3.19.3.4. Allow tyre to cool to 38 °C and readjust inflation pressure to applicable pressure in 3.19.2.1. immediately before the test.

3.19.3.5. Throughout the test, the inflation pressure is not corrected and the test load is maintained at the value applied in 3.19.2.1.

3.19.3.6. During the test, the ambient temperature, measured at a distance of not less than 150 mm and not more than 1 m from the tyre, is maintained at 35 ± 3°C.

3.19.3.7. The test is conducted, continuously and uninterrupted, for ninety minutes through three thirty-minute consecutive test stages at the following speeds: 140, 150, and 160 km/h.

3.19.3.8. Allow the tyre to cool for between 15 minutes and 25 minutes. Measure its inflation pressure. Then, deflate the tyre, remove it from the test rim, and inspect it for the conditions specified in 3.19.1.1.(a).

3.20 Physical dimensions of LT/C tyres 1/

3.20.1. Requirements

3.20.1.1. The actual section width and overall width for each tyre measured in accordance with 3.20.3. shall not exceed the section width specified one of the publications described in 3.5.8. for its size designation and type by more than:

(a) For tyres with a maximum permissible inflation pressure of 32, 36, or 40 psi, 7 percent, or

(b) For tyres with a maximum permissible inflation pressure of 240, 280, 300, 340 or 350 kPa, 7 percent or 10 mm, whichever is larger.

3.20.2. Preparation of the tyre

3.20.2.1. Mount the tyre on the measuring rim specified by the tyre manufacturer or in one of the publications listed in paragraph 3.5.8.

3.20.2.2. Inflate the tyre to the pressure at maximum load as labelled on sidewall.

3.20.2.3. Condition the assembly at an ambient room temperature of 20 °C to 30 °C for not less than 24 hours.

3.20.2.4. Readjust the tyre pressure to that specified in 3.20.1.2.

1/ from FMVSS 139

3.20.3. Test Procedure

3.20.3.1. Measure the section width and overall width by caliper at six points approximately equally spaced around the circumference of the tyre, avoiding measurement of the additional thickness of the special protective ribs or bands. The average of the measurements so obtained is taken as the section width and overall width, respectively.

3.20.3.2. Determine the outer diameter by measuring the maximum circumference of the tyre and dividing the figure so obtained by Pi (3.1416).

3.21 Physical dimensions of LT/C tyres 1/

3.21.1. Requirements

3.21.1.1. Section width of a tyre

3.21.1.1.1. The section width shall be obtained by means of the following formula:

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

where:

S is the "section width" expressed in millimetres and measured on the measuring rim;

S_1 is "the nominal section width" in millimetres, as shown on the sidewall of the tyre in the tyre designation as prescribed;

A is the width of the measuring rim in millimetres, as shown by the manufacturer in the descriptive note; and

A_1 is the width of the theoretical rim in millimetres.

A_1 shall be taken to equal S_1 multiplied by the factor x as specified by the manufacturer, and K shall be taken to equal 0.4.

3.21.1.1.2. However, for the existing types of tyres whose designation is given in the first column of the tables in Appendix 7 to this Regulation, the section width shall be deemed to be that given opposite the tyre designation in those tables.

3.21.1.2. Outer diameter of a tyre

3.21.1.2.1. The outer diameter of a tyre shall be obtained by means of the following formula:

$D = d + 2H$

where:

D is the outer diameter expressed in millimetres;

1/ From UN ECE Regulation 54

d is the rim diameter, expressed in millimetres as shown in Appendix 3;

S_1 is the nominal section width in millimetres;

Ra is the nominal aspect ratio;

H is the nominal section height in millimetres and is equal to S_1 x 0.01Ra.

All as in the tyre designation shown on the sidewall of the tyre.

3.21.1.2.2. However, for the existing types of tyres whose designation is given in the first column of the tables in Appendix 7 to this Regulation, the outer diameter shall be deemed to be that given opposite the tyre designation in those tables.

3.21.1.3. Tyre section width specifications

3.21.1.3.1. The overall width of a tyre may be less than the section width or widths determined pursuant to paragraph 3.21.1.1. above.

3.21.1.3.2. It may exceed that value by 4 per cent. However, for tyres with nominal section width exceeding 305 mm intended for dual mounting (twinning), the value determined pursuant to paragraph 3.21.1.1. above shall not be exceeded by more than 2 per cent for tyres with nominal aspect ratio higher than 60.

3.21.1.4. Tyre outer diameter specifications

3.21.1.4.1. The outer diameter of a tyre must not be outside the values Dmin and Dmax obtained from the following formulae:

Dmin = d + (2H x a)

Dmax = d + (2H x b)

where:

3.21.1.4.2. For sizes listed in Appendix 7 the nominal section height H is equal to:

H = 0.5 (D-d) - for references see paragraph 3.21.1.5.

3.21.1.4.2.1. For other sizes, not listed in annex 5

"H" and "d" are as defined in paragraph 3.21.1.2.1.

3.21.1.4.2.2. Coefficients "a" and "b" are respectively:

3.21.1.4.2.2.1. Coefficient "a" = 0.97

3.21.1.4.2.2.2. Coefficient "b"

for normal use tyres	1.04
for special use tyres	1.06

3.21.1.4.2.2.3. For snow tyres the outer diameter (Dmax) established in conformity with the above may be exceeded by 1 per cent.

3.21.2. Test procedure

3.21.2.1. The tyre is mounted on the measuring rim specified by the manufacturer and inflated to the pressure corresponding to the pressure index specified by the manufacturer.

3.21.2.2. The tyre fitted on its rim is conditioned to the ambient temperature of the laboratory for at least 24 hours.

3.21.2.3. The pressure is readjusted to the value specified in paragraph 3.21.2.1. above.

3.21.2.4. The overall width is measured by caliper at six equally spaced points, account being taken of the thickness of the protective ribs or bands. The highest measurement so obtained is taken as the overall width.

3.21.2.5. The outer diameter is calculated from the maximum circumference.

Appendix 1

SPEED SYMBOL TABLE

Speed symbol	Corresponding 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
V	240
W	270
Y	300

Appendix 2

LOAD INDEX (LI) AND EQUIVALENT LOAD CAPACITY TABLE

LI	kg	LI	kg	LI	kg L	I	kg L	I	kg
0	45	27	97.5	54	212	81	462	108	1 000
1	46.2	28	100	55	218	82	475	109	1 030
2	47.5	29	103	56	224	83	487	110	1 060
3	48.7	30	106	57	230	84	500	111	1 090
4	50.0	31	109	58	236	85	515	112	1 120
5	51.5	32	112	59	243	86	530	113	1 150
6	53.0	33	115	60	250	87	545	114	1 180
7	54.5	34	118	61	257	88	560	115	1 215
8	56.0	35	121	62	265	89	580	116	1 250
9	58.0	36	125	63	272	90	600	117	1 285
10	60.0	37	128	64	280	91	615	118	1 320
11	61.5	38	132	65	290	92	630	119	1 360
12	63.0	39	136	66	300	93	650	120	1 400
13	65.0	40	140	67	307	94	670	121	1 450
14	67.0	41	145	68	315	95	690	122	1 500
15	69.0	42	150	69	325	96	710	123	1 550
16	71.0	43	155	70	335	97	730	124	1 600
17	73.0	44	160	71	345	98	750	125	1 650
18	75.0	45	165	72	355	99	775	126	1 700
19	77.5	46	170	73	365	100	800	127	1 750
20	80.0	47	175	74	375	101	825	128	1 800
21	82.5	48	180	75	387	102	850	129	1 850
22	85.0	49	185	76	400	103	875	130	1 900
23	87.5	50	190	77	412	104	900		
24	90.0	51	195	78	425	105	925		
25	92.5	52	200	79	437	106	950		
26	95.0	53	206	80	450	107	975		

Appendix 3

NOMINAL RIM DIAMETER CODE TABLE

Nominal rim diameter code ("d" symbol)	Value of the "d" symbol expressed in mm
8	203
9	229
10	254
11	279
12	305
13	330
14	356
14.5	368
15	381
16	406
16.5	419
17	432
17.5	445
18	457
19	482
19.5	495
20	508
20.5	521
21	533
22	559
22.5	572
23	584
24	610
24.5	622
25	635
26	660
28	711
30	762

Appendix 4

RELATION BETWEEN THE PRESSURE INDEX ('PSI') AND THE UNITS OF PRESSURE (kPa)

kPa	psi	kPa	psi	kPa	psi	kPa	psi
10	1	270	39	530	77	790	115
15	2	275	40	540	78	800	116
20	3	280	41	545	79	810	117
25	4	290	42	550	80	815	118
35	5	295	43	560	81	820	119
40	6	300	44	565	82	825	120
45	7	310	45	575	83	835	121
55	8	320	46	580	84	840	122
60	9	325	47	585	85	850	123
70	10	330	48	590	86	855	124
75	11	340	49	600	87	860	125
80	12	345	50	610	88	870	126
90	13	350	51	615	89	875	127
95	14	360	52	620	90	880	128
100	15	365	53	625	91	890	129
110	16	375	54	635	92	900	130
120	17	380	55	640	93	905	131
125	18	385	56	650	94	910	132
130	19	390	57	655	95	920	133
140	20	400	58	660	96	925	134
145	21	410	59	670	97	930	135
150	22	415	60	675	98	940	136
160	23	420	61	680	99	945	137
165	24	425	62	690	100	950	138
170	25	435	63	695	101	960	139
180	26	440	64	700	102	965	140
185	27	450	65	710	103	975	141
190	28	455	66	720	104	980	142
200	29	460	67	725	105	985	143
210	30	470	68	730	106	990	144
215	31	475	69	740	107	1 000	145
220	32	480	70	745	108	1 010	146
230	33	490	71	750	109	1 015	147
235	34	495	72	760	110	1 020	148
240	35	500	73	765	111	1 030	149
250	36	510	74	775	112	1 035	150
255	37	520	75	780	113	1 040	151
260	38	525	76	785	114	1 050	152

Appendix 5

VARIATION OF LOAD CAPACITY WITH SPEED COMMERCIAL VEHICLES TYRES

Variation of load capacity (per cent)										
Speed (km/h)	All load indices				Load indices ≥ 122 1/		Load indices ≤ 121 1/			
	Tyre speed symbol				Tyre speed symbol		Tyre speed symbol			
	F	G	J	K	L	M	L	M	N	P 2/
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 capacity indices refer to a single operation.

2/ Load variations are not allowed for speeds above 160 km/h. For tyre speed symbols "Q" and above the speed corresponding to the tyre speed symbol (Appendix 1) specifies the maximum speed permitted for the tyre.

Appendix 6

SPECIFICATIONS FOR THE ROLLING SOUND EMISSIONS TEST SITE

1. Introduction

This appendix describes the specifications relating to the physical characteristics and the laying of the test track. These specifications based on a special standard 1/ describe the required physical characteristics as well as the test methods for these characteristics.

2. Required characteristics of the surface

A surface is considered to conform to this standard provided that the texture and voids content or sound absorption coefficient have been measured and found to fulfil all the requirements of paragraphs 2.1. to 2.4. below and provided that the design requirements (para.3.2.) have been met.

2.1. Residual voids content

The residual voids content (VC) of the test track paving mixture shall not exceed 8 per cent. For the measurement procedure, see paragraph 4.1.

2.2. Sound absorption coefficient

If the surface fails to comply with the residual voids content requirement, the surface is acceptable only if its sound absorption coefficient $\alpha \leq 0.10$. For the measurement procedure, see paragraph 4.2. The requirement of paragraphs 2.1. and 2.2. is met also if only sound absorption has been measured and found to be $\alpha \leq 0.10$.

Note: The most relevant characteristic is the sound absorption, although the residual voids content is more familiar among road constructors. However, sound absorption needs to be measured only if the surface fails to comply with the voids requirement. This is motivated because the latter is connected with relatively large uncertainties in terms of both measurements and relevance and some surfaces therefore erroneously may be rejected when based only on the voids measurement.

1/ ISO 10844:1994. If a different test surface is defined, in the future, the reference standard will be amended accordingly.

2.3. Texture depth

The texture depth (TD) measured according to the volumetric method (see paragraph 4.3. below) shall be:

$TD \geq 0.4$ mm

2.4. Homogeneity of the surface

Every practical effort shall be taken to ensure that the surface is made to be as homogeneous as possible within the test area. This includes the texture and voids content, but it should also be observed that if the rolling process results in more effective rolling at some places than others, the texture may be different and unevenness causing bumps may also occur.

2.5. Period of testing

In order to check whether the surface continues to conform to the texture and voids content or sound absorption requirements stipulated in this standard, periodic testing of the surface shall be done at the following intervals:

(a) For residual voids content (VC) or sound absorption (α):

when the surface is new;

if the surface meets the requirements when new, no further periodical testing is required. If it does not meet the requirement when it is new, it may do later because surfaces tend to become clogged and compacted with time.

(b) For texture depth (TD):

when the surface is new;

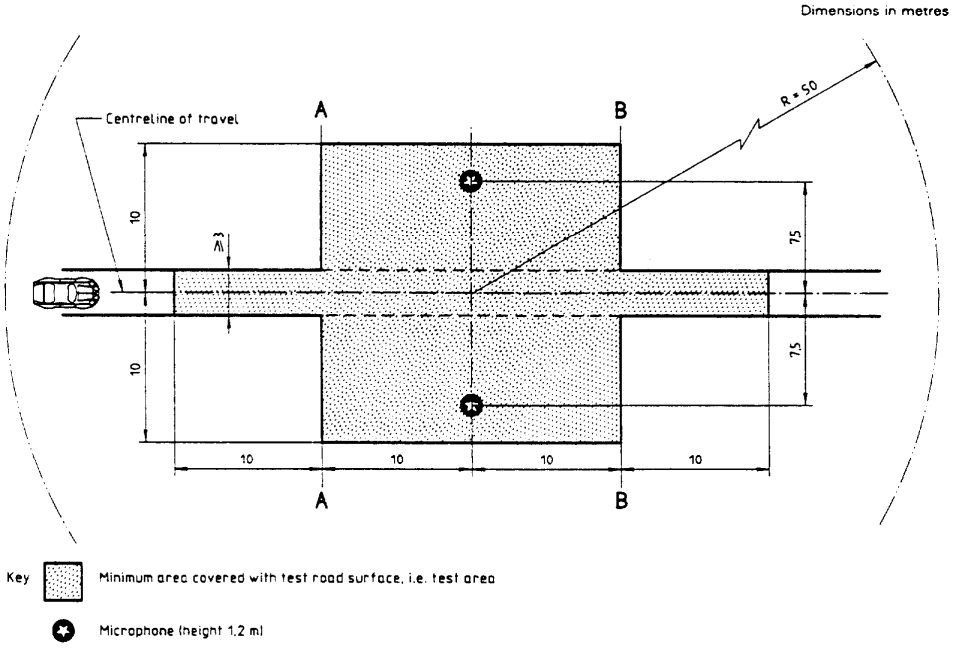
when the noise testing starts (NB: not before four weeks after laying);

then every twelve months.

3. Test surface design

3.1. Area

When designing the test track layout it is important to ensure that, as a minimum requirement, the area traversed by the vehicles running through the test strip is covered with the specified test material with suitable margins for safe and practical driving. This will require that the width of the track is at least 3 m and the length of the track extends beyond lines AA and BB by at least 10 m at either end. Figure 1 shows a plan of a suitable test site and indicates the minimum area which shall be machine laid and machine compacted with the specified test surface material. According to Annex 3, paragraph 3.2., measurements have to be made on each side of the vehicle. This can be made either by measuring with two microphone locations (one on each side of the track) and driving in one direction, or measuring with a microphone only on one side of the track but driving the vehicle in two directions. If the latter method is used, then there are no surface requirements on that side of the track where there is no microphone.



NOTE — There shall be no large acoustically reflective objects within this radius.

Figure 1: Minimum requirements for test surface area

The shaded part is called "Test Area".

3.2. Design and preparation of the surface

3.2.1. Basic design requirements

The test surface shall meet four design requirements:

3.2.1.1. It shall be a dense asphaltic concrete.

3.2.1.2. The maximum chipping size shall be 8 mm (tolerances allow from 6.3 mm to 10 mm).

3.2.1.3. The thickness of the wearing course shall be ≥ 30 mm.

3.2.1.4. The binder shall be a straight penetration grade bitumen without modification.

3.2.2. Design guidelines

As a guide to the surface constructor, an aggregate grading curve which will give desired characteristics is shown in Figure 2. In addition, Table 1 gives some guidelines in order to obtain the desired texture and durability. The grading curve fits the following formula:

$$P\ (\%\ passing) = 100 \times (d/d_{max})^{1/2}$$

where:

d = square mesh sieve size, in mm
d_{max} = 8 mm for the mean curve
= 10 mm for the lower tolerance curve
= 6.3 mm for the upper tolerance curve

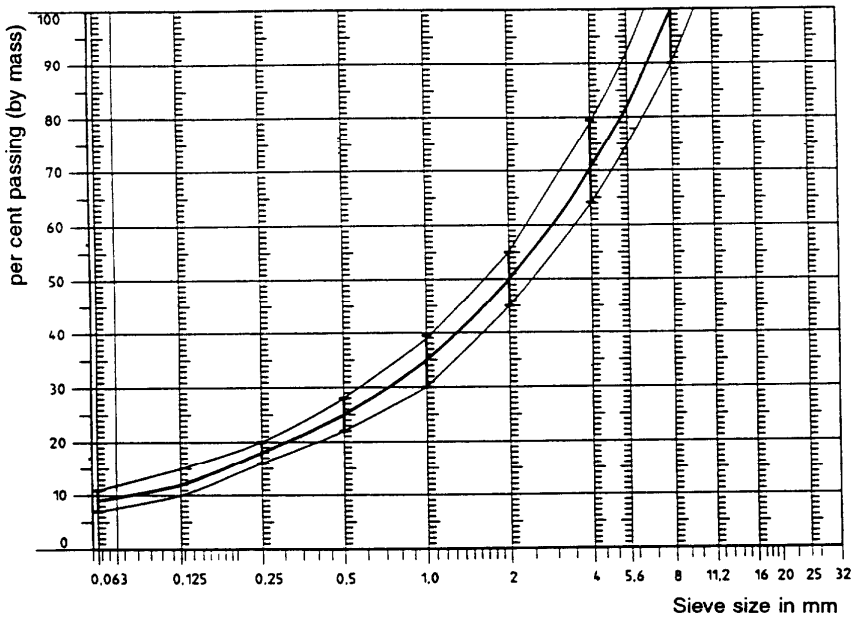


Figure 2: Grading curve of the aggregate in the asphaltic mix with tolerances.

In addition to the above, the following recommendations are given:

(a) The sand fraction (0.063 mm < square mesh sieve size < 2 mm) shall include no more than 55 % natural sand and at least 45 % crushed sand.

(b) The base and sub-base shall ensure a good stability and evenness, according to best road construction practice.

(c) The chippings shall be crushed (100 % crushed faces) and of a material with a high resistance to crushing.

(d) The chippings used in the mix shall be washed.

(e) No extra chippings shall be added onto the surface.

(f) The binder hardness expressed as PEN value shall be 40-60, 60-80 or even 80-100 depending on the climatic conditions of the country. The rule is that as hard a binder as possible shall be used, provided this is consistent with common practice.

(g) The temperature of the mix before rolling shall be chosen so as to achieve by subsequent rolling the required voids content. In order to increase the probability of satisfying the specifications of paragraphs 2.1. to 2.4. above, the compactness shall be studied not only by an appropriate choice of mixing temperature, but also by an appropriate number of passings and by the choice of compacting vehicle.

Table 1: Design guidelines

	Target values		Tolerances
	By total mass of mix	By mass of the aggregate	
Mass of stones, square mesh sieve (SM) > 2 mm	47.6 %	50.5 %	± 5
Mass of sand 0.063 < SM < 2 mm	38.0 %	40.2 %	± 5
Mass of filler SM < 0.063 mm	8.8 %	9.3 %	± 5
Mass of binder (bitumen)	5.8 %	N.A.	± 0.5
Max. chipping size	8 mm		6.3 - 10
Binder hardness	(see para. 3.2.2. (f))		
Polished stone value (PSV)	> 50		
Compactness, relative to Marshall compactness	98 %		

4. Test method

4.1. Measurement of the residual voids content

For the purpose of this measurement, cores have to be taken from the track in at least four different positions, which are equally distributed in the test area between lines AA and BB (see figure 1). In order to avoid inhomogeneity and unevenness in the wheel tracks, cores should not be taken in wheel tracks themselves, but close to them. Two cores (minimum) should be taken close to the wheel tracks and one core (minimum) should be taken approximately midway between the wheel tracks and each microphone location.

If there is a suspicion that the condition of homogeneity is not met (see paragraph 2.4.), cores shall be taken from more locations within the test area.

The residual voids content has to be determined for each core, then the average value from all cores shall be calculated and compared with the requirement of paragraph 2.1. In addition, no single core shall have a voids value, which is higher than 10 per cent.

The test surface constructor is reminded of the problem, which may arise when the test area is heated by pipes or electrical wires and cores must be taken from this area. Such installations must be carefully planned with respect to future core drilling locations. It is recommended to leave a few locations of size approximately 200 mm x 300 mm where there are no wires/pipes or where the latter are located deep enough in order not to be damaged by cores taken from the surface layer.

4.2. Sound absorption coefficient

The sound absorption coefficient (normal incidence) shall be measured by the impedance tube method using the procedure specified in ISO 10534-1:1996 or ISO 10534-2:1998.

Regarding test specimens, the same requirements shall be followed as regarding the residual voids content (see paragraph 4.1.). The sound absorption shall be measured in the range between 400 Hz and 800 Hz and in the range between 800 Hz and 1,600 Hz (at least at the centre frequencies of third octave bands) and the maximum values shall be identified for both of these frequency ranges. Then these values, for all test cores, shall be averaged to constitute the final result.

4.3. Volumetric macrotexture measurement

For the purpose of this standard, texture depth measurements shall be made on at least 10 positions evenly spaced along the wheel tracks of the test strip and the average value taken to compare with the specified minimum texture depth. See Standard ISO 10844:1994 for description of the procedure.

5. Stability in time and maintenance

5.1. Age influence

In common with any other surfaces, it is expected that the tyre rolling sound level measured on the test surface may increase slightly during the first 6 - 12 months after construction.

The surface will achieve its required characteristics not earlier than four weeks after construction. The influence of age on the noise from trucks is generally less than that from cars.

The stability over time is determined mainly by the polishing and compaction by vehicles driving on the surface. It shall be periodically checked as stated in paragraph 2.5.

5.2. Maintenance of the surface

Loose debris or dust, which could significantly reduce the effective texture depth must be removed from the surface. In countries with winter climates, salt is sometimes used for de-icing. Salt may alter the surface temporarily or even permanently in such a way as to increase noise and is therefore not recommended.

5.3. Repaving the test area

If it is necessary to repave the test track, it is usually unnecessary to repave more than the test strip (of 3 m width in figure 1) where vehicles are driving, provided the test area outside the strip met the requirement of residual voids content or sound absorption when it was measured.

6. Documentation of the test surface and of tests performed on it

6.1. Documentation of the test surface

The following data shall be given in a document describing the test surface:

6.1.1. The location of the test track.

6.1.2. Type of binder, binder hardness, type of aggregate, maximum theoretical density of the concrete (DR), thickness of the wearing course and grading curve determined from cores from the test track.

6.1.3. Method of compaction (e.g. type of roller, roller mass, number of passes).

6.1.4. Temperature of the mix, temperature of the ambient air and wind speed during laying of the surface.

6.1.5. Date when the surface was laid and contractor.

6.1.6. All or at least the latest test result, including:

6.1.6.1. the residual voids content of each core;

6.1.6.2. the locations in the test area from where the cores for voids measurements have been taken;

6.1.6.3. the sound absorption coefficient of each core (if measured). Specify the results both for each core and each frequency range as well as the overall average;

6.1.6.4. the locations in the test area from where the cores for absorption measurement have been taken;

6.1.6.5. texture depth, including the number of tests and standard deviation;

6.1.6.6. the institution responsible for tests according to paragraphs 6.1.6.1. and 6.1.6.2. and the type of equipment used;

6.1.6.7. date of the test(s) and date when the cores were taken from the test track.

6.2. Documentation of vehicle noise tests conducted on the surface

In the document describing the vehicle noise test(s) it shall be stated whether all the requirements of this standard were fulfilled or not. Reference shall be given to a document according to paragraph 6.1. describing the results which verify this.

Appendix 7

TYRE-SIZE DESIGNATIONS AND DIMENSIONS

Table A

CODE DESIGNATED SIZES MOUNTED ON 5° TAPERED RIMS OR FLAT BASE RIMS.

Tyre Size Designation (+)	Measuring Rim Width Code	Nominal Rim Diameter d (mm)	Outer Diameter D (mm)	Section Width S (mm)
			Radial	Radial
Std. series				
4.00R8 (*)	2.50	203	414	107
4.00R10(*)	3.00	254	466	108
4.00R12(*)	3.00	305	517	108
4.50R8 (*)	3.50	203	439	125
4.50R10(*)	3.50	254	490	125
4.50R12(*)	3.50	305	545	125
5.00R8 (*)	3.00	203	467	132
5.00R10(*)	3.50	254	516	134
5.00R12(*)	3.50	305	568	134
6.00R9	4.00	229	540	160
6.00R14C	4.50	356	626	158
6.00R16(*)	4.50	406	728	170
6.50R10	5.00	254	588	177
6.50R14C	5.00	356	640	170
6.50R16(*)	4.50	406	742	176
6.50R20(*)	5.00	508	860	181
7.00R12	5.00	305	672	192
7.00R14C	5.00	356	650	180
7.00R15(*)	5.00	381	746	197
7.00R16C	5.50	406	778	198
7.00R16	5.50	406	784	198
7.00R20	5.50	508	892	198
7.50R10	5.50	254	645	207
7.50R14C	5.50	356	686	195
7.50R15(*)	6.00	381	772	212
7.50R16(*)	6.00	406	802	210
7.50R17(*)	6.00	432	852	210
8.25R15	6.50	381	836	230
8.25R16	6.50	406	860	230
9.00R15	6.00	381	840	249
9.00R16(*)	6.50	406	912	246

Table B - TYRES FOR LIGHT COMMERCIAL VEHICLES

Tyre size designation	Measuring rim width code	Nominal rim diameter d (mm)	Outer diameter D (mm)	Section Width S (mm)
Metric Designated				
145 R 10 C	4.00	254	492	147
145 R 12 C	4.00	305	542	147
145 R 13 C	4.00	330	566	147
145 R 14 C	4.00	356	590	147
145 R 15 C	4.00	381	616	147
155 R 12 C	4.50	305	550	157
155 R 13 C	4.50	330	578	157
155 R 14 C	4.50	356	604	157
165 R 13 C	4.50	330	596	167
165 R 14 C	4.50	356	622	167
165 R 15 C	4.50	381	646	167
175 R 13 C	5.00	330	608	178
175 R 14 C	5.00	356	634	178
175 R 16 C	5.00	406	684	178
185 R 13 C	5.50	330	624	188
185 R 14 C	5.50	356	650	188
185 R 15 C	5.50	381	674	188
185 R 16 C	5.50	406	700	188
195 R 14 C	5.50	356	666	198
195 R 15 C	5.50	381	690	198
195 R 16 C	5.50	406	716	198
205 R 14 C	6.00	356	686	208
205 R 15 C	6.00	381	710	208
205 R 16 C	6.00	406	736	208
215 R 14 C	6.00	356	700	218
215 R 15 C	6.00	381	724	218
215 R 16 C	6.00	406	750	218
245 R 16 C	7.00	406	798	248
17 R 15 C	5.00	381	678	178
17 R 380 C	5.00	381	678	178
17 R 400 C	150 mm	400	698	186
19 R 400 C	150 mm	400	728	200
Code Designated				
5.60 R 12 C	4.00	305	570	150
6.40 R 13 C	5.00	330	648	172
6.70 R 13 C	5.00	330	660	180
6.70 R 14 C	5.00	356	688	180
6.70 R 15 C	5.00	381	712	180

Table C - TYRES FOR SPECIAL APPLICATIONS

Tyre size designation	Measuring rim width code	Nominal rim diameter d (mm)	Outer diameter D (mm)	Section Width S (mm)
Code Designated				
15x4 1/2R8	3.25	203	385	122
16x6R8	4.33	203	425	152
18x7	4.33	203	462	173
18x7R8	4.33	203	462	173
21x8R9	6.00	229	535	200
21x4	2.32	330	565	113
22x4 1/2	3.11	330	595	132
23x5	3.75	330	635	155
23x9R10	6.50	254	595	225
25x6	3.75	330	680	170
27x10R12	8.00	305	690	255
28x9R15	7.00	381	707	216
Metric designated				
200R15	6.50	381	730	205
250R15	7.50	381	735	250
300R15	8.00	381	840	300

Table D - TYRES WITH LT DESIGNATION

Tolerances shown at the bottom of the tables apply in place of those shown in paragraph 3.21.1.

Outer diameters are listed for the various categories of use: Normal, Snow, Special.

Tyre size designation	Measuring rim width code	Nominal rim diameter d(mm)	Outer diameter D (mm) 1/		Section width S (mm) 2/
			Normal	Snow	
6.00R16LT	4.50	406	732	743	173
6.50R16LT	4.50	406	755	767	182
6.70R16LT	5.00	406	722	733	191
7.00R13LT	5.00	330	647	658	187
7.00R14LT	5.00	356	670	681	187
7.00R15LT	5.50	381	752	763	202
7.00R16LT	5.50	406	778	788	202
7.10R15LT	5.00	381	738	749	199
7.50R15LT	6.00	381	782	794	220
7.50R16LT	6.00	406	808	819	220
8.25R16LT	6.50	406	859	869	241
9.00R16LT	6.50	406	890	903	257
G78R15LT	6.00	381	711	722	212
H78R15LT	6.00	381	727	739	222
L78R15LT	6.50	381	749	760	236
L78R16LT	6.50	406	775	786	236
7R14.5LT 3/	6.00	368	677		185
8R14.5LT 3/	6.00	368	707		203
9R14.5LT 3/	7.00	368	711		241
7R17.5LT	5.25	445	758	769	189
8R17.5LT	5.25	445	788	799	199

1/ Coefficient "b" for the calculation of Dmax: 1.08.

2/ Overall width may exceed this value up to +8 per cent.

3/ The suffix "MH"' may replace "LT" in the tyre size designation (e.g. 7R14.5 MH).

Table E - HIGH FLOTATION LT TYRES

Tyre size designation	Measuring rim width code	Nominal rim diameter d (mm)	Outer diameter D (mm) 1/		Section width S (mm) 2/
			Normal	Snow	
9R15LT	8.00	381	744	755	254
10R15LT	8.00	381	773	783	264
11R15LT	8.00	381	777	788	279
24x7.50R13LT	6	330	597	604	191
27x8.50R14LT	7	356	674	680	218
28x8.50R15LT	7	381	699	705	218
29x9.50R15LT	7.5	381	724	731	240
30x9.50R15LT	7.5	381	750	756	240
31x10.50R15LT	8.5	381	775	781	268
31x11.50R15LT	9	381	775	781	290
31x13.50R15LT	11	381	775	781	345
31x15.50R15LT	12	381	775	781	390
32x11.50R15LT	9	381	801	807	290
33x12.50R15LT	10	381	826	832	318
35x12.50R15LT	10	381	877	883	318
37x12.50R15LT	10	381	928	934	318
37x14.50R15LT	12	381	928	934	372
8.00R16.5LT	6.00	419	720	730	203
8.75R16.5LT	6.75	419	748	759	222
9.50R16.5LT	6.75	419	776	787	241
10R16.5LT	8.25	419	762	773	264
12R16.5LT	9.75	419	818	831	307
30x9.50R16.5LT	7.50	419	750	761	240
31x10.50R16.5LT	8.25	419	775	787	266
33x12.50R16.5LT	9.75	419	826	838	315
37x12.50R16.5LT	9.75	419	928	939	315
37x14.50R16.5LT	11.25	419	928	939	365
33x9.50 R15LT	7.50	381	826	832	240
35x12.50 R16.5LT	10.00	419	877	883	318
37x12.50 R17LT	10.00	432	928	934	318

1/ Coefficient 'b' for the calculation of Dmax: 1.07.

2/ Overall width may exceed this value up to +7 per cent.

Appendix 8

TEST REPORT – ROLLING SOUND EMISSIONS FOR TYRES

Part 1 - Report

Name of Testing Organization: …….....……

Name and address of applicant: ……..... .....

……..

Test report No.: ……

Manufacturer and Brand Name or Trade description: …….

Tyre Class (C1 or C2 or C3): ……..

Category of use: ……

Sound level according to paragraphs. 3.8.6.11. and 3.8.6.12. of this gtr: ……dB(A)
at reference speed of 70/80 km/h 1/

Comments (if any): ……

Date: ……..

Signature: …….

Part 2 - Test data

Date of test: ……..

Test vehicle (Make, model, year, modifications, etc.): …….

…….....

Test vehicle wheelbase: ……..mm

Location of test track: …….….

Date of track certification to ISO 10844:1994: .....

Issued by: .....

Method of certification: ……..

Tyre test details: ……

Tyre size designation: .....

Tyre service description: .....

Reference inflation pressure: .....

Test data

	Front left	Front right	Rear left	Rear right
Test mass (kg)				
Tyre load index (%)				
Inflation pressure (cold) (kPa)				

Test rim width code: .....

Temperature measurement sensor type: .....

Valid Test results:

Run No.	Test Speed km/h	Direction of run	Sound level left 2/ measured dB(A)	Sound level right 2/ measured dB(A)	Air temp. °C	Track temp °C	Sound level left 2/ temp. corrected dB(A)	Sound level right 2/ temp. corrected dB(A)	Comments
1									
2									
3									
4									
5									
6									
7									
8									

Regression line slope: .....

Sound level after temperature correction according to paragraph 3.8.6.10: ……dB(A)

_____

1/ Strike out what does not apply.
2/ Relative to the vehicle.

Appendix 9

TEST REPORT - ADHESION ON WET SURFACE

Part 1 – Report

Name of Testing Organization: .....

Name and address of applicant: .....

Test report No.: .....

Manufacturer and brand name or trade description: .....

Tyre Class (C1): .....

Category of use: .....

Adhesion coefficient on wet surfaces relative to SRTT according to paragraphs 3.12.3.1.2.15. or 3.12.3.2.2.14.:

Comments (if any): .....

Date: .....

Signature: .....

Part 2 - Test data

Date of test: .....

Test vehicle (make, model, year, modifications, etc. or trailer identification): .....

Location of test track: .....

Test track characteristics: .....

Issued by: .....

Method of certification: .....

Test tyre details: .....

Tyre size designation and service description: .....

Tyre brand and trade description: .....

Reference inflation pressure: kPa .....

Test data: .....

Tyre	SRTT	Candidate	Control
Test tyre load (kg)			
Water depth (mm) (from 0.5 to 1.5 mm)			
Wetted track temperature average (^{o}C) (from 5 to 35 °C)			

Test rim width code: .....

Temperature measurement sensor type: .....

Identification of the SRTT: .....

Valid test results: .....

Run No	Test Speed (Km/h)	Direction of run	SRTT	Candidate tyre	Control tyre	Peak brake force coefficient (pbfc)	Mean fully developed deceleration (mfdd)	Wet Grip index (G)	Comments
1									
2									
3									
4									
5									
6									
7									
8									

Appendix 10

TYRE STANDARDS ORGANISATIONS

The Tire and Rim Association, Inc. (TRA)
The European Tyre and Rim Technical Organisation (ETRTO)
The Japan Automobile Tyre Manufacturers' Association (JATMA)
The Tyre and Rim Association of Australia (TRAA)
South Africa Bureau of Standards (SABS)
China Association for Standardization (CAS)
Indian Tyre Technical Advisory Committee (ITTAC)
International Standards Organisation (ISO)