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DRAFT – 3 SEPTEMBER 2008

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

Transmitted by the Experts from the ETRTO, JATMA, and RMA

Note: The text reproduced below was prepared by the experts from the European Tyre and Rim Technical Organisation (ETRTO), Japan Automobile Tyre Manufacturers Association (JATMA), and the Rubber Manufacturers Association (RMA) on behalf of the informal group on tyres in charge of developing a draft global technical regulation (gtr).

STATEMENT OF TECHNICAL RATIONALE AND JUSTIFICATION

following is Sample Statement of Technical Rationale and Justification

SAMPLE ONLY DETAILS DO NOT APPLY TO TYRE GTR

1. Technical and economic feasibility

To be completed.

2. Anticipated benefits

To be completed.

3. Potential cost effectiveness.

To be completed.

Global Technical Regulation
For
Passenger and Light Truck (Commercial) Tyres

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FOR PASSENGER AND LIGHT TRUCK (COMMERCIAL) VEHICLES

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* * *

1. INTRODUCTION

This global technical regulation (gtr) is promulgated under the WP.29, 1998 Agreement and is formulated on the basis of requirements which are considered to be mandatory in those territories that require the gtr mark. [This current document addresses radial passenger tyres only. A future, second part will address commercial and light truck tyres.]

2. SCOPE

This global technical regulation (gtr) specifies performance, dimensional and marking requirements of new radial passenger car tyres*, excluding high pressure temporary use spare tyres.

**Passenger car tyres, as used in the above statement, means a tyre specified in the "passenger car tyre" section of one of the international tyre standards.*

3 DEFINITIONS

For the purpose of this regulation the following definitions apply:

"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;

"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;

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

"Bias-belted tyre" means a pneumatic tyre structure of bias ply (diagonal) type in which the carcass is restrained by circumferential belts comprised of two or more layers of substantially inextensible cord material;

"Bias ply tyre (diagonal or cross ply)" means a pneumatic tyre structure in which the ply cords that extend to the beads are laid at alternate angles substantially less than 90^{o} to the centreline of the tread;

"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");

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

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

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

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

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

"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;

"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;

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

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

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

"Light Truck (Commercial) tyre" means a tyre of a group prescribed in the Light Truck or "C" Commercial tyre section of the standards manual from European Tyre and Rim Technical Organisation, the Japan Automobile Tyre Manufacturers Association, the Tire and Rim Association, etc;

"Load index" means a code number indicating the reference mass (subsequently referred to as "load capacity") a tyre can support under specific, industry standardized, operating conditions (see next paragraph "load capacity variation with speed" below and appendix 2 "load index and equivalent load capacity table" to this regulation). Light Truck tyres designed for fitting in dual formation (twinning) specify two load indices as shown in the second example in the "service description" paragraph, the first related to single formation fitting and the second to dual formation fitting;

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

"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;

"Maximum load rating" means the Load Capacity Index;

"Measuring rim" means an actual rim, on which the tyre is fitted for measuring the physical dimensions;

"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);

"Nominal section width" shall be indicated in millimeters, 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";

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

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

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

"Passenger tyre" means a tyre of a group prescribed in the passenger tyre section of the standards manuals from European Tyre and Rim Technical Organisation, the Japan Automobile Tyre Manufacturers Association, the Tire and Rim Association, etc;

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

"Ply separation" means a parting of adjacent plies;

"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;

"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;

"PSI index" is a code identifying the inflation pressure which may be used during testing of tyres;

"Radial ply tyre" means a pneumatic tyre structure in which the ply cords that extend to the beads are laid at substantially 90^{o} to the centreline of the tread, the carcass being restrained by circumferential belts of 2 or more layers of substantially inextensible cord material;

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

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

are seated;

"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";

"Run flat tyre" means a tyre which is specifically designed to allow limited use under restricted conditions following loss of inflation pressure. These tyres may be marked with a symbol indicating the performance prescribed by ISO 16992 (SUSE);

"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 mi) when operating in flat tyre running mode.

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

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

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

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

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

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

"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 labeled on at least one sidewall with the letters "M" and "S" (e.g., MS, M/S, M&S, M+S, etc.);

"Snow tyre for use in severe snow conditions" distinguished by 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 1136 standard reference test tyre (SRTT). An example of the symbol is shown below;

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

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

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

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

"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;

"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;

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

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

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

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

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

"T-type temporary use spare tyre" means a temporary use spare tyre designed for use at inflation pressures higher than those established for customary passenger tyres;

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

"Tyre size designation" means a combination of letters, numbers and symbols which uniquely identify the geometric size of the tyre.

* * *

4. REQUIREMENTS

4.1 **Plant Code Registration** *[US NHTSA is willing to continue to provide this service.]*

4.1.1 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

4.1.2 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:

a. The name or other designation identifying the applicant, and its main office address.

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

c. 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.

* * *

4.2 Marking (Labeling)

4.2.1 GTR Identification Format:

4.2.2 Certification and Approval Marks: Contracting Parties to the 1998 Agreement shall accept either manufacturer self-certification or government type approval to indicate compliance with the three modules shown in the table below. As the name implies the compulsory module is mandatory among all Contracting Parties. Modules "**A**" and "**B**" are optional at the discretion of the Contracting Party. To qualify as a "global tyre", the candidate tyre must comply with all the requirements of the compulsory plus modules "**A**" and "**B**".

Modules

Compulsory	**Module A**
• Physical dimensions • Required markings • High-speed Test • Endurance Test/Low Pressure Test • Wet Grip Test • [Run-flat Assessment Test for RF marked tyres]	• Bead Unseating Test • Plunger Energy Test
	Module B • Rolling Sound Emissions Test

4.2.3 Tyres that fully meet the requirements of all three modules (compulsory, A, and B) are eligible to carry the Global Tyre pictogram shown below. *[For now "G" is shown just as a sample.]*

G

The Global Tyre pictogram or mark can be used in conjunction with either "manufacturer self-certification" or government "type approval". For Contracting Parties requiring type approvals, the country granting type approval will be indicated via use of a subscript symbol (can be two digits) following the "G" pictograph as shown below.

G_4

For type approval granting countries, the subscript numbers will remain the same as presently assigned under the 1958 Agreement. Countries that are not members of the 1958 Agreement, but require type approval, will be given a 1998 Agreement number that

is different from any of the numbers already assigned for use within the 1958 Agreement context. The WP 29 Secretariat will assign and maintain the record of any non-'58 agreement numbers that may be assigned to 1998 Agreement Contracting Parties. For self certification, no country code will be used.

4.2.4 Tyres that meet the requirement of the compulsory module plus modules "A" or "B", but not both "A" and "B", are regional tyres and shall be marked on the sidewall with the regional pictograph shown below. *[For now "R" is shown as an example only.]*

R

All regional tyres must comply with the compulsory module. Moreover, in order to identify if they also comply with either module "A" or "B", the "R" mark may contain a superscript of either an "A" or a "B" as shown below.

R^{A} R^{B}

Regional tyres can also be certified via either manufacturer self-certification or government type approval. In the case of type approval, the approval granting country's identification number will be shown as a subscript to the "R" mark. For countries requiring type approval, the subscript number will be the same as assigned to them under the 1958 Agreement, or if they are not a signatory to the 1958 Agreement, then a number (different from any assigned under the 1958 Agreement) will be assigned to them by the WP 29 Secretariat. An example of the regional mark showing both an optional compliance (Module "A") and a type approval country mark ("4" for the Netherlands) is shown below.

R^{A}_{4}

4.2.5 The certification marks ("G" = global or "R" = regional) as described above will be located as shown in the following table. Together this data will form the GTR identification format. The table below shows the format with the component parts. Each character in the GTR Identification Format shall be: for the approval number not less that 4mm height, and for all other symbols not less than 6 mm in height.

GTR Identification Format

XXXXXXX_G_4_YYY_MMMMMMMM_DDDD

XXXXXXX	Type Approval Number *[7 digits]*
G_4 (R_4)	New GTR Global or Regional Pictograms **With optional country code subscript** *[Actual pictograms TBD]*
YYY	Plant Code *[increased from 2 to 3 digits]*
MMMMMMMM	Manufacturer's Code *[Combines current size and type codes]*
DDDD	Four Digit Date Code
_	Space *[6mm – 12mm]*

4.2.5.1 In the table above the **"G_4"** represents the new global mark with a type approval country code that identifies the country authorizing the approval. As noted above, the subscript number (which can be two digits) is not required for manufacturer self certification. *[Actual "G" and "R" marks to be determined by GRRF AC.3 Executive Committee]*.

4.2.5.2 The **"XXXXXXX"** is the universal approval number (7 digits proposed); self certification will use all '0's.

4.2.5.3 The **"YYY"** is the universal plant code for place of manufacture of the tyre. *[Plan is to change current NHTSA assigned 2 digit plant codes to 3 digits. One symbol, "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. Existing plant code holders will have 5 years to phase-in new 3-symbol (may appeal for longer period if justified). It is expected that US NHTSA will continue to assign global plant codes.]*

4.2.5.4 The **"MMMMMMMM"** is an [8] digit manufacturer's code. Within the GTR identification format, this will be an [8] digit required field, but the content is up to the tyre manufacturer. *[This field replaces the size code field and the optional type code field that is part of the US NHTSA Tyre Identification Number (TIN). The US is receptive to this revised format for the manufacturers to use at their discretion.]*

4.2.5.5 The **"DDDD"** represents the week and year of manufacture. 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 may 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.

4.2.5.6 The "_" is a space is not less than 6mm nor greater than 12mm.

4.2.6 GTR Identification Location: Must be located on the intended outboard sidewall of the tyre, and positioned between the bead and [ ] the distance from the bead to the tread. On the other sidewall of the tyre either a GTR identification or a partial GTR identification is required. A partial GTR identification is comprised of all characters except the type approval number and date code.

4.2.7 Below is a table showing all the possible options for the GTR Identification Format as discussed above (note the country code of "4" was used just as an example and will change with country issuing the type approval).

GTR Identification Format						
	Type Approval Number	**Pictogram**	**Plant Code**	**Manufacturer Code**	**Date Code**	**Global or Regional**
Self Certification	0000000	G	YYY	MMMMMMMM	DDDD	Global Tyre (All Modules)
	0000000	R	YYY	MMMMMMMM	DDDD	Regional Tyre – Mandatory Only
	0000000	R^A	YYY	MMMMMMMM	DDDD	Regional Tyre – Mandatory + A
	0000000	R^B	YYY	MMMMMMMM	DDDD	Regional Tyre – Mandatory + B
Type Approval	1234567	G_4	YYY	MMMMMMMM	DDDD	Global Tyre (All Modules)
	1234567	R_4	YYY	MMMMMMMM	DDDD	Regional Tyre – Mandatory Only
	1234567	$R^A{}_4$	YYY	MMMMMMMM	DDDD	Regional Tyre – Mandatory + A
	1234567	$R^B{}_4$	YYY	MMMMMMMM	DDDD	Regional Tyre – Mandatory + B

Notes:

1. While there is no universal approval number for self certification, the data field is to be completed with "0000000".
2. The content of the manufacturer's code is optional, but the data field is not.
3. Symbols **to be used** in the gtr identification 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".
4. Symbols that **may NOT be used** are:
   "G, I, O, Q, S, and Z".

4.2.8 Other (non GTR Certification) Sidewall Marking (Labeling)

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

in the case of symmetrical tyres on both sidewalls;

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

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.

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

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

4.2.8.1.3 The tyre designation comprising:

- the tyre size designation including an indication of the tyre structure;

  "**R**" for Radial construction

  "**RF**" for run flat tyre

- the service description (Load index and Speed symbol)
- an identification of the tyre to rim fitment configuration when it differs from the standard configuration.

The characters shall be not less than 6 mm high;

4.2.8.1.4 Each tyre must be labeled on the other side (from that directed in 4.2.7.2 above) with the same information except for the date code and, at the discretion of the manufacturer, any optional code on the other sidewall.

4.2.8.1.5 For radial ply 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.

4.2.8.1.6 Each tyre must be labeled with its maximum permissible inflation pressure. For standard load and light load tyres: 240 kPa (35 psi), 300 kPa (44 psi) or 350 kPa (51 psi). For reinforced or extra load tyres: 280 kPa (41 psi) or 340 kPa (50 psi).

4.2.8.1.7 Each tyre must be labeled with its maximum load rating, in kilograms (lbs), pursuant to the maximum permissible inflation pressure in the preceding paragraph 4.2.7.5 above.

4.2.8.1.8 The word "REINFORCED", or "EXTRA LOAD", or "LIGHT LOAD", if applicable, in characters not less than 4 mm high;

4.2.8.1.9 The word "TUBETYPE", if applicable, in characters not less than 4 mm high;

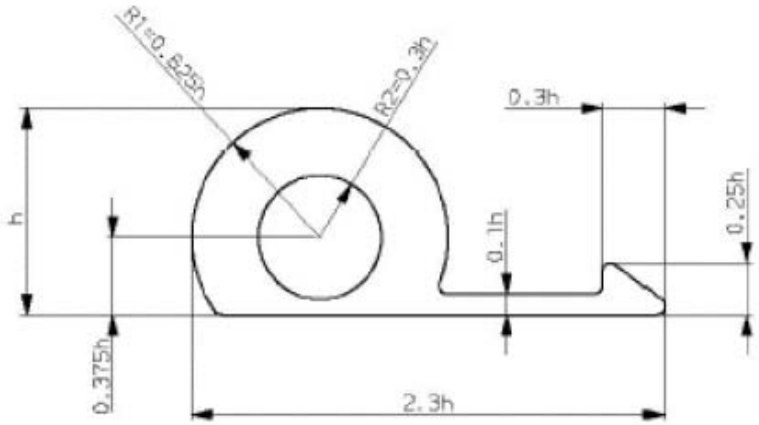
4.2.8.1.10 The inscription "M+S", "M.S.", "M&S", "M-S", or "M/S", in characters not less than

4 mm high, if the tyre is a snow tyre.

4.2.8.1.11 Three-peaked mountain snowflake symbol: 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.

4.2.8.1.12 Run flat marking

4.2.8.1.13 The symbol below if the tyre is a "run flat" or "self supporting" tyre, and run flat performance requirements are met (ref. ISO 16992), where "h" is at least 12 mm.



* * *

4.3. Treadwear Indicators

4.3.1 Except as noted below, each passenger 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.

4.3.2 For passenger 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.

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

* * *

4.4 Physical Dimensions of Radial Pneumatic Tyres

4.4.1 Introduction

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

4.4.2 Definitions (see section 3 of the main document for detailed definitions of various terms)

4.4.3 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, but excluding rim protectors.

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

4.4.3.2 The section width of the tyre is its width at the widest point excluding any markings, protective ribs or rim protectors.

4.4.3.3 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 4000-1, and K shall be taken to equal 0.4.

1/2/ When the conventional number is given by codes, the value in millimetres is obtained by multiplying the code number by 25.4.

4.4.3.4 Outer diameter of tyre

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

D = d + 2H, where:

D is the theoretical outer diameter in millimetres,

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.

4.4.4 Physical Dimensions Measurement Method

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

4.4.4.2 Adjust the pressure according to the following table:

	Radial and Run-flat tyres
Standard Load, Light Load	180 kPa
Reinforced or Extra Load	220 kPa

4.4.4.3 Condition the tyre, mounted on its rim, at the ambient room temperature between 18°C and 36°C for not less than 24 hours.

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

4.4.4.5 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.

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

4.4.4.7 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

1/2/ When the conventional number is given by codes, the value in millimetres is obtained by multiplying the code number by 25.4.

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.

4.4.5 Physical Dimension Tolerances

4.4.5.1 Overall width

The tyre overall width may exceed the theoretical section width defined in paragraph 4.4.3.3 above by the following percentages:

in radial and run flat tyres: 4%
In addition, for tyres with protective ribs, the overall width may exceed the values shown above by an additional 8 mm.

4.4.5.2 Outer diameter

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

$$Dmin = d + (2H \cdot a)$$
$$Dmax = d + (2H \cdot b)$$

where:

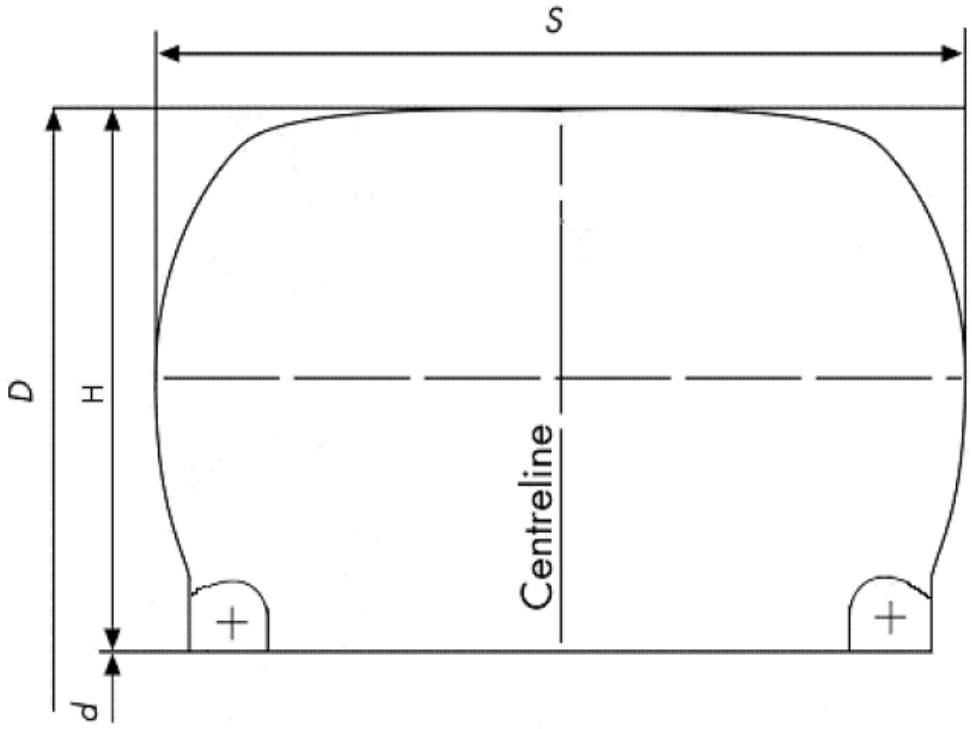
the coefficients "a" and "b" are:

coefficient "a" = 0.97

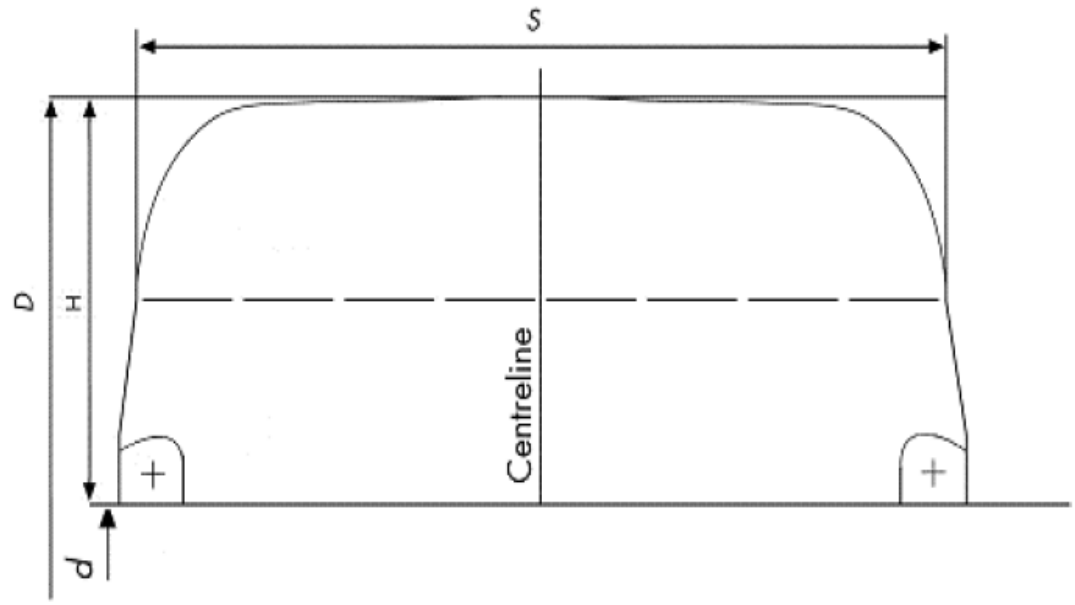
coefficient "b" = 1.04 for normal (road type) radial and run-flat tyres

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

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



4.4.5.4 Figure 2: Drawing of tyre with rim protector showing rim diameter (d), outside diameter (D), sidewall height (H) and section width (S).



4.4.5.5 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 following organizations and which were current either at the date of manufacture of the tyre or at any later date:

The Tire and Rim Association, Inc.
The European Tyre and Rim Technical Organisation
The Japan Automobile Tyre Manufacturers' Association
The Tyre and Rim Association of Australia
[Associação Latino Americana de Pneus e Aros]
South Africa Bureau of Standards

* * *

4.5 **Strength Test**

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

Size Designation		Maximum Permissible Inflation (kPa)				
		240	280	300	340	350
Below 160 mm	joules……	220	441	220	441	220
	in-lbs.....	1,950	3,900	1,950	3,900	1,950
160 mm or above	Joules…….	294	588	294	589	294
	In-lbs……..	2,600	5,200	2,600	5,200	2,600

STRENGTH TEST PROCEDURE – PASSENGER TYRES

***(NOTE:** ASTM International has published ASTM F 414-06 titled "Standard Test Method for Energy Absorbed by a Tyre When Deformed by Slow-Moving Plunger", which may be helpful for certain conditions when conducting this test. However, F 414 is currently being balloted for final approval. Reference to or adoption of the ASTM procedures should be delayed until the final update is complete.)*

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

Test Type	Passenger Tyres				
	kPa				
	240	280	300	340	350
Tyre Strength	**180**	**220**	**180**	**220**	**180**

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

4.5.4. Re-adjust the tyre pressure to that specified in the previous table above (4.5.2);

4.5.5 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.;

4.5.6 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 the following paragraph (4.5.7) below. If the tyre fails to break before plunger is stopped on reaching the rim and the required minimum breaking energy is not achieved, then the required minimum breaking energy is deemed to have been achieved at that point.

4.5.7. 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, inch-pounds;
F = Force, pounds; and
P = Penetration, inches.

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

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

* * *

4.6 Tubeless Tyre Bead Unseating Resistance Test

4.6.1 Requirements

The following requirements apply to all radial ply tyres using the blocks referred to in the test procedure described in this section.

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

4.6.1.2 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

4.6.2 Preparation of tyre

[The figures and information below are from ASTM F 2663-07a, Bead Unseating of Tubeless Tyres for Motor Vehicles with GVWR of 4536 kg (10,000 lb) or less.]

4.6.2.1 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.

4.6.2.2 Inflate the tyre to the pressure specified in the table shown below:

Test Type	Passenger Tyres				
	kPa				
	240	280	300	340	350
Bead Unseat Test Pressure	**180**	**220**	**180**	**220**	**180**

4.6.3 Test Procedure

4.6.3.1 Mount the assembly on a fixture as shown in Figures 1, below.

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

4.6.3.3 NOTE: Use the lower of the "A" dimensions published in Table 1 List of "A" Dimensions, or the "A" dimension derived from the following formula :

A=0.75 X [0.5(OD – RD)] + 0.5RD

Where:

OD = tyre outer diameter or nominal diameter from applicable standard

RD = nominal rim diameter

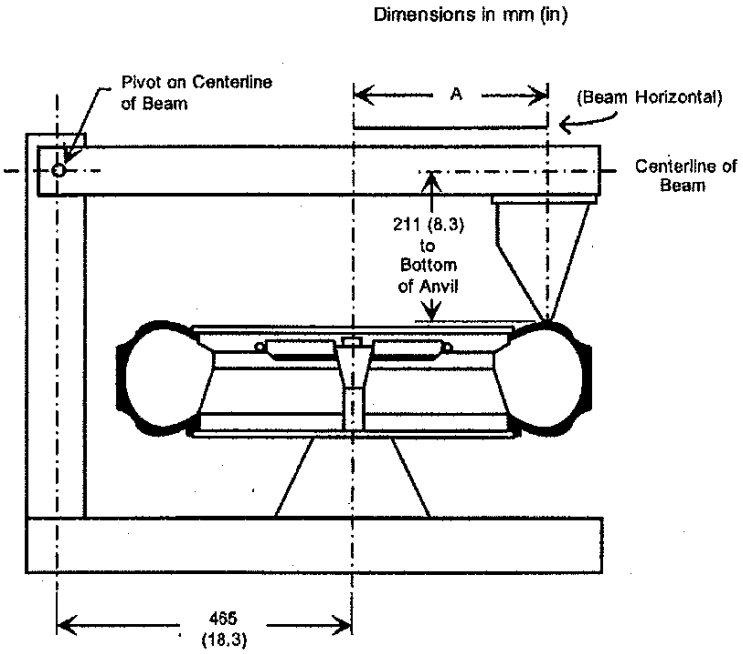
Note: The tolerance for the "A" dimension (calculated or listed in the table) is +/- 1.5 mm (0.06 in.).

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

4.6.3.5 Increase the force until the bead unseats or until the prescribed value is reached.

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

Figure 1 right
Bead unseating fixture



Recommended Block	Rim Size		"A" Dimension	
	Diameter Code	mm	Inch	mm
2C	30		18.5	470
2C	29		18.0	458
2C	28		17.5	445
2C	27		17.0	432
2C	26		16.5	420
2C	25		16.0	406
2B	24		15.5	394
2B	23		15.0	381
2B	22		14.5	368
2B	21		14.0	356
2B	20		13.5	343
2B	19		13.0	330
2A	18		12.5	318
2A	17		12.0	305
2A	16		11.5	292
2A	15		11.0	279
2A	14		10.5	267
2A	13		10.0	254
2A	12		9.5	241
2A	11		9.0	229
2A	10		8.5	216
2A		415	11.5	292
2A		390	11.0	279
2A		370	10.0	254
2A		365	9.8	248
2A		345	9.3	235
2A		340	9.0	229
2A		320	8.5	216
2A		315		
2A		290		

Table 1 above: List of "A" Dimensions

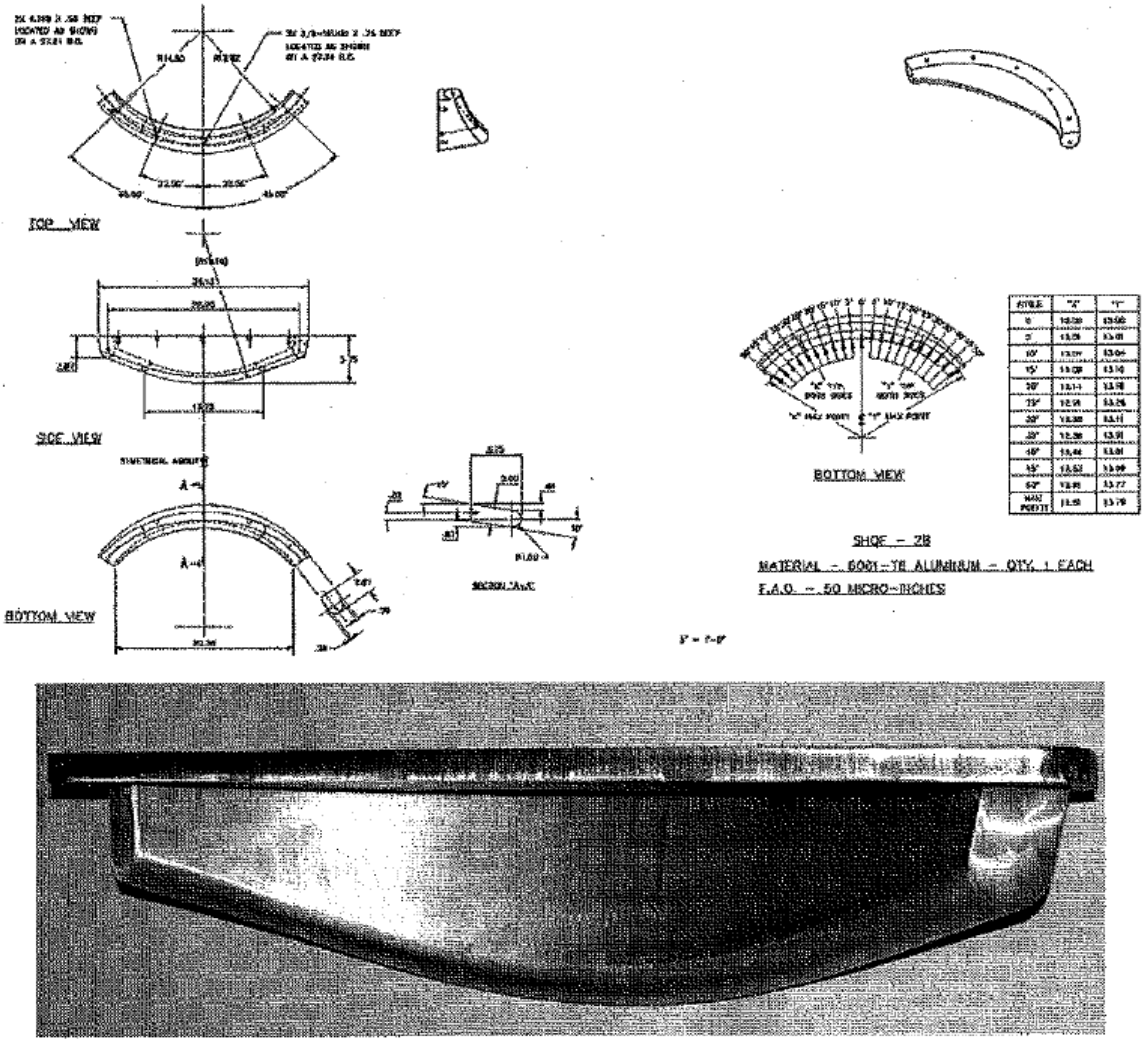


Figure 2 – Type 2A Bead Unseating Block

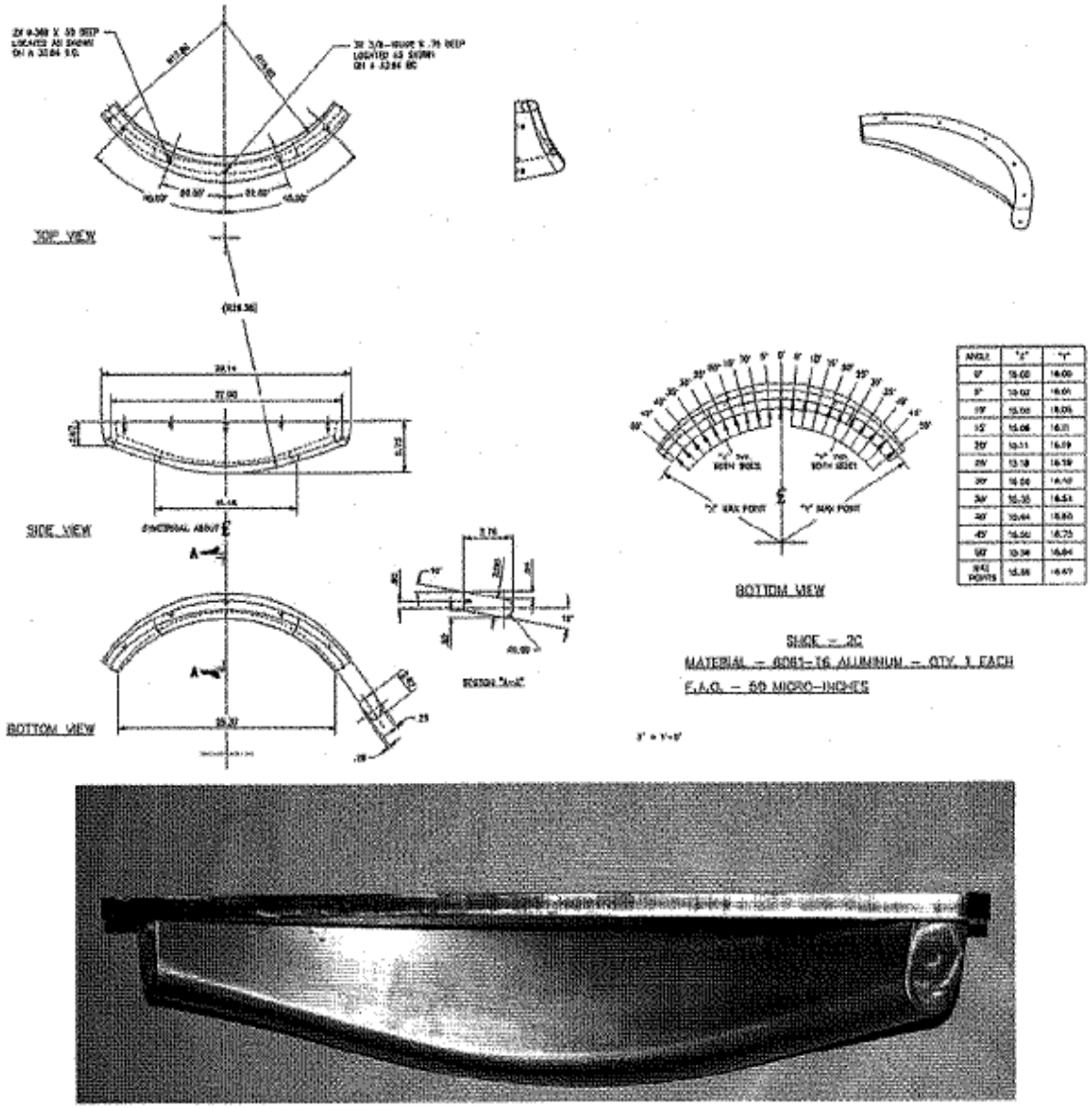


Figure 3 Type 2B Bead Unseating Block and Adaptor

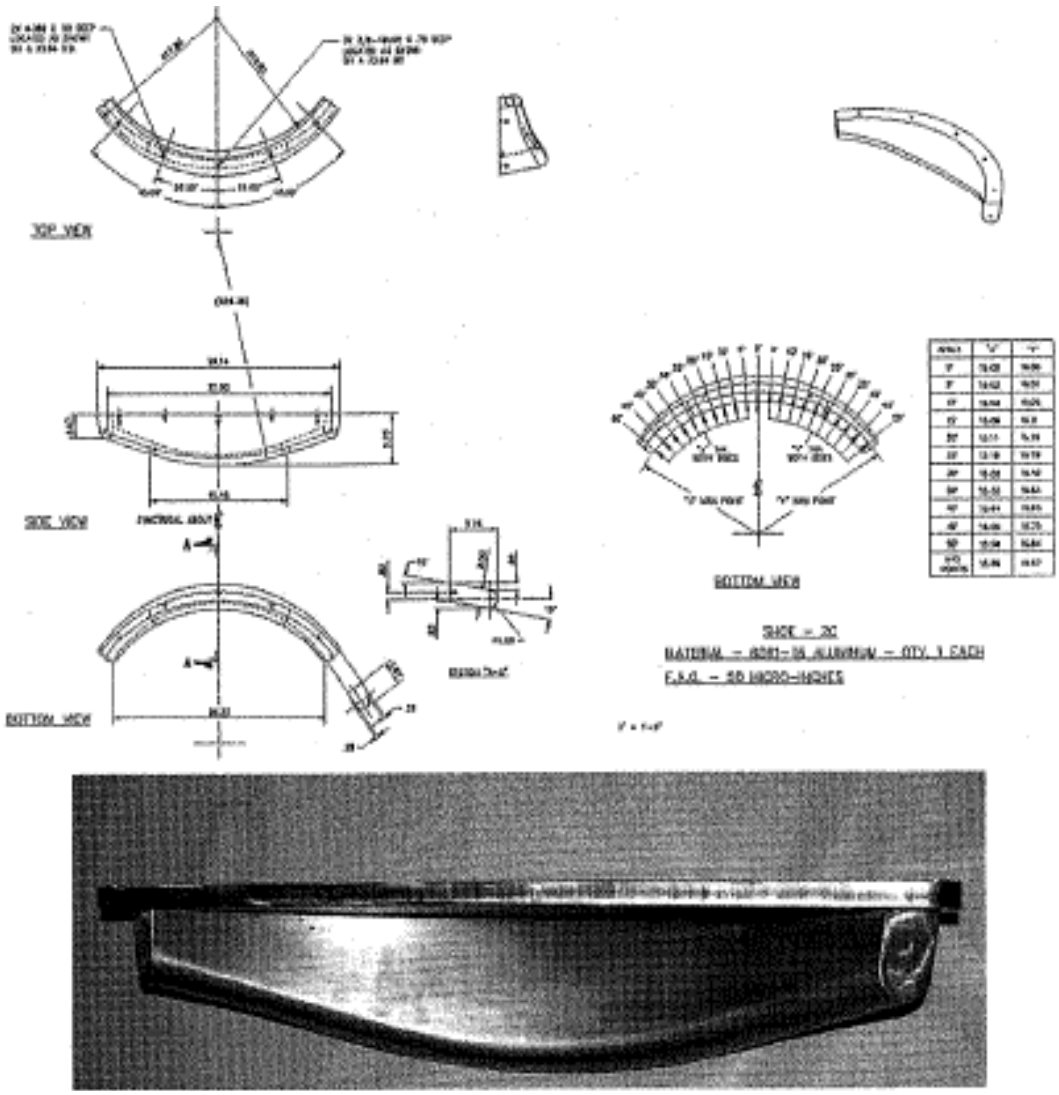


Figure 4 Type 2C Bead Unseating Block and Adaptor

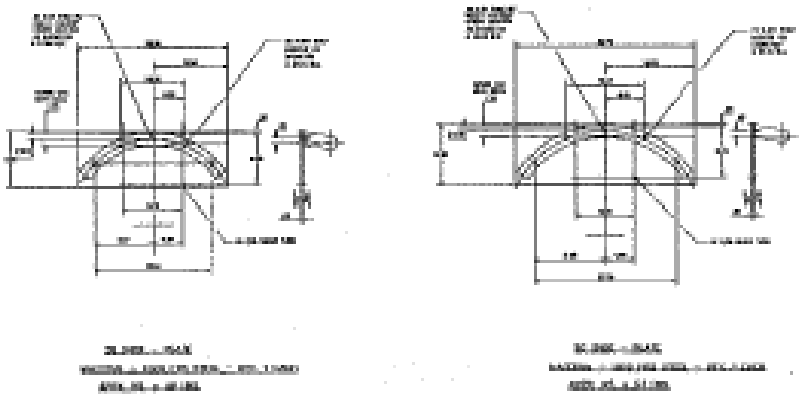


Figure 5 Diagrams of Adaptors for RJS Style Machines

* * *

4.7 **Endurance Test**

4.7.1 Requirements

4.7.1.1 The following requirements shall be met by all radial passenger tyres when tested in accordance with the procedures (4.7.2 and 4.7.3) given below.

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

4.7.1.3 The tyre pressure, measured no less than 60 minutes after the test, shall not be less than the initial pressure specified in paragraph 4.7.2 below.

4.7.2 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
	Reinforced or Extra Load	220

4.7.2.1 Condition the assembly at an ambient temperature of not less than 38° C for at least three hours.

4.7.2.2 Readjust the pressure to the value specified in the table in paragraph 4.7.2 immediately before testing.

4.7.3 Test Procedure

4.7.3.1 Mount the assembly on a test axle and apply a load as given in paragraph 4.7.3.3 below to load it against the outer face of a smooth wheel having a diameter of 1.70 m ± 1%.

4.7.3.2 During the test the ambient temperature, at a distance of not less than 150 mm and not more than 1 m from the tyre, shall be at least 38° C.

4.7.3.3 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:

Radial passenger 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%

4.7.3.4 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.

4.7.3.5 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 4.7.1 above.

* * *

4.8 Low Inflation Pressure Performance Test

4.8.1 Requirements

The following requirements shall be met by radial tyres when tested in accordance with the procedure given in paragraph 4.8.3 below.

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

4.8.1.2 The tyre pressure, measured no less than 60 minutes after the test, shall not be less than the initial pressure specified in paragraph 4.8.2 below.

4.8.2 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 4.7 above, with the tyre deflated to the following pressures show in the table below:

Low Inflation Pressure Performance test
Inflation Pressure Chart for Passenger Tyres

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

4.8.2.1 The assembly is conditioned at not less than 38°C.

4.8.2.2 Before or after mounting the assembly on a test axle, readjust the tyre pressure to that specified in the table 4.8.2.

4.8.3 Test Procedure

4.8.3.1 The test is conducted for ninety minutes at the end of the test specified in section 4.7, continuous and uninterrupted, at a speed of 120 km/h.

4.8.3.2 Press the assembly against the outer face of a test drum with a diameter of 1.7 m +/- 1%.

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

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

4.8.3.5 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 not less than 38°C.

4.8.3.6 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 4.8.1 above.

* * *

4.9 **High Speed Performance Test**

4.9.1 Requirements

4.9.1.1 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 category "Y") or above, superficial blistering in the tyre tread due to localized heat build-up in the test drum is acceptable.

4.9.1.2 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.

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

4.9.1.4 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.

4.9.2 Preparation of the Tyres With Speed Symbols "S" and Below

4.9.2.1 For tyres with a speed symbol "S" and below, mount the tyre on a test rim and inflate it to the appropriate pressure specified in the table below:

High Speed Test Inflation Pressure Chart for Passenger Tyres

Passenger Tyres	Standard Load, Light Load	220
	Reinforced, Extra Load	260

4.9.2.2 Condition the assembly at 38°C for not less than three hours.

4.9.2.3 Before or after mounting the assembly on a test axle, readjust the tyre pressure to that specified in the table above in 4.9.2.1.

4.9.3 Test Procedure for Tyres With Speed Symbols "S" and Below

4.9.3.1 Press the assembly against the outer face of a test drum with a diameter of 1.70 m +/- 1%.

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

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

4.9.3.4 Allow the tyre to cool to 38° C and readjust inflation pressure to applicable pressure in table in 1.6.1.1 above immediately before the test.

4.9.3.5 Throughout the test, the inflation pressure is not corrected and the test load is maintained at the value applied in paragraph 4.8.2.1.

4.9.3.6 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 not less than 38° C.

4.9.3.7 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.

4.9.3.8 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 Section 4.9.1 above.

4.9.4 Preparation of Tyres With Speed Symbols "T" and Above

4.9.4.1 Mount a new tyre on the test rim specified by the manufacturer as the "measuring rim and test rim".

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

Inflation Pressure kPa

Speed Symbol	Radial / Run Flat System	
	Standard Load, Light Load	Reinforced or Extra Load
T, U, H	280	320
V	300	340
W	320	360
Y	320	360

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

4.9.4.4 Re-adjust the tyre pressure to that specified in paragraph 4.9.4.2 above.

4.9.5 Test Procedure for Tyres With Speed Symbols “T” and Above

4.9.5.1 Press the assembly against the outer face of the test drum.

4.9.5.2 Depending upon the speed symbol applicable to the tyre, apply to the test axle, a load equal to 80% of:

4.9.5.3 The maximum load rating equated to the Load Capacity for tyres with Speed Symbols “T” to “H” inclusive.

4.9.5.4 The maximum load rating associated with a maximum speed of 240 km/h for tyres Speed Symbol "V"; equal to 91% of the load capacity index.

4.9.5.5 The maximum load rating associated with a maximum speed of 270 km/h for tyres with speed symbol "W"; equal to 85% of the load capacity index.

4.9.5.6 The maximum load rating associated with a maximum speed of 300 km/h for tyres with speed symbol "Y"; equal to 85% of the load capacity.

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

4.9.5.8 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.

4.9.5.9 Carry the test through, without interruptions as follows, in relation to the tyre’s speed symbol:

4.9.5.10 The initial test speed (ITS) is equal to the tyre’s speed symbol,

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

4.9.6 For tyres of speed symbol “T” through “W”, inclusive;

4.9.6.1 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;

4.9.6.2 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.

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

4.9.7.1 Test the tyre at the load and inflation for a speed symbol "Y" tyre according to the procedures specified above in paragraphs 4.9.4 and 4.9.5 above.

4.9.7.2 Test a further sample of the same type according to:

Inflate the tyre to 320 kPa for standard load or light load and 360 kPa for reinforced/extra load. 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.
NOTE: paragraphs [4.9.6.1] above may be carried out on the same tyre if the tyre manufacturer agrees.

4.9.8 If a method other than that described in this section (4.9) is used, its equivalence or greater severity must be demonstrated.

* * *

4.10 Tyre Rolling Sound Emission Test

4.10.8 Requirements

For passenger tyres (Class C1), which are included within the scope of this gtr, the rolling sound emission value shall not exceed the values given below. These values apply to both normal and snow tyres and refer to the nominal section width given in paragraph 3.1.19 of the definitions section of this gtr standard.

Note: One dB(A) allowance for extra load or reinforced tyres.
Two dB(A) allowance for special tyres.

Nominal Section Width	Limit dB(A)
145 and lower	72
Over 145 up to 165	73
Over 165 up to 185	74
Over 185 up to 215	75
Over 215	76

4.10.9 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 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.

4.10.2 Measuring instruments

4.10.2.1 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.

4.10.2.2 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.

4.10.2.3 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.

4.10.2.4 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 1) 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').

4.10.3 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 1).

4.10.4 Temperature measurements

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

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

4.10.4.1 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.

4.10.4.2 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.

4.10.5 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.

4.10.6. Conditions of measurement

4.10.6.1 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 2 of this Annex.

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.

4.10.6.2 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.

4.10.6.3 Ambient noise

4.10.6.3.1 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.

4.10.6.3.2 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.

4.10.6.4 Test vehicle requirements

4.10.6.4.1 General

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

4.10.6.4.2 Vehicle load

The vehicle must be loaded such as to comply with the test tyre loads as specified in paragraph 2.5.2. below.

4.10.6.4.3 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.

4.10.6.4.4. 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.

4.10.6.4.5 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.

4.10.6.4.6 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.

4.10.6.5 Tyres

4.10.6.5.1. General

Four identical tyres shall be fitted on the test vehicle. In the case of tyres with a load capacity 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.

4.10.6.5.2 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 capacity index of the tyre. In the case where the load capacity index is constituted by two numbers divided by slash (/), reference shall be made to the first number.

4.10.6.5.3 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.

4.10.6.5.4 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.

4.10.6.6 Method of testing

4.10.6.6.1 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.

4.10.6.6.2 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 1 - 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 4.1. 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 4.10.6.6.3.

4.10.6.6.3 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.

4.10.6.7 Interpretation of results

The measurement shall be invalid if an abnormal discrepancy between the values is recorded (see paragraph 4.10.6.3.2 above).

4.10.6.8. Determination of test result

Reference speed V_{ref} used to determine the final result will be:

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

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

4.10.6.9 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:

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

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 ($n \geq 16$),

$\overline{\nu}$ is the mean value of logarithms of speeds V_i:

$$\overline{\nu} = \frac{1}{n} \sum_{i=1}^{n} \nu_i \quad \text{with} \quad \nu_i = \lg(V_i / V_{ref})$$

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

$$a = \frac{\sum_{i=1}^{n} (\nu_i - \overline{\nu})(L_i - \overline{L})}{\sum_{i=1}^{n} (\nu_i - \overline{\nu})^2}$$

4.10.6.10 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.

There will be no temperature correction for Class C3 tyres.

4.10.6.11 In order to take account of any measuring instrument inaccuracies, the results according to paragraph 4.3. shall be reduced by 1 dB(A).

4.10.6.12 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.

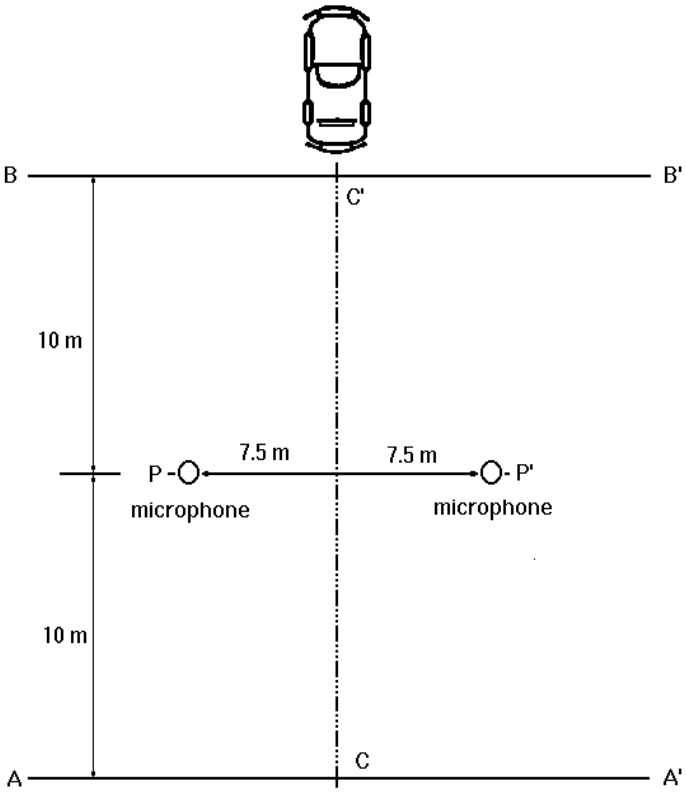


Figure 1. Microphone positions for the measurement

4.10.7 Test Report – Rolling Sound Emissions for Tyres

Part 1 - Report

1. Type approval authority or Technical Service: ……

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

……..

3. Test report No.: ……

4. Manufacturer and Brand Name or Trade description: ……

5. Tyre Class (C1, C2 or C3): ……..

6. Category of use: ……

7. Sound level according to paras. 4.4. and 4.5. of Annex 3: ……dB(A) at reference speed of 70/80 km/h 1/

8. Comments (if any): ……

……

……

9. Date: ……..

10. Signature: ……

Part 2 - Test data

1. Date of test: ……..

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

……

……

2.1. Test vehicle wheelbase: ……..mm

3. Location of test track: ……..…

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

3.2. Issued by:

3.3. Method of certification: ……..

4. Tyre test details: ……

4.1. Tyre size designation: ……..

4.2. Tyre service description: .....

4.3. Reference inflation pressure: .....

4.4. Test data

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

4.5. Test rim width code: .....

4.6. Temperature measurement sensor type: .....

5. 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									

5.1. Regression line slope: .....

5.2. Sound level after temperature correction according to paragraph 4.3: ……dB(A)

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

4.11 Tyre Wet Grip Test

4.11.1 Requirements

Passenger 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

4.11.2 Test track characteristics

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 E-965 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:

4.11.2.1 Standard reference test tyre (SRTT) method

The SRTT shall be the tyre referenced in ASTM International E 1136 Standard Specification for a Radial Standard Reference Test Tire. When tested using the SRTT and the method given in paragraph 2.1, 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:

$$pbfc = pbfc\ (measured) + 0.003 \cdot 5(t - 20)$$

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.

14.11.2.2 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 International standard 303-93 (re-approved 1998) and using the pad as specified in ASTM standard E 501-94, 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:

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

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.

4.11.2.3 The type approval authority shall satisfy itself of the characteristics of the track on the basis of evidence produced in test reports.

4.11.2.4 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.

4.11.2.5 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.

4.11.3 Test Procedure

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 (M_1 category as defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.) contained in document TRANS/WP.29/78/Rev.1/Amend.2 as last amended by Amend.4).

4.11.3.1 Trailer or special purpose tyre evaluation vehicle procedure

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

4.11.3.1.1 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;

4.11.3.1.2 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;

4.11.3.1.3 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;

4.11.3.1.4 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;

4.11.3.1.5 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 ls^{-1} per metre of wetted track surface width.

4.11.3.1.6 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.

4.11.3.1.7 Test procedure

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

4.11.3.1.9 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 a reinforced or extra load tyre.

4.11.3.1.10 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.

4.11.3.1.11 TThe 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.

4.11.3.1.12 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.

4.11.3.1.13 Immediately prior to testing, the tyre inflation pressure shall be checked and reset, if necessary, to the values given in paragraph 4.11.3.2.2.

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

4.11.3.1.15 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.

4.11.3.1.16 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.

4.11.3.1.17 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.

4.11.3.1.18 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.

4.11.3.1.19 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

4.11.3.1.20 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 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.

4.11.3.1.21 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

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

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

4.11.3.2 Standard vehicle procedure

4.11.3.2.1 The vehicle shall be a standard M_1 category vehicle, capable of a minimum speed of 90 km/h and equipped with an anti-lock braking system (ABS).

4.11.3.2.2 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.

4.11.3.2.3 Test procedure

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

4.11.3.2.5 The test tyre shall be mounted on the test rim declared by the tyre manufacturer in the approval application and shall be inflated to 220 kPa in all cases.

4.11.3.2.6. 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.

4.11.3.2.7 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.

4.11.3.2.8 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.

4.11.3.2.9 Immediately prior to testing, the tyre inflation pressure shall be checked and reset, if necessary, to the values given in paragraph 4.11.3.2.5.

4.11.3.2.10 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.

4.11.3.2.11 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.

4.11.3.2.12 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.

4.11.3.2.13 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.

4.11.3.2.14 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

4.11.3.2.15 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.

4.11.3.2.15 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

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

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

4.11.3.2.17 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.

4.11.3.2.18 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 paragraph 4.11.3.2.17.

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.

4.11.3.2.19 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.

4.11.3.2.20 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.

4.11.3.2.21 Control tyres that have been used for testing shall subsequently be stored under the same conditions as required for the SRTT, that is, in accordance with ASTM E 1136 – 93 (re-approved in 1998).

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

4.11.4 TEST REPORT (Adhesion on wet surface)

Part 1 - Report

1. Type approval authority or Technical Service: .....

2. Name and address of applicant: .....

3. Test report No.: .....

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

5. Tyre Class (C1, C2 or C3): .....

6. Category of use: .....

7. Adhesion coefficient on wet surfaces relative to SRTT according to paragraphs 2.1.2.15. or 2.2.2.15.: .....

8. Comments (if any): .....

9. Date: .....

10. Signature: .....

Part 2 - Test data

1. Date of test: .....

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

3. Location of test track: .....

3.1. Test track characteristics: .....

3.2. Issued by: .....

3.3. Method of certification: .....

4. Test tyre details: .....

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

4.2. Tyre brand and trade description: .....

4.3. Reference inflation pressure: kPa .....

4.4. 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)			

4.5. Test rim width code: .....

4.6. Temperature measurement sensor type: .....

4.7. Identification of the SRTT: .....

5. 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									

* * *

4.12 **Runflat System Assessment Test**

Where application is made for the type approval of a "run flat system" the load/speed test (section 4.9) is carried out on one tyre, inflated as per paragraph 4.9.2 or 4.9.4 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 as specified in paragraph 4.12.1 below. The second test may be carried out on the same sample if the manufacturer agrees.

If a "run flat system" tyre which, after undergoing the test as specified below in paragraph 4.12.1, does not exhibit a change in the deflected section height, compared to the deflected section height at the start of the test, higher than 20 per cent and retains the tread connected to the two sidewalls, it is deemed to have passed the test.

4.12.1 Test Procedure

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

4.12.1.2 Condition the tyre at 38 ºC +/- 3 and 250 kPa for three hours.

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

4.12.1.4 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.

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

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

4.12.1.7 During the test the temperature of the test room must be maintained at 38°C ± 3°C.

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

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.

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

4.12.1.10 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.

4.12.2 If a method other than that described in this appendix is used, it must be demonstrated to be equivalent or more severe.

* * *

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	LI	kg	LI	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		
19	77.5	46	170	73	365	100	800		
20	80.0	47	175	74	375	101	825		
21	82.5	48	180	75	387	102	850		
22	85.0	49	185	76	400	103	875		
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		

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Appendix 3

NOMINAL RIM DIAMETER CODE TABLE
Specified rim diameter, D_r for nominal rim-diameter codes is given below.
Specified rim diameter for 5° tapered (drop-centre) rims, in millimetres
Note: information in the table below complies with ISO 4000-2, table 4.

Nominal rim-diameter code	Nominal rim- diameter D_r - mm
10	254
12	305
13	330
14	356
15	381
16	406
17	432
18	457
19	483
20	508
21	533
22	559
23	584
24	610
25	635
26	660
28	711
30	762

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