

**AMENDMENT NO. 2**  
**TO**  
**AIS – 044 (Part 3)**  
**Automotive Vehicles –**  
**Pneumatic Tyres for Two and Three-Wheeled Motor Vehicles**

- 1.0** Page No. 10, cl. 7.3 :  
Delete entire note given below the clause No. 7.3.
- 2.0** Page No. 8, cl. 5.7, Tyre Stiffness Test  
Delete entire clause 5.7.
- 2.1** Page No. 11, cl. 13.0, Tyre Stiffness Test  
Delete entire clause 13.0 and Annex K.
- 3.0** Page No. 8, cl. 5.8, Tyre Uniformity Test  
Delete entire clause 5.8.
- 3.1** Page No. 11, cl. 14.0, Tyre Uniformity Test  
Delete entire clause 14.0 and Annex L
- 4.0** Renumber existing clause No.5.9 as “5.7”

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THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA  
P.B. NO. 832, PUNE 412 004

ON BEHALF OF  
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER  
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

SET-UP BY  
MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS  
( DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS )  
GOVERNMENT OF INDIA

September 2005

**AMENDMENT NO. 1**  
**TO**  
**AIS – 044 (Part 3)**  
**Automotive Vehicles – Pneumatic Tyres for Two and Three-Wheeled**  
**Motor Vehicles.**

1. Page no. 11:  
Add new clause 15.3.1 as follows:

**15.3.1 Family of Tyre**

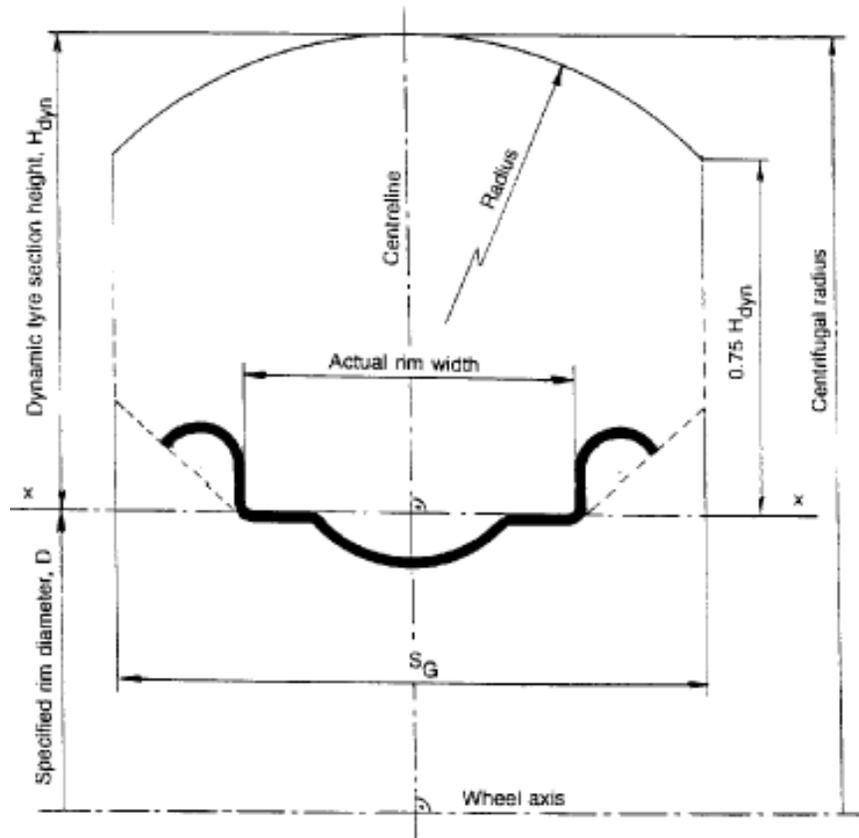
The understanding of “ Family / Range of Tyres ” would mean tyres which do not differ in the following parameters:

- a) Registered name of the company
- b) Manufacturing country
- c) Manufacturing plant
- d) Application category ( ordinary or snow )
- e) Construction type ( Standard or reinforced )
- f) Construction cord material ( Nylon / Polyester / Polyamide – one type and any other material different family )
- g) Structure ( Diagonal / Radial / Bias belted )
- h) Tyre size designation
- i) Speed category
- j) Tube / Tubeless ( worst case is tubeless )
- k) Load index or Load capacity
- l) Ply rating of tyres

but having different brand names / trade names and trade descriptions or trade marks

2. Page no. 24, Annex G, clause G4.1, Figure G1

Substitute existing Figure G1 by following Figure and text :



$S_G$  = Maximum overall width in service  
( This changes 1 mm per 0.1 Rim width code change from the measuring rim)

$H_{dyn}$  = Centrifugal radius -  $D/2$

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SET-UP BY  
MINISTRY OF ROAD TRANSPORT & HIGHWAYS  
GOVERNMENT OF INDIA

October 2004

**AIS-044 (Part 3)**

**AUTOMOTIVE INDUSTRY STANDARD**

**Automotive Vehicles – Pneumatic  
Tyres for Two and Three-Wheeled  
Motor Vehicles**

PRINTED BY:

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AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER  
CENTRAL MOTOR VEHICLES RULES – TECHNICAL STANDING COMMITTEE

SET-UP BY  
MINISTRY OF ROAD TRANSPORT & HIGHWAYS  
GOVERNMENT OF INDIA

March 2004



## Introduction

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the Ministry of Surface Transport (MoST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the secretariat of the AIS Committee, has published this standard. For better dissemination of this information ARAI may publish this document on their Web site.

The pneumatic tyre is an important safety critical item. With the new generation vehicles and development in road infrastructure facilities the vehicle speeds are increasing day by day. To ensure, safety of operation of tyres and vehicles, there was a need for a standard specifying the performance requirements of the pneumatic tyres.

Considerable assistance has been taken from the following documents while preparing this part.

- 97/24/EC, Chapter 1: - Tyres for two or three-wheeled motor vehicles and their fitting.
- ECE 75:- Uniform provisions concerning the approval of pneumatic tyres for motor cycles and mopeds
- ITTAC Standards manual 2002, JATMA Yearbook, ETRTO Standards manual
- IS 11157: 1984:- Specification for pneumatic tyres for mopeds- diagonal ply
- IS 12151: 1987:- Specification for motorcycle tyres - diagonal ply
- IS 10194 (Part 4): 1992:- Scooters and Scooter derivatives-Diagonal Ply-Specification
- FMVSS 109:- New pneumatic tyres

The Automotive Industry Standards Committee (AISC) responsible for preparation of this standard is given in Annex N .

## **Automotive Vehicles Pneumatic Tyres for Two and Three-Wheeled Motor Vehicles**

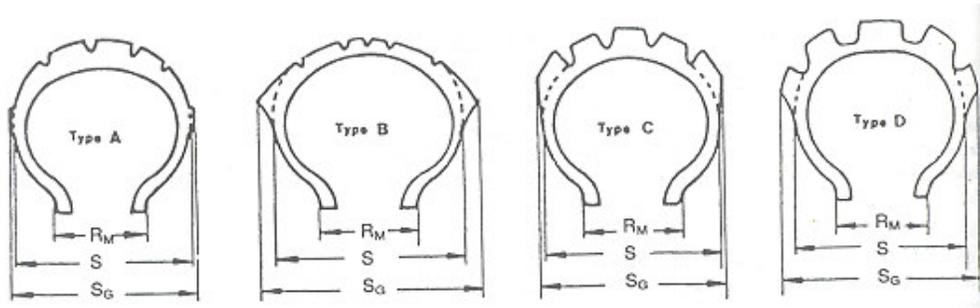
### **1.0 SCOPE**

- 1.1** This standard prescribes the general, dimensional and performance requirements of new pneumatic tyres for two and three wheeled motor vehicles.

### **2.0 DEFINITIONS**

- 2.1** "**Bead**" means the part of the pneumatic tyre, the shape and structure of which enables it to fit the rim and hold the tyre on that rim see figure 1.
- 2.2** "**Carcass**" means the part of the pneumatic tyre other than the tread and the rubber sidewalls which, when inflated, bears the load see figure 1.
- 2.3** "**Chunking**" means the breaking away of pieces of rubber from the tyre tread.
- 2.4** "**Cords**" means the strands forming the fabric of the plies in the pneumatic tyre. See figure 1.
- 2.5** "**Cord separation**" means parting of the cords from their rubber coating.
- 2.6** "**Load-capacity Index**" means a figure associated with the maximum permissible load which a tyre can carry at the speed corresponding to its speed symbol according to the operating conditions specified by the manufacturer. Annex B contains a list of indices and the corresponding loads.
- 2.7** "**Maximum load rating**" means the maximum mass which a tyre is rated to carry, subject to the following:
- 2.7.1** For speed lower or equal to 130 km/h the maximum load rating shall not exceed the percentage of the value associated with the relevant load capacity index of the tyre as indicated in the "Table of load variations as a function of speed" (see para 2.21) with reference to the speed category symbol of the tyre and the speed capability of the vehicle to which the tyre is fitted.
- 2.7.2** For speed above 130 km/h but not exceeding 210 km/h the maximum load rating shall not exceed the value of the mass associated with the load capacity index of the tyre.
- 2.7.3** In the case of tyres designed for a speed exceeding 210 km/h but not exceeding 270 km/h, the maximum load rating shall not exceed the percentage of the mass associated with the load capacity index for the tyre set out in the table 1 below with reference to the speed category symbol of the tyre and the maximum design speed of the vehicle to which the tyre is to be fitted.

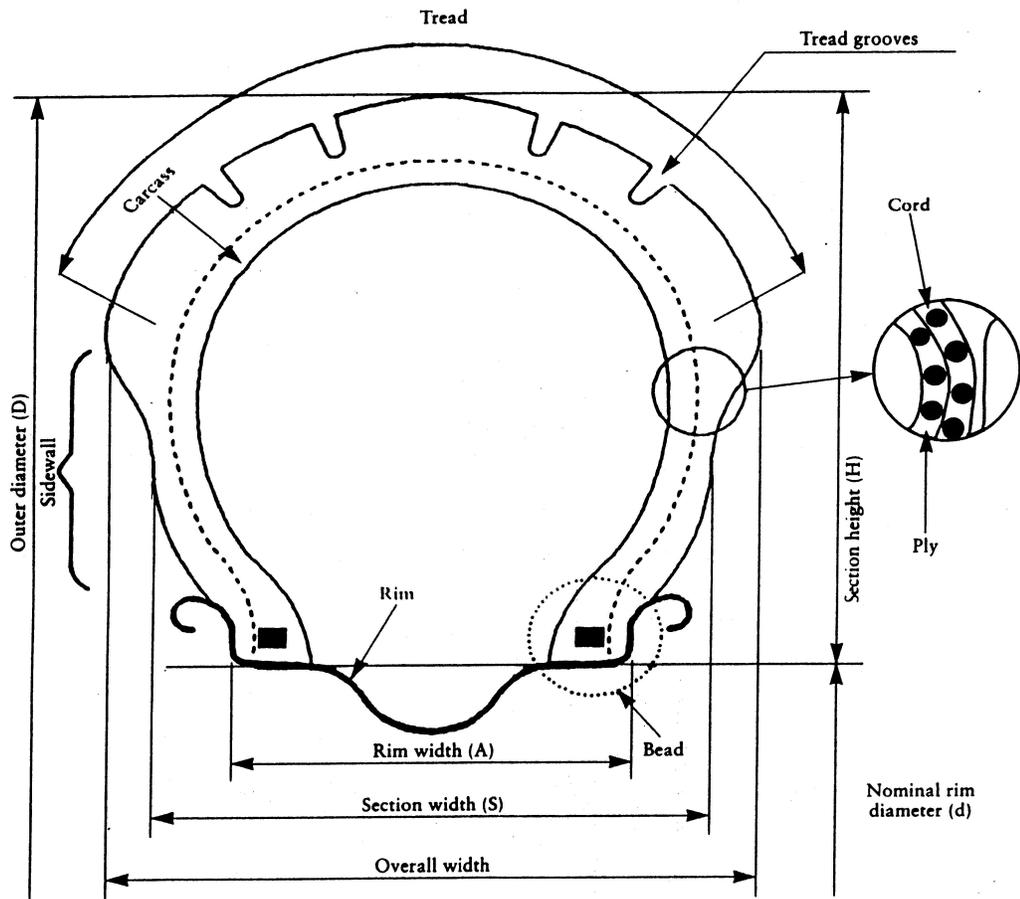
**Figure 1**  
(Refer Para 2.0)



S: Tyre Section width.

S<sub>G</sub>: Tyre Overall width.

R<sub>M</sub>: Measuring Rim width.



**Table 1 (See Para 2.7.3)**  
**Load Rating for tyres designated for speeds**  
**210 to 270 km/h**

Maximum speed km/h <sup>(1)</sup>	Maximum load rating (%)	
	Speed Category V symbol	Speed Category System W <sup>(3)</sup>
210	100	100
220	95	100
230	90	100
240	85	100
250	(80) <sup>(2)</sup>	95
260	(75) <sup>(2)</sup>	85
270	(70) <sup>(2)</sup>	75

- <sup>(1)</sup> For intermediate speeds linear interpolation of maximum load rating is allowed.
- <sup>(2)</sup> Applicable only to tyres identified by means of letter code "V" within the size designation and upto the maximum speed specified by the tyre manufacturer.
- <sup>(3)</sup> Applicable also to tyres identified by means of letter code "Z" within the size designation
- 2.7.4 For speeds in excess of 270 km/h the maximum load rating shall not exceed the mass specified by the tyre manufacturer with reference to the speed capability of the tyre. For intermediate speeds between 270 km/h and the maximum speed permitted by the tyre manufacturer a linear interpolation of the load rating applies.
- 2.8 **"Measuring Rim"** means the rim on which a tyre shall be fitted for dimensional measurement purposes.
- 2.9 **"Nominal Aspect Ratio (Ra)"** means one hundred times the number obtained by dividing the nominal section height by the nominal section width (S<sub>1</sub>) both being expressed in the same unit of measurement.
- 2.10 **"Nominal Rim Diameter (d)"** means the diameter of the rim on which a tyre is designed to be mounted. See figure 1.
- 2.11 **"Principal Groove"** means the wide grooves located in the central zone of the tread see figure 1.
- 2.12 **"Outer Diameter (D)"** means the overall diameter of an inflated new tyre see figure 1.
- 2.13 **"Overall Width"** means the linear distance between the outer edges of the sidewalls of an inflated tyre, including markings, embellishments and protective bands or ribs (see figure 1); the overall width of tyres the tread width of which is greater than the section width is the width of the tread.
- 2.14 **"Ply"** means a layer of rubber coated parallel cords see figure 1.
- 2.15 **"Ply separation"** means the parting of adjacent plies.
- 2.16 **"Rim"** means the support for either a tyre and inner tube or a tubeless tyre on which the beads of the tyre are seated see figure 1.

- 2.17 "Section Height (H)"** means the distance equaling half the difference between the outer diameter of the tyre and the nominal rim diameter. See figure 1.
- 2.18 "Section Width (S)"** means the linear distance between the outer edges of the sidewalls of an inflated tyre excluding the protrusions due to markings, embellishments or protective bands or ribs. See figure 1.
- 2.19 "Side Wall"** means that part of a pneumatic tyre lying between the tread and the part intended to be covered by the wheel rim. See figure 1.
- 2.20 "Speed Category"** means the maximum designated speed of the tyre, expressed by the speed category symbol as shown in the Table 2.

Tyres suitable for maximum speeds in excess of 240 km/h are identified by the letter "V" or "Z" placed within the tyre size designation in front of the indications of tyre structure.

**Table 2 (See Para. 2.20)  
Speed Category Symbol**

Speed category symbol	Maximum speed (km/h)	Speed category symbol	Maximum speed (km/h)
A1	5	J	100
A2	10	K	110
A3	15	L	120
A4	20	M	130
A5	25	N	140
A6	30	P	150
A7	35	Q	160
A8	40	R	170
B	50	S	180
C	60	T	190
D	65	U	200
E	70	H	210
F	80	V	240
G	90	W	270

- 2.21 "Table of load variations as a function of speed"** means the table in Annex C, which shows, by reference to indices of load capacity and of capacity at nominal speed, load variations of a tyre if used at speeds other than those corresponding to that indicated by the nominal speed category.
- 2.22 "Test Rim"** means the rim to which a tyre shall be fitted for testing.

**2.23 "Theoretical Rim"** means an imaginary rim the width of which would be X times the nominal section width of a tyre.

The value of X shall be specified by the tyre manufacturer.

**2.24 "Tread"** means that part of the tyre which comes into contact with the ground, protects the carcass against mechanical damage and contributes to ground adhesion. See figure 1.

**2.25 "Tread Groove"** means the space between two adjacent ribs or blocks in the tread pattern. See figure 1.

**2.26 "Tread Separation"** means the pulling away of the tread from the carcass.

**2.27 "Type of Tyre"** means tyres intended for normal road use which basically do not differ from one another in respect of:

- the make or trade name,
- the tyre size designation,
- structure (diagonal or bias ply (cross-ply), belted-bias, radial),
- speed category symbol,
- load capacity index/Maximum load carrying capacity,
- the cross section profile dimension when fitted to a specified rim.

**2.28 "Tyre Structure"** means the technical characteristics of a tyre carcass. The following structures of a pneumatic tyre are distinguished in particular:

- **"diagonal or bias ply (cross-ply)"** means a pneumatic tyre structure the ply cords of which extend to the beads and are laid in such a way as to form alternating angles which are perceptibly less than 90° to the tread center line,
- **"bias belted"** means a pneumatic tyre structure of the "cross-ply" type in which the carcass is restrained by a belt consisting of two or more layers of basically inextensible cord materials forming alternating angles close to those of the carcass,
- **"radial"** means a pneumatic tyre structure the ply cords of which extend to the beads and are laid substantially at 90° to the tread center line, while the carcass is stabilized by a basically inextensible circumferential belt,
- **"reinforced"** means a pneumatic tyre structure in which the carcass is more resistant than that of a corresponding standard tyre;

**2.29 "Tyre size Designation"** means the description containing the following:

- the nominal section width ( $S_1$ ) - means a tyre section width indicated in the tyre size designation (Refer Annexure D) (expressed in mm, except for certain types of tyre for which the tyre size designation is set out in the first Column of the tables in Annex A)
- the nominal aspect ratio (Ra), except for certain types of tyre for which the tyre size designation is given in the first column of the tables in Annex A.

- a conventional number (d) denoting the nominal rim diameter and corresponding to that diameter expressed either in the form of a code (a figure of less than 100) or in millimeters (a figure of more than 100).

### 3.0 General

Expressions such as “moped tyres”, “motorcycle tyres”, “three wheeler tyres” etc. used in this standard are with the following general meaning:

- Moped tyre means those intended to be used on two or three wheelers with maximum design speed not exceeding 50km/h.
- Motorcycle tyres means tyres intended to be used on other two wheelers.
- Three wheeler tyres means tyres intended for use on three wheelers.

These are for the purpose of convenience of tabulation and does not refer to actual classification of vehicles on which the tyre is intended to be used.

Suitability of a particular tyre for a vehicle depends only on the speed capability of the tyre, its load rating with respect to the maximum design speed of the vehicle, and its maximum permissible axle loads. Details are given in AIS-050.

### 4.0 MARKINGS

4.1. On at least one of their sidewalls, pneumatic tyres submitted for approval shall bear the following markings:

4.1.1 the make or trade name

4.1.2 the tyre size designation as defined in para 2.29

4.1.3 The load index and/or maximum load carrying capacity and ply rating: In the case of ISO designated tyres the marking of load index is mandatory.

Examples of Tyre sizes designations for code designated and ISO designated tyres are given in Tables 3 and 4 respectively.

**Table 3 (See Para. 4.1.2)**  
**Examples of tyre designation for Code Designated Tyres**

Tyre Type	Tyre Size Designation					
Moped	1¾	—	19	64	H	
Motor-cycle	4.00	—	18	64	P	4PR
	3.50	—	10	64	P	4PR
	(1)	(2)	(3)	(4)	(5)	(6)
	(1) Nominal section width code (2) Structure code, “—” for diagonal, and “R” for radial (3) Nominal rim diameter code (4) Load Index/ Maximum load carrying capacity (5) Speed Symbol (6) Ply Rating					

**Table 4 (See Para. 4.1.2)**  
**Examples of tyre designation for ISO Designated Tyres**

<b>Motor- cycle</b>	<b>120</b>	<b>/</b>	<b>90</b>	<b>—</b>	<b>18</b>	<b>65</b>	<b>S</b>
	<b>140</b>	<b>/</b>	<b>80</b>	<b>R</b>	<b>17</b>	<b>69</b>	<b>H</b>
	<b>(1)</b>		<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>
	(1) Nominal section width code (2) Nominal aspect ratio (3) Structure code, “—”for diagonal and “R” for radial (4) Nominal rim diameter code (5) Load Index/ Maximum load carrying capacity (6) Speed Symbol						

- 4.1.4 The indication of the tyre structure as follows:
- in the case of diagonal or bias ply (cross-ply) tyres, no marking or the letter “—” or the letter “D” preceding the rim diameter code;
  - in the case of belted-bias tyres, the letter “B” preceding the rim-diameter code and, optionally, the words “BELTED-BIAS”;
  - in the case of radial-ply tyres, the letter “R” preceding the rim-diameter code and, optionally, the word “RADIAL”;
- 4.1.5 The speed category of the tyre, expressed by the symbol referred to in para. 2.20.
- 4.1.6 The load capacity index as defined in para. 2.6 or maximum load carrying capacity at the designated speed.
- 4.1.7 The word “TUBELESS” where the tyre is intended for use without an inner tube.
- 4.1.8 The symbol “REINFORCED” or “REINF” in the case of a reinforced tyre;
- 4.1.9 Week and Year code or Month and Year code of manufacture;
- 4.1.10 Tread wear indicators at minimum six/four (as applicable) places along the circumference
- 4.1.11 Tyres suitable for speeds above 240 km/h shall be marked with the appropriate letter code “V” or “Z”, as applicable (see para.2.7.3) within the tyre size designation and in front of the indication of the structure (see para. 4.1.4).
- 4.1.12 Tyres suitable for speeds above 240 km/h (or 270 km/h respectively) shall bear, within parentheses, the marking of the load capacity index (see para. 4.1.6) applicable at a speed of 210 km/h (or 240 km/h respectively) and a reference speed category symbol (see para. 4.1.5) as follows:
- “V” in case of tyres identified with the letter code “V” within the size designation.
- “W” in case of tyres identified with the letter code “Z” within the size designation.
- 4.1.13 An arrow marking to indicate the direction in which the tyre should rotate in service in the case of directional type tyres.

- 4.2** Annex D provides an example of layout for the tyre markings.
- 4.3** The markings referred to in para. 4.1 shall be moulded into or onto the tyres. They shall be clearly legible.
- 5.0 REQUIREMENTS RELATING TO TYRES**  
The following are the requirements for type approving the tyres:
- 5.1** Tyre Dimensions (new tyre):
- 5.1.1 Section Width (See 6.0)
- 5.1.2 Outer diameter (See 7.0)
- 5.2.** Load/speed performance test (See 8.0)
- 5.3.** Dynamic growth of tyres (See 9.0)
- 5.4.** Tyre Strength Test (Plunger Test) (See 10.0)
- 5.5** Endurance Test (See 11.0)
- 5.6** Tread wear indicator (See 12.0)
- 5.7** Tyre Stiffness Test (See 13.0) – This test shall be for record only
- 5.8** Tyre Uniformity Test (See 14.0) – This test shall be for record only
- 5.9** The details of tyres of certain designations are listed in various tables in Annex A
- 6.0 Section Width**
- 6.1 For tyre designations listed in Annex A:**
- 6.1.1 The nominal section width ( $S_1$ ), the maximum overall width of the tyre shall be as per the details given in Annex A.
- 6.1.2 The overall width of a tyre shall not exceed the value specified in the relevant table in Annex A.
- 6.2 For tyre designations not listed in Annex A:**
- 6.2.1 For the tyre designations not listed in Annex A, these shall be calculated as per the following formula:  
For tyres, which are not covered in Annex A, the section width is calculated via the following formula:  
 $S = S_1 + K (A - A_1)$ , where:  
 $S$  = Section width expressed in mm measured on measuring rim  
 $S_1$  = Nominal section width (in mm) as set out on the tyre sidewall in the tyre size designation  
 $A$  = Width expressed in mm of the measuring rim stated by the manufacturer in the technical specification

$A_1$  = Theoretical rim width expressed in mm  
 = The value  $S_1$  multiplied by the X factor quoted by the tyre manufacturer

$K$  = 0.4

6.2.2 The overall width of a tyre may be less than the section width  $S$  as determined in accordance with Para. 6.2.1.

It may exceed that value up to + 10 % for the rim diameter code greater than or equal to 13 and upto + 8 % for tyres having the rim diameter code not more than 12.

**7.0 Tyre outer diameter**

7.1 For tyre designations listed in Annex A:

The outer diameter of the tyre shall not exceed the minimum and maximum diameter values specified in Annex A.

7.2 For tyre designations not listed in Annex A:

7.2.1 For tyres, which are not covered in Annex A, the outer diameter of a tyre is that obtained from the following formula:

$$D = d + 2H,$$

where:

- $D$  = the outer diameter expressed in mm
- $d$  = the nominal rim diameter expressed in mm
- $H$  = the nominal tyre height =  $S_1 \times 0.01 Ra$ ,
- $S_1$  = the nominal section width
- $Ra$  = the nominal aspect ratio as set out in the description on the tyre sidewall as required by Para. 4.1.3

7.2.2 The outer tyre diameter shall not exceed the minimum and maximum diameter values obtained by applying the following formulae:

$$D_{min} = d + (2H \times a)$$

$$D_{max} = d + (2H \times b),$$

where:

$H$  and  $d$  are as defined in para. 7.2.1 and " $a$ " and " $b$ " are as defined Table 5.

**Table 5: (See Para. 7.2.2)**

**Values of "a" and "b" for normal purpose tyres**

	<b>a</b>	<b>b</b>
For tyres, the rim diameter code for which is more than 12.	0.96	1.07
For the rim diameter code for which is not more than 12.	0.93	1.10

- 7.3** The tyre dimensions (Outer diameter and Section width) shall be measured as specified in Annex E.

**Note:**

Tyre sizes covered in other International tyre standard (ECE, JATMA, ETRTO and T&RA) shall meet the dimensional requirements of respective standards. Further, if same size of tyre with different dimensions appears in more than one standard. It shall meet the dimension requirement of any one standard as per priority ITTAC, T&RA, JATMA, ECE, ETRTO.

**8.0 Load / Speed Performance Test**

- 8.1** The load/speed performance test shall be carried out on a tyre in accordance with the method set out in **Annex F**.
- 8.2** In case of tyres identified by means of letter code "V" within the size designation and suitable for speeds over 240 km/h or for tyres identified by means of letter code "Z" within the size designation and suitable for speeds over 270 km/h, the above Load/Speed Test is carried out on one tyre at the load and speed conditions marked within parentheses on the tyre (see Para. 4.1.11). Another load/speed test shall be carried out on a second tyre of the same type at the load and speed conditions, if any, specified as maximum by the tyre manufacturer.
- 8.3** After successfully undergoing the load/speed test a tyre shall not exhibit any tread ply or cord separation or any chunking or cord breakage.
- 8.4** The outer diameter of the tyre measured at least six hours after the load/speed performance test shall not differ from the outer diameter measured before the test by more than 3.5 %.
- 8.5** The tyre overall width measured at the end of the load/speed performance test shall not exceed the value specified in Para. 6.1.2 or Para. 6.2.2 as applicable.

**9.0 Dynamic growth of tyres**

- 9.1** This test is applicable only to tyres of the speed category symbol above "P" (150 km/h).
- 9.2** The tyres which have passed the load/speed performance test required in Para. 8.0 shall undergo a dynamic growth test, to be carried out in accordance with the practical method set out in the Annex G.

**10.0 Tyre Strength Test (Plunger Test)**

- 10.1** The Tyre strength test (Plunger test) shall be carried out on a tyre in accordance with the method set out in Annex H, and the tyre shall comply with the requirements specified in the same Annex.

**11.0 Endurance Test:**

- 11.1** The endurance shall be carried out on a tyre in accordance with the method set out in Annex J and the tyre shall comply with the requirements specified in the same Annex.

**12.0 Tread Wear Indicators**

- 12.1 The pneumatic tyre shall include not less than six transverse rows of wear indicators, approximately equally spaced and situated in the principal grooves of the tread. The tread-wear indicators shall be such that they cannot be confused with the rubber ridges between the ribs or blocks of the tread.
- 12.2 However, in the case of tyres of dimensions appropriate for mounting on rims of a nominal diameter of 12 or less, minimum 4 no of tread-wear indicators shall be accepted.
- 12.3 The tread-wear indicators must provide a means of indicating with a tolerance of + 0.60/-0.00 mm, when the tread grooves are no longer more than 0.8 mm deep.
- 12.4 The height of tread-wear indicators is determined by measuring the difference between the depth, from the tread's surface, to the top of the tread-wear indicator and to the bottom of the tread groove close to the slope at the base of the tread-wear indicator.

**13.0 Tyre Stiffness Test**

- 13.1 Each type of pneumatic tyre shall undergo tyre stiffness test carried out by the procedure described in Annex K to this Standard.
- 13.2 This test shall be for record only.

**14.0 Tyre Uniformity Test**

- 14.1 Each type of pneumatic tyre shall undergo tyre uniformity test carried out by the procedure described in Annex L to this Standard.
- 14.2 This test shall be for record only.

**15.0 APPLICATION FOR TYPE APPROVAL:**

- 15.1 The application for the type approval shall contain at least the technical information as specified in Annex M.
- 15.2 Number of tyre to be provided shall be minimum " 4 " numbers or at the discretion of test agency.
- 15.3 For Type Approval of tyre belonging to one family of tyre, brand of the tyre to be selected for type approval shall be left to test agency. Worst-case selection may be made at the discretion of the test agency.
- 15.4 Type approval procedure shall be as decided by Central Motor Vehicles Rules (CMVR-TSC) and Ministry of Road Transport & Highways (MoRT&H).

## **16.0 TYPE APPROVAL**

- 16.1 If the type of pneumatic tyre submitted for approval in pursuance of this standard meets the requirements of Para. 4.1 and Para. 5.0 above, approval of that type of tyre shall be granted.
- 16.2 Approval number shall be as decided by CMVR- TSC and MoRT&H.

## **17.0 MODIFICATIONS AND EXTENSION OF APPROVAL OF TYRE TYPE**

- 17.1 Every modification of the type of pneumatic tyre shall be notified to testing agency which approved the type of pneumatic tyre. The test agency may then either.
  - 17.1.1 Consider that the modifications made are unlikely to have an appreciable n adverse effect and that in any case, the pneumatic tyre still compiles with the requirements; or
  - 17.1.2 Require a further test report from the testing agency responsible for conducting the test.
 

For considering whether any further verification is required or not, guidelines given in Para. 18 (Criteria for Extension of Approval) may be used.

## **18.0 CRITERIA FOR EXTENSION OF APPROVAL**

- 18.1 In case of following changes, the verification shall be carried out for establishing compliance of the changed parameters to the requirements specified in this standard:
  - 18.1.1 Size designation:
  - 18.1.2 If the rim diameter is within, and the section is not more than already type approved sizes; test need not be carried out for approval.
  - 18.1.3 Material-Fabric Style (e.g. rayon, nylon etc.)
  - 18.1.4 Tyre Construction (e.g. diagonal / bias ply, radial, reinforced, etc.)
  - 18.1.5 Increase in Speed category.
  - 18.1.6 Increase in Load Capacity Index/ Maximum load carrying capacity.
  - 18.1.7 Colour of sidewall if changed to white.
  - 18.1.8 Tyre type approved for the requirements specified for three wheeler tyres, if to be approved for use on a two-wheeler.
- 18.2 However these test shall be carried out for extensions of approval for tyres suitable for speeds over 240 km/h for tyres identified by means of letter code "V" within the size designation (or 270 km/h for tyres identified by means of letter code "Z" within the size designation), for different maximum speeds and/or loads.

**19.0 CONFORMITY OF PRODUCTION:**

19.1 The tyres approved under this standard shall be so manufactured as to conform to requirements set forth in Paras. 5.1 & 4.0, 5.2, 5.3, 5.4 and 5.5 for the following tests respectively:

19.1.1 Dimensions & marking.

19.1.2 Load / Speed performance test.

19.1.3 Dynamic growth test for tyres having speed above 150 cm/h.

19.1.4 Tyre strength test.

19.1.5 Endurance test.

19.2 The test agency may at any time verify the conformity control methods applied in each production facility.

19.3 Conformity of production procedure shall be as decided by CMVR-TSC and MoRT&H.

**20.0 PENALTIES FOR NON-CONFORMITY OF PRODUCTION**

20.1 As and when decided by CMVR-TSC and MoRT&H.

**21.0 PRODUCTION DEFINITELY DISCONTINUED**

21.1 As and when decided by CMVR-TSC and MoRT&H.

**Annex A (See Para. 2.29, 6.1, 7.1)**  
**TYRE SIZE DESIGNATION AND DIMENSIONS**

- A1** The details of tyres of certain designations are listed in various tables in Annex A. In these tables the following are the units of measurement.
- A2** In these tables the following are the unit of measurement for dimension is millimeter, unless otherwise mentioned.

<b>Parameter</b>	<b>Unit</b>
Dimensions	millimetre
Load	Kg
Pressure	kPa

- A3** Width of permitted rim code specified in the table is for reference and are allowed to be used instead of the recommended. The use rims other than those listed in the “Permitted” column is as mutually agreed between the tyre and vehicle manufacturer.
- A4** The details of tyre sizes covered by the ITTAC Standards Manual 2002 are listed in the tables A1 to A6.

In the case of tyre sizes not listed in the above referred tables, the dimensional details given in the following documents are applicable:

- i) ECE 75: Uniform provisions concerning the approval of pneumatic tyres for motor cycles and mopeds
- ii) 97/24/EC, Chapter 1 : Tyres for two or three-wheeled motor vehicles and their fitting.
- iii) ITTAC Standards manual
- iv) JATMA Yearbook
- v) ETRTO Standards manual

**TABLE A1: Motorcycle Tyres Size rim diameter up to code 12**

Tyre size designation	Width of RIM (code)		Overall diameter			Nominal section width (S <sub>1</sub> )	Max. overall width
	Recommended	Permitted	D <sub>min</sub>	D	D <sub>max</sub>		
2.75 – 10	1.75	1.50, 1.85, 2.1	395	399	412	71	75
3.00 – 10	2.10	1.85, 2.15, 2.50	408	413	427	80	84
3.50 – 8	2.50	2.10, 2.15	380	386	402	92	97
3.50 – 10	2.50	2.10, 2.15, 2.15	431	437	453	92	97

**TABLE A2: Moped Tyres Normal Profile  
(with rim diameter code more than 12)**

Tyre size designation	Width of RIM (code)		Overall diameter			Nominal section width (S <sub>1</sub> )	Max. overall width
	Recommended	Permitted	D <sub>min</sub>	D	D <sub>max</sub>		
1¾ - 19	1.20	--	586	589	596	50	53
2 – 19	1.35	--	592	595	603	55	58
2 – 22	1.35	--	667	670	678	55	58
2¼ - 16	1.50	--	528	532	541	62	65
2¼ - 19	1.50	--	605	609	618	62	65
2½ - 16	1.60	--	544	548	558	68	71
2½ - 19	1.60	--	621	625	635	68	71

**TABLE A3: Motorcycle Tyres Normal Profile  
(with rim diameter code more than 12)**

Tyre size designation	Width of RIM (code)		Overall diameter			Nominal section width(S <sub>1</sub> )	Max. overall width
	Recom- mended	Permitted	D <sub>min</sub>	D	D <sub>max</sub>		
			2.25 - 16	1.60	1.20,1.35,1.40,1.50		
2.25 - 17	1.60	1.20,1.35,1.40,1.50	552	556	567	61	65
2.25 - 18	1.60	1.40, 1.50	577	581	592	61	65
2.25 - 19	1.60	1.20,1.35,1.50	603	607	616	61	65
2.50 - 16	1.60	1.35,1.40,1.50	538	542	554	65	70
2.50 - 17	1.60	1.35,1.40,1.50	564	568	580	65	70
2.50 - 18	1.60	1.35,1.40,1.50	589	593	605	65	70
2.75 - 14	1.85	1.35, 1.60	507	512	523	75	80
2.75 - 16	1.85	1.40,1.50, 1.60	557	562	573	75	80
2.75 - 17	1.85	1.40,1.50, 1.60	583	588	599	75	80
2.75 - 18	1.85	1.40,1.50, 1.60	608	613	624	75	80
3.00 - 14	1.85	1.60	521	526	538	80	86
3.00 - 17	1.85	1.60, 2.15,	597	602	614	80	86
3.00 - 18	1.85	1.60, 2.15	623	627	639	80	86
3.00 - 19	1.85	1.60, 2.15	648	653	665	80	86
3.25 - 16	2.15	1.85, 2.50	583	588	601	89	95
3.25 - 18	2.15	1.85, 2.50	634	639	652	89	95
3.25 - 19	2.15	1.85, 2.50	660	665	678	89	95
3.50 - 18	2.15	1.85, 2.50	643	649	662	93	100
3.50 - 19	2.15	1.85, 2.50	669	675	688	93	100

**TABLE A4: Motor cycle tyres -ISO designated tyres  
(with rim diameter code upto 12)**

Tyre size designation	Width of RIM (code)		Overall diameter			Nominal section width(S <sub>1</sub> )	Max. overall width
	Recom- mended	Permitted	D <sub>min</sub>	D	D <sub>max</sub>		
100/90 - 10	2.50MT	--	429	434	445	101	106

**TABLE A5: Motor cycle tyres -ISO designated tyres  
(with rim diameter code more than 12)**

Tyre size designation	Width of RIM (code)		Overall diameter			Nominal section width(S <sub>1</sub> )	Max. overall width
	Recom- mended	Permitted	D <sub>min</sub>	D	D <sub>max</sub>		
90/80 - 17	2.15	1.85, 2.50.	572	576	586	90	96
120/80 - 16	2.75	2.15, 2.50, 3.00	592	598	611	119	127
90/90 - 17	2.15	1.85, 2.50	589	594	605	90	96
90/90 - 18	2.15	1.85, 2.50	614	619	630	90	96
100/90 - 18	2.50	2.15, 2.75	632	637	650	101	108
110/90 - 18	2.50	2.15, 2.75, 3.00	649	655	669	109	117
130/90-15	3.00	2.15, 2.50, 2.75, 3.50	608	615	631	129	138

**TABLE A6 Tyres for three wheelers**

Tyre size designation	Width of RIM (code)		Overall diameter			Nominal section width(S <sub>1</sub> )	Max. overall width
	Recom- mended	Permitted	D <sub>min</sub>	D	D <sub>max</sub>		
3.50 - 10	2.50	2.10, 2.15, 2.15	431	437	453	92	97
4.00 - 8	3.00	2.50, 2.15	409	415	434	114	120
4.00 - 10	3.00	2.50, 2.75	460	466	485	110	116
4.50 - 10	3.50	3.00	483	490	511	125	131

**Annex B**  
**(See Para. 2.6)**  
**LIST OF LOAD-CAPACITY INDICES AND**  
**CORRESPONDING PERMISSIBLE MAXIMUM MASS**

**LCI** - load capacity index

**Max. Mass** - corresponding maximum mass (kg)

<b>LCI</b>	<b>Max. Mass</b>						
0	45	31	109	61	257	91	615
1	46.2	32	112	62	265	92	630
2	47.5	33	115	63	272	93	650
3	48.7	34	118	64	280	94	670
4	50	35	121	65	290	95	690
5	51.5	36	125	66	300	96	710
6	53	37	128	67	307	97	730
7	54.5	38	132	68	315	98	750
8	56	39	136	69	325	99	775
9	58	40	140	70	335	100	800
10	60	41	145	71	345	101	825
11	61.5	42	150	72	355	102	850
12	63	43	155	73	365	103	875
13	65	44	160	74	375	104	900
14	67	45	165	75	387	105	925
15	69	46	170	76	400	106	950
16	71	47	175	77	412	107	975
17	73	48	180	78	425	108	1000
18	75	49	185	79	437	109	1030
19	77.5	50	190	80	450	110	1060
20	80	51	195	81	462	111	1090
21	82.5	52	200	82	475	112	1120
22	85	53	206	83	487	113	1150
23	87.5	54	212	84	500	114	1180
24	90	55	218	85	515	115	1215
25	92.5	56	224	86	530	116	1250
26	95	57	230	87	545	117	1285
27	97.5	58	236	88	560	118	1320
28	100	59	243	89	580	119	1360
29	103	60	250	90	600	120	1400
30	106						

**Annex C**  
**(See Para. 2.21)**  
**VARIATION OF LOAD CAPACITY AS A FUNCTION OF SPEED**

Speed (km/h)	Variation in load carrying capacity ( % )										
	Moped	Rim diameter code $\leq 12$				Rim diameter code $\geq 13$					
	Speed Symbol					Speed Symbol					
	B	E	J	K	L	J	K	L	M	N	P and above
30	+ 30	+12	+30	+ 30	+ 30	+30	+ 30	+ 30	+ 30	+ 30	+ 30
50	0	+12	+30	+ 30	+ 30	+30	+ 30	+ 30	+30	+ 30	+ 30
60		+6	+23	+ 23	+ 23	+23	+ 23	+ 23	+23	+ 23	+ 23
70		0	+16	+ 16	+ 16	+16	+ 16	+ 16	+16	+ 16	+ 16
80			+10	+ 10	+ 10	+10	+ 10	+ 10	+10	+ 10	+ 14
90			+5	+ 5	+ 7.5	+ 5	+ 5	+ 7.5	+7.5	+ 7.5	+ 12
100			0	0	+5	0	0	+5	+5	+5	+ 10
110				0	+ 2.5		0	+ 2.5	+ 2.5	+ 2.5	+ 8
120					0			0	0	0	+ 6
130									0	0	+ 4
140										0	0

**Annex D**  
**(See Para. 4.2)**  
**ARRANGEMENT OF TYRE MARKINGS**

Example of the markings which shall appear on type approved  
types of tyres

$b \geq 4\text{mm}$	—	<b>100/80 R 18 53 S</b>	<b>TUBELESS</b>	<b>MAR 02</b>
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These markings define a tyre:

- having a nominal section width of 100.
- having a nominal aspect ratio of 80.
- being of Radial Ply structure (R).
- having a rim diameter of 457 mm. the code for which is 18.
- having a load capacity of 206 kg. corresponding to load index 53 (see Annex B).
- classified in the speed category S (maximum speed 180 km/h).
- which may be fitted without an inner tube (tubeless).
- manufactured during Month, March of the Year 2002

The size of markings, other than these can be of a minimum height of 2.5 mm.

The position and order of the markings constituting the tyre designation shall be as follows:

- a) The tyre size designation including the nominal section width. the nominal aspect ratio. the symbol of the structure, where appropriate and the nominal rim diameter shall be combined as shown in the above example i.e. 100/80 R 18;
- b) The load capacity index and the speed category symbol shall be placed near the tyre size designation. They may either precede or follow this or be located above or below it;
- c) The descriptions "TUBELESS" and "REINFORCED" or "REINF" may be further away from the dimensional description;
- d) In the case of tyres suitable for speeds above 240 km/h. the letter codes "V" or "Z". as applicable. shall be marked in front of the structure marking (e.g. 140/60ZR18). The reference load capacity index and speed category symbol shall be marked within parentheses as applicable (see para. 4.1.12).

**Note:** The marking need not be in the sequence shown above. Arrangement of tyre marking relates to the tyre size designation. Other markings location will be left to the discretion of the tyre manufacturer.

**Annex E**  
**(See Para. 7.3)**

**METHOD OF MEASURING TYRE DIMENSIONS**

**E1.0** The tyre shall be fitted to the measuring rim and inflated to the pressure specified by its manufacturer.

In the absence of such specification from the tyre manufacturer, the values given in Table E1 may be used for the categories listed.

**E 2.0** The tyre mounted on its rim is left at ambient laboratory temperature for at least 24 hours.

**E 3.0** The pressure is reset at the value as per para. E1.0

**E4.0** The overall width is measured by means of a caliper gauge at six equally spaced points account being taken of the thickness of the ribs or bands.

The highest measurement thus obtained shall be considered as the overall width.

**E5.0** The outer diameter is determined as follows: the maximum circumference is measured and the figure thus obtained is divided by  $\pi$  (3.1416).

**Table E1. (See Para. E1.0)**  
**Recommended inflation pressure for measuring tyre dimensions.**

Tyre version		Speed category symbol	Pressure	
			bar	kPa
MOPEDS				
Standard		B	2.50	250
Reinforced		B	2.75	275
MOTORCYCLES				
Standard		J	2.50	250
		F, G, K, L, M, N, P,Q,R,S	2.25	225
		T, U, H, V,W	2.80	280
Reinforced		F to P	2.80	280
		Q, R, S, T, U, H	3.30	330
SCOOTER & MOTORCYCLE, SCOOTER DERIVATIVES	4PR	E	3.45	345
	6PR		4.25	425
	8PR		5.00	500
	4PR	F to M	3.50	350
	6PR		4.00	400
	8PR		4.50	450

**Annex F**  
(See Para. 8.1)

**PROCEDURE FOR TESTING LOAD / SPEED PERFORMANCE**

**F1.0 TYRE PREPARATION**

- F1.1** A new tyre shall be fitted to the test rim identified by the manufacturer.
- F1.2** The tyre shall be inflated to the pressure specified by its manufacturer. In the absence of such specification from the tyre manufacturer, the values given in Table F1 may be used for the categories listed.

**Table F1. (See F1.2)**  
**Recommended inflation pressure for testing load/speed performance**

Tyre version		Speed category symbol	Pressure	
			Bar	kPa
Mopeds - standard		B	2.25	225
Mopeds -reinforced		B	3.00	300
Motorcycles – standard		F, G, J, K, L, M, N, P	2.50	250
		Q,R,S	3.00	300
		T, U, H, V <sup>(1)</sup>	3.50	350
Motorcycles – reinforced		F G, J, K, L, M, N, P	3.30	330
		Q, R, S, T, U, H	3.90	390
Scooter & Motorcycle, Scooter Derivatives	4PR	F, G, J, K, L, M	3.70	370
	6PR		4.50	450
	8PR		5.20	520
(1) For speeds above 240 km/h the test pressure is 3.20 bar (320 kPa). Other types of tyre shall be inflated to the pressure quoted by their manufacturer				

- F1.3** The wheel/tyre combination shall be stored at the temperature of the test chamber for at least three hours.

- F1.4** The tyre pressure shall be brought to that specified in para. F 1.2.

**F2.0 TEST SEQUENCE**

- F2.1** The tyre/wheel combination shall be fitted to a test spindle and pressed against the outer surface of a smooth flywheel having a diameter of 1.7 m  $\pm$  1% or 2.0 m  $\pm$  1%.

- F2.2** A load, which is equal to 65 % of the following, shall be applied to the test spindle.

In the case of moped tyres (speed category symbol B) the test load shall be 67 % on a test drum which is 2.0 m in diameter, instead of 65%.

- F2.2.1** The maximum load rating corresponding to the load capacity index for tyres bearing speed symbols up to and including "H" (210km/h).

- F2.2.2** The maximum load rating associated with a maximum speed of 240 km/h for tyres bearing speed symbol "V" (see para. 2.20).

- F2.2.3** The maximum loading rating associated with a maximum speed of 270 km/h for tyres with speed symbol "W" (see Para. 2.20).
- F2.2.4** The load rating associated with the maximum speed specified by the tyre manufacturer for tyres suitable for speeds above 240 km/h (or 270 km/h as applicable) (see Para. 2.7.3).
- F2.3** Throughout the test the tyre pressure shall not be reset and the test load shall be held constant.
- F2.4** During the test the temperature in the test room shall be kept at between 20 and 40 °C or at a higher temperature if so accepted by the manufacturer.
- F2.5** The test shall proceed uninterrupted, in accordance with the following:
- F2.5.1** Time for transition from speed 0 to initial test speed shall be carried out in 20 minutes.
- F2.5.2** Initial test speed shall be equal to the maximum speed intended for the type of tyre reduced by 30 km/h if the test is carried out on a 2 m-diameter drum or by 40 km/h if the test is carried out on a 1.7 m-diameter drum.
- F2.5.3** Successive speed increments shall be 10 km/h and duration of test at each speed range shall be of 10 minutes
- F2.5.4** Total duration of test shall be one hour.
- F2.5.5** Maximum test speed shall be the maximum speed intended for the type of tyre if the test is carried out on a 2 m-diameter drum and maximum speed intended for the type of tyre reduced by 10 km/h if the test is carried out on a 1.7 m-diameter drum.
- F2.5.7** In the case of moped tyres (speed-category symbol B), the test speed shall be 50 km/h, the time taken to accelerate from 0 to 50 km/h being 10 minutes, a steady state speed then being held for 30 minutes and the total duration of the test being 40 minutes.
- F2.6** However, if a second test is performed to assess the top performances of tyres suitable for speeds above 240 km/h identified by means of letter code "V" within the size designation (or 270 km/h for tyres identified by means of letter code "Z" within the size designation) the procedure shall be as follows:
- F2.6.1** The maximum speed shall be the maximum speed specified by the tyre manufacturer
- F2.6.2** Twenty minutes to build up from zero to the initial test speed.
- F2.6.3** Twenty minutes at the initial test speed.

**F2.6.4** Ten minutes to build up to the maximum test speed.

**F2.6.5** Five minutes at the maximum test speed.

**F3.0 EQUIVALENT TEST METHODS**

If a test method other than that described in para. F2.0 is used its equivalence shall be demonstrated.

**Annex G**  
**(See Para. 9.2)**  
**METHOD FOR DETERMINING**  
**THE DYNAMIC GROWTH OF TYRES**

**G1** This test method shall apply to motorcycle tyres of the speed capability symbol greater than P (150km/hr).

It is intended to determine the maximum growth of the tyre which is due to the effect of the centrifugal force at the maximum permissible speed.

**G2.0 Description of test procedure**

**G2.1** The test axle and the rim shall be checked in order to ensure that radial eccentricity is less than  $\pm 0.5$  mm and that lateral displacement is less than  $\pm 0.5$  mm, when measured at the outer periphery of the bead seat of the wheel.

**G2.2 Contour-outline device**

Any device (projection grid camera, spotlights and others) enabling the outer contour of the cross section of the tyre to be outlined distinctly or to establish an enveloping curve at right angles to the equator of the tyre at the point of maximum tread deformation.

This device shall reduce any deformation to a minimum and ensure a constant (known) ratio (K) between the contour plotted and the actual dimensions of the tyre. This device will enable the tyre contour to be determined in relation to the wheel axis.

**G3.0 Execution of test**

**G3.1** During the test the temperature in the test room shall be held between 20 °C and 40 °C or at a higher temperature if so accepted by the tyre manufacturer.

**G3.2** The tyres to be tested shall have undergone the load/speed performance test in accordance with Annex F without any faults having emerged.

**G3.3** The tyre to be tested shall be fitted to a wheel rim of which conforms to the applicable standard.

**G3.4** The tyre inflation pressure (test inflation pressure) shall be adjusted to the values indicated in Table G1

**Table G1: (See Para. G3.4)**

**Inflation Pressure for Diagonal or Bias Ply and Belted-Bias Tyres**

Speed category symbol	Tyre version	Tyre inflation pressure (bar)
Q/ R / S	Standard	2.50 {250 kPa}
T and above	Standard	2.90 {290 kPa}

**G3.5** The wheel/tyre combination shall be stored at the temperature of the test room for at least three hours.

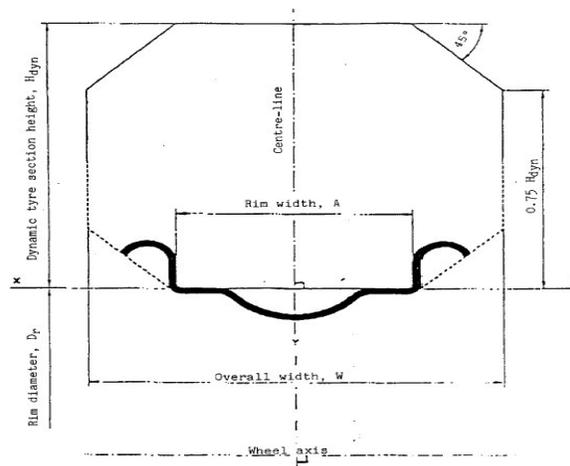
**G3.6** Following that period of storage the inflation pressure shall be corrected to the value laid down in para. G.3.4

**G3.7** The wheel/tyre combination shall be mounted on the test axle and checked to ensure that it turns freely. The tyre may be rotated by a motor acting on the tyre axis or else via pressure against a test drum.

- G3.8** The entire assembly shall be accelerated without interruption in order to achieve the maximum speed capability of the tyre within five minutes.
- G3.9** The contour-outline device shall be installed care being taken to ensure that it is at right angles to the direction of rotation of the tread of the tyre being tested.
- G3.10** A check shall be made that the peripheral speed of the tread surface is equal to the maximum speed capability of the tyre within  $\pm 2\%$ . The equipment shall be kept at a constant speed for five minutes at least and then the cross section of the tyre shall be traced in the area of maximum deformation or a check shall be made that the tyre does not exceed the enveloping curve.
- G4.0 Assessment of results**
- G4.1** The limiting curve (enveloping curve) specified for the mounted tyre/wheel assembly shall be as in the example shown in Figure G1.

**Figure G1. (See Para. G4.1) Enveloping curve for dynamic growth test**

The limit values for the envelope outline are laid down as follows:



Tyre speed category	Q / R / S	T / U / H	Over 210 km/h.
H <sub>dyn</sub> (mm)	H X 1.10	H X 1.13	H X 1.16
were H is nominal tyre height as given in Para 7.2.1			

- G4.1.1** The main dimensions of the enveloping curve shall be adjusted. If applicable, taking into account the constant ratio K (see Para. G2.2 above).
- G4.2** The contour of the tyre portrayed at the maximum speed shall not exceed the enveloping curve, with reference to the tyre axes.
- G4.3** No other test is carried out on the tyre.

**Annex H (See Para. 10.1)**  
**TYRE STRENGTH TEST (PLUNGER TEST)**

**H1 Apparatus**

The equipment consists of a cylindrical steel plunger having a hemispherical end of a diameter specified in the Tables H1, H2 or H3, as applicable for type of tyre and a device to force the plunger rod into a tyre at the rate specified in H3.

**H2 Preparation of Tyre for the test**

The tyre with a tube shall be mounted and inflated on a test rim of the recommended size and shall be conditioned at approximately the temperature of the room in which the test is to be conducted for at least 3 hours after which the pressure shall be adjusted if necessary to the test inflation pressure specified in Para. E1.0.

**H3 Test procedure**

The plunger rod shall be forced into the tread of the tyre/wheel assembly mounted as described in Para. H2. Perpendicularly over a tread element at the centerline of the tread or as near as possible to avoiding penetration into a tread groove.

The rate of travel of the plunger shall be  $50 \pm 1.5$  mm per minute until the tyre breaks or the plunger is stopped by the rim (bottoming of the plunger against the rim) in which case the tyre shall be deemed to have passed the test regardless of energy value.

Measurement of force and penetration at break (or bottoming against the rim) shall be made at 5 points nearly equally spaced round the tyre circumference. The arithmetic mean energy absorbed shall be calculated from the five energy values obtained at the break using the formula given in Para. H4.

**H4 Formula for calculating the breaking energy:**

The breaking energy shall be calculated as:

$$W = \frac{F \times P}{2} \times 10^{-3}$$

where;

W = energy at break (or bottoming) in J (Joule)  
 F = Force at break (or bottoming) in N; and  
 P = Penetration at break (or bottoming) in mm.

**H5** As an option for purpose of conformity if the plunger energy measurements meet or exceed the minimum value specified it is not necessary to continue penetration of the plunger to break the tyre.

**H6 Requirements**

**H6.1** Nylon cord tyre should conform to the requirements specified in Tables H1, H2 or H3, as applicable, when tested as per procedure detailed above.

**H6.2** For rayon tyres, the minimum static breaking energy values will be 60 percent of those for Nylon tyre.

**H6.3** Tyre designations, Load Index and speed category symbol not covered by Table H1, the test inflation pressure, Plunger diameter and Static Breaking energy shall be as declared by the tyre manufacturer.

**Table H1 (See Para. H6.3)  
Requirements for Plunger test for Diagonal Ply Tyres**

	<b>Ply rating</b>	<b>Plunger Dia (mm)</b>	<b>Static Breaking Energy (J)</b>
Tyres with rim diameter code more than 12 (Motorcycle and three wheeler)	2 PR	$8 \pm 0.2$	17
	4 PR	$8 \pm 0.2$	34
	6 PR	$8 \pm 0.2$	45
Tyres with rim diameter code not more than 12 (Scooter and three wheeler)	4 PR	$19 \pm 0.2$	136
	6 PR	$19 \pm 0.2$	203
	8 PR	$19 \pm 0.2$	271
Moped tyres (Diagonal)	--	$8 \pm 0.2$	34.6

**Table H2 (See Para. H6.3)  
Requirements for Plunger test for Radial Millimetric Designated Tyres**

	<b>Ply rating</b>	<b>Plunger Dia (mm)</b>	<b>Static Breaking Energy (J)</b>
Nominal Section width upto 62	2PR	$8 \pm 0.2$	15
	4 PR	$8 \pm 0.2$	29
	6 PR	$8 \pm 0.2$	39
Radial ply tyres, Code designated -Nominal Section width above 62	2PR	$8 \pm 0.2$	17
	4 PR	$8 \pm 0.2$	34
	6 PR	$8 \pm 0.2$	45
	8 PR	$8 \pm 0.2$	56

**Table H3 (See Para. H6.3)  
Requirements for Plunger test for Millimetric ISO Designated Tyres**

	<b>Inflation pressure (Kpa) (1)</b>	<b>Plunger Dia (mm)</b>	<b>Static Breaking Energy (J)</b>
Nominal Section width upto 62	upto 225 Kpa	$8 \pm 0.2$	15
	225 Kpa and above	$8 \pm 0.2$	29
Nominal Section width more than 62	upto 225 Kpa	$8 \pm 0.2$	17
	225 Kpa and above	$8 \pm 0.2$	34
(1): Inflation pressure corresponding to maximum load carrying capacity			

**Annex J (See Para. 11.1)**  
**ENDURANCE TEST**

**J1** This test is applicable for all tyres.

**J2 Test Apparatus**

The test wheel shall be a flat smooth faced wheel having a diameter of 1700 mm  $\pm$  1%. The surface width of the wheel shall be more than the loaded tyre tread width. The air surrounding the tyre during the test shall at a temperature of 20 to 40 °C.

**J3 Preparation of tyre for the test**

Mount the tyre after ensuring that it exhibits no visual evidence of tread, side-wall, ply, cord or bead separation, broken cord or cracking, on a test rim of the recommended size and inflate to the pressure specified in F1.2 of Annex F.

Condition the inflated tyre-rim assembly in an ambient atmosphere with temperature 20 to 40 °C for a minimum period of 3 hours.

Read just if necessary, the tyre pressure to the original inflation pressure immediately before the test.

**J4 Test Procedure**

Mount the conditioned tyre-rim assembly on a test machine axle and press the tyre against the face of the test drum at initial (Stage I) test load followed by the test loads Stage II and Stage III as those specified in Table J1. The test speed shall be as given Table J1.

At the end of each run, a record shall be kept of the tyre inflation pressure. Additionally, the first reading of inflation pressure shall be taken 3hours after the start of the test. A normal tyre pressure rise from initial test inflation pressure is permitted. But, if at later stages of pressure checks, the inflation pressure drops below the first value, the test tyre shall be rejected and the test repeated with afresh tyre after cause of the drop in pressure is ascertained and defect rectified.

**J5 Examination of tyre after test**

On completion of the cumulative test running time, the tyre shall cut and examined. There shall be no evidence of broken cords, tread separation, ply or bead separation or cracking of tread of side-wall rubber deep enough to expose the carcass cords fabric.

**Table J1 (See Para. J4)**  
**Endurance test schedule**

	Speed (% of rated speed)	Stage I		Stage II		Stage III	
		Load (1)	Time (h)	Load (1)	Time (h)	Load (1)	Time (h)
Motorcycle tyres (with rim diameter code more than 12	40	100	4	108	6	117	24
Scooter (with rim diameter code not more than 12) and moped tyres	64	100	4	108	6	117	24
Three wheeler tyres	57	66	4	84	6	101	24
(1) The figures indicated are percentage of the maximum load carrying capacity							

**Annex K**  
**(See Para. 13.1)**  
**TYRE STIFFNESS TEST**

**K.1.0 PREPARING THE TYRE**

- K.1.1 Mount a new tyre on the test rim specified by the manufacturer pursuant to para. 15.1 of this standard.
- K.1.2 Use a new inner tube or combination of inner tube, valve and flap (as required) when testing tyres with inner tubes.
- K.1.3 Inflate the tyre to the pressure corresponding to the pressure specified by the manufacturer.
- K.1.4 Condition the tyre-and-wheel assembly at test-room temperature for not less than three hours.

**K.2.0 TEST PROCEDURE****K.2.1 Radial Stiffness**

- K2.1.1 Radial load shall be applied equal to its maximum load capacity. Stiffness shall be reported for the load (difference between 80% and 20% of rated load) divided by corresponding deflection in mm.

**K 2.2 Lateral Stiffness**

- K2.2.1 Radial load shall be applied equal to its maximum load or load Index
- K.2.2.2 Tyre or the surface on which radial load is applied shall be pulled laterally at a speed of 50mm/min by maintaining constant radial load.
- K.2.2.3 Load required to pull tyre/surface shall be monitored and slip is recorded when there is reduction in lateral pull load.
- K.2.2.4 Stiffness shall be reported for the load (between 80% & 20% of maximum lateral load) divided by corresponding displacement in mm (Surface finish of surface on which radial load is applied shall be reported in test report).

**K2.3 Tangential Stiffness**

- K2.3.1 Radial load shall be applied equal to its maximum load or load index
- K.2.3.2 Tyre or the surface on which radial load is applied shall be pulled in the direction of rotation of tyre at a speed of 50mm/min by maintaining constant radial load.
- K.2.3.3 Load required to pull tyre/surface shall be monitored and slip is recorded when there is reduction in tangential pull load.
- K.2.3.4 Stiffness shall be reported for the load (between 80% & 20% of maximum lateral load) divided by corresponding displacement in mm (Surface finish of surface on which radial load is applied shall be reported in test report).

**Annex L**  
**(See Para. 14.1)**  
**TYRE UNIFORMITY TEST**

**L.1.0 PREPARING THE TYRE**

- L.1.1 Mount a new tyre on the test rim specified by the manufacturer pursuant to Para. 15.1 of this standard.
- L.1.2 Use a new inner tube or combination of inner tube, valve and flap (as required) when testing tyres with inner tubes.
- L.1.3 Inflate the tyre to the pressure corresponding to the pressure specified by the manufacturer.
- L.1.4 Condition the tyre-and-wheel assembly at test-room temperature for not less than three hours.

**L.2.0 TEST PROCEDURE**

- L.2.1 Apply a load of 85% of rated load (for rim up to 14 inch) and 88% of rated Load (for rim above 15 inch) to the tyre and warm up the tyre for two minutes at 300-400 rpm of tyre rotating speed.
- L.2.2 Outer diameter of test drum shall be  $854.1 \pm 2.5$  mm for rim diameter upto 14 inches and  $1600.2 \pm 2.5$  mm for rim diameter above 15 or more and drum surface shall have High friction coarse textured surface
- L.2.3 Adjust the inflation pressure and rotating speed of tyre to 60 rpm
- L.2.4 The distance between the axis of the tyre and the axis of the drum shall be held constant.
- L.2.4 Rotate the tyre at 60 rpm and measure the components and variations of the following generated force with indicators and recorders:

- Radial force variation
- Lateral force variation
- Tractive force variation
- Conicity and ply steer

If necessary, repeat the measurements after reversing the tyre on the machine, or reversing the direction of the rotation.

**Annex M**  
**(See Para. 15.1)**

**INFORMATION TO SUBMITTED FOR TYPE APPROVAL OF TYRES**

- 1 Manufacturer's name & address:
- 2 Telephone No:
- 3 Fax. No.:
- 4 E mail address:
- 5 Contact person:
- 6 The tyre-size designation as defined in para. 2.29:
- 7 The trade name or mark:
- 8 The category of use:
- 9 Structure: diagonal (bias ply)/ bias belted / radial;
- 10 The speed category:
- 11 The load-capacity index of the tyre / Maximum Load carrying capacity (kg):
- 12 Whether the tyre is to be used with or without an inner tube:
- 13 Whether the tyre is "normal" or "reinforced";
- 14 The ply-rating number of tyres for (for code designated tyres):
- 15 Overall section width (mm):
- 16 Overall diameter (mm):
- 17 The measuring rim and test rim:
- 18 Inflation pressure (bar):
- 18.1 Inflation pressure corresponding to maximum load carrying capacity:
- 18.2 The test and measurement pressures:
- 19 The factor X referred to in para. 2.23:
- 20 The maximum speed permitted by the tyre manufacturer and the load carrying capacity allowed for that maximum speed.  
Applicable only for tyres identified by means of letter code "V" within the size designation and suitable for speeds over 240 km/h or for tyres identified by means of letter code "Z" within the size designation and suitable for speeds over 270 km/h:
- 21 Intended for use on: Moped/Motorcycle/Three-wheeler:
- 22 In addition, the following shall be submitted in triplicate:
  - Sketch, or a representative photograph, which identify the tyre tread pattern.
  - Sketch of the inflated tyre mounted on the measuring rim showing the relevant dimensions (para. 6.2 and 7.2).

**ANNEX N**  
**(See Introduction)**

**COMMITTEE COMPOSITION**  
**Automotive Industry Standards Committee**

<b>Chairman</b>	
Shri B. Bhanot	Director The Automotive Research Association of India, Pune
<b>Members</b>	<b>Representing</b>
Shri Alok Rawat	Ministry of Road Transport & Highways, New Delhi
Shri Sushil Kumar	Department of Heavy Industry, Ministry of Heavy Industries & Public Enterprises, New Delhi
Director	Office of the Development Commissioner Small Scale Industries, Ministry of Small Scale Industries, New Delhi
Shri L. R. Singh	Bureau of Indian Standards, New Delhi
Shri A. S. Lakra Shri D. G. Shirke (Alternate)	Central Institute of Road Transport, Pune
Director	Indian Institute of Petroleum, Dehra Dun
Shri R.C. Sethi Shri N. Karuppaiah (Alternate)	Vehicles Research & Development Establishment, Ahmednagar
Shri Rajat Nandi	Society of Indian Automobile Manufacturers
Shri T.C. Gopalan Shri Ramakant Garg (Alternate)	Tractor Manufacturers Association, New Delhi
Shri K.N.D. Nambudiripad	Automotive Components Manufacturers Association, Pune
Shri G. P. Banerji	Automotive Components Manufacturers Association, New Delhi

**Member Secretary**  
**Mrs. Rashmi Urdhwareshe**  
**Sr. Assistant Director**  
**The Automotive Research Association of India, Pune**