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**PASSENGER CAR TYRES  
PART 3: METHODS OF TEST**

**ICS: 38.140**

# **PASSENGER CAR TYRES**

## **PART 3: METHODS OF TEST**

**Date of GSO Board of Directors' Approval** : **19/5/1428h (5/6/2007)**  
**Issuing Status** : **Technical Regulation**

## **Foreword**

GCC Standardization Organization (GSO) is a regional Organization which consists of the National Standards Bodies of GCC member States. One of GSO main functions is to issue Gulf Standards /Technical regulations through specialized technical committees (TCs).

GSO through the technical program of committee TC No. (2) " Technical Committee of Mechanical standards" has updated the GSO Standard No. : 53/1986 " Passenger Car Tyres - Part 3: Methods of Test ". The Draft Standard has been prepared by Kingdom of Saudi Arabia.

This standard has been approved as a Gulf Technical Regulation by GSO Board of Directors in its meeting No.(6) held on 19/5/1428H (5/6/2007G). The approved standard will replace and supersede the GSO standard No. 53/1986.

**PASSENGER CAR TYRES  
PART 3: METHODS OF TEST**

**1- SCOPE AND FIELD OF APPLICATION**

This standard is concerned with methods of test for the new passenger car tyres inflated with compressed air.

**2- COMPLEMENTARY REFERENCES**

- 2.1 GSO 51/2007 “Passenger Car Tyres - Part 1: Nomenclature, Designation, Marking, Dimensions, Load Capacity and Inflation Pressure”.
- 2.2 GSO 52/2007 “Passenger Car Tyres - Part 2: General Requirements”.
- 2.3 GSO 581/1995 “Requirements for Storage of Motor Vehicle Tyres”.
- 2.4 GSO Standard to be approved by the Organization “Motor Vehicles Tyers – Treadwear, Traction and Temperature Resistance Grading”.
- 2.5 GSO Standard to be approved by the Organization “Motor Vehicles Tyers – Methods of Testing of Temperature Resistance Grading”.

**3- VISUAL INSPECTION**

- 3.1 Tyres shall be visually inspected to check the absence of any cracks or cuts in the tread or on either sidewalls, and ensure it is free from any metal pieces, gravel or other foreign matter pinched or stuck in the tyre.
- 3.2 Information marked on the tyre shall be checked.
- 3.3 Temperature rating marked on the tyre shall be checked.
- 3.4 The speed symbol marked on the tyre shall be checked.
- 3.5 The date of manufacture marked shall be checked.

**4- DIMENSIONS MEASUREMENT****4.1 Overall width**

The tyre shall be mounted on a measuring rim and inflated to the pressure specified in Table 1, and allowed to stand for 24 h, at room temperature (20 to 30) °C prior to measuring. The pressure shall be readjusted to the original value, then the tyre width shall be callipered at six different points spaced approximately equally around the circumference. The average of these measurements is to be taken as the tyre overall section width.

**4.2 Overall diameter**

The maximum outer circumference shall be measured with a steel tape and then the value divided by 3.1416 to obtain the overall diameter.

**TABLE 1**  
**Inflation Pressure in kPa**

Radial Tyres		Diagonal (bias-ply) Tyres			T-Type Temperature Use Spare
Standard	Reinforced or Extra Load	Ply Rating			
		4	6	8	
180	220	170	190	220	420

## 5- TENSILE STRENGTH AND ELOGATION TEST

5.1 A test specimen shall be taken from the tread in the direction of the circumference with dimensions as in Fig. (1<sub>a</sub> or 1<sub>b</sub>).

5.2 Procedure

The test specimen shall be fixed between the two jaws of the testing machine, and shall be tensiled at a rate of 500 ± 25 mm/min.

5.3 Calculation

5.3.1 The tensile strength shall be calculated as follows:

$$T = \frac{L}{A} \text{ kg/mm}^2$$

Where:

T = tensile strength kg/mm<sup>2</sup>

L = maximum load kg

A = Cross sectional area of the test specimen mm<sup>2</sup>

5.3.2 The elongation shall be calculated as follows:

$$\text{Elongation} = \frac{l_2 - l_1}{l_1} \times 100$$

Where:

l<sub>1</sub> = standard length mm

l<sub>2</sub> = the length at breaking time, mm

## 6- AGEING TEST

6.1 Preparation of Sample

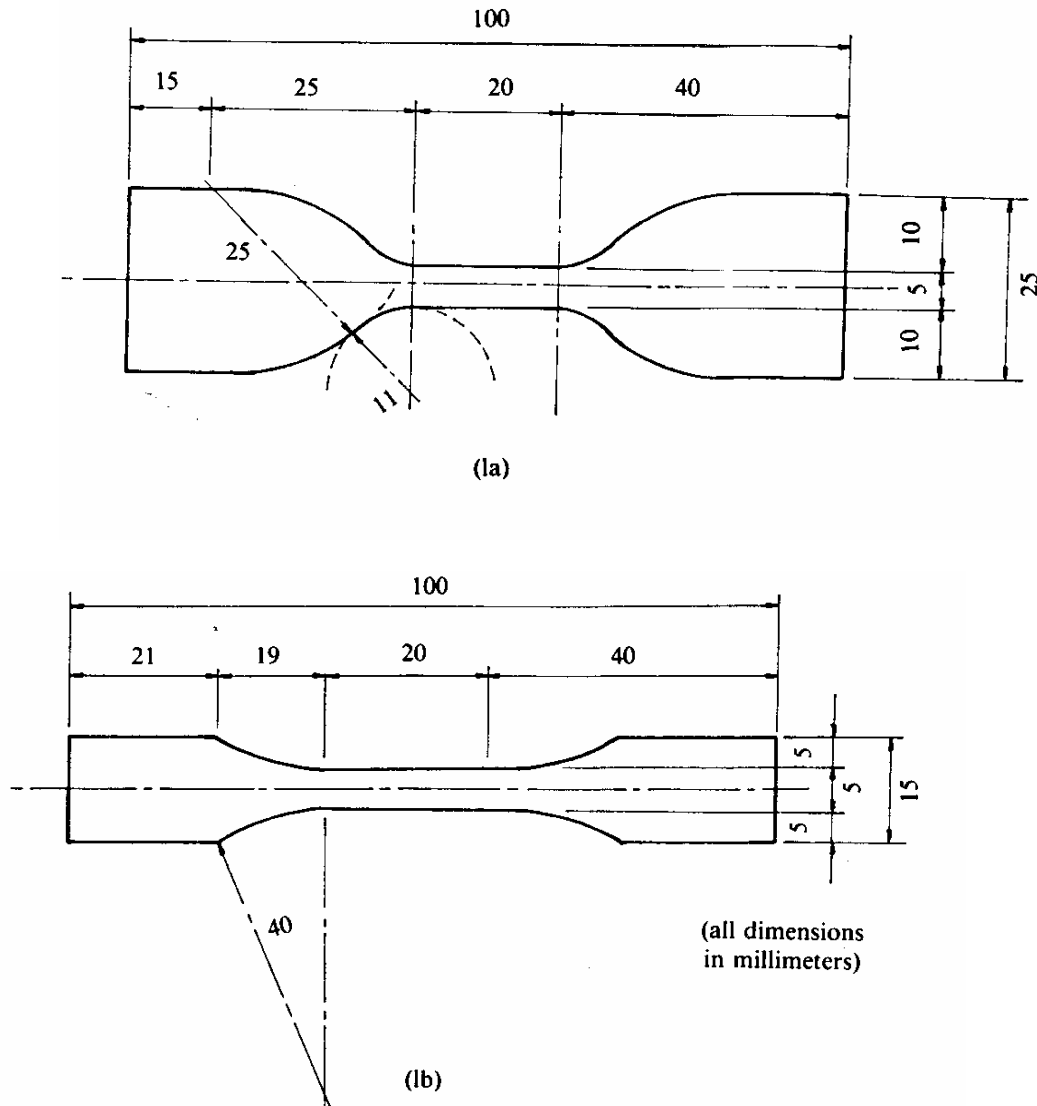
Four test specimens shall be taken by the same methods and dimensions mentioned in item 5.1.

6.2 Apparatus

A closed furnace, with the temperature adjusted so as to be  $(70 \pm 1)^\circ\text{C}$ , at its centre, provided that it shall not be changed at any point in the furnace by  $\pm 2^\circ\text{C}$ . The furnace shall be equipped with a thermostat with a precision  $\pm 1^\circ\text{C}$ , and a system to change the inside air once per hour at least. The volume of inside area of the furnace must be proportioned to the weight of the test portion. It shall be 10 ml for each 1 gram of the sample weight at least.

6.3 Procedure

Test specimens shall be hung in the centre of the furnace after the inside temperature becomes steady. Test specimens shall not touch each other and shall not be touching the furnace walls. It shall be kept in the furnace for 96 hours, then taken out and left in room temperature before carrying out the tensile test after 16-96 hours.



**Fig. 1**  
**Test Specimens**

7- **STRENGTH TEST**

## 7.1 Preparation of Tyre

The tyre shall be mounted on the test rim and inflated to the pressure specified in Table (2) and conditioned at the temperature of the room in which the test shall be conducted for at least 3 hrs., after which the pressure shall be adjusted to the values shown in Table (2). For convenience in testing, a tube may be used with tubeless tyres.

**TABLE (2)**  
**Inflation Pressure in kPa**

Radial Tyres		Diagonal (bias-ply) Tyres			T-Type Temperature Use Spare Tyres
Standard	Reinforced or Extra Load	Ply Rating			360
		4	6	8	
180	220	170	190	220	

## 7.2 Apparatus

A cylindrical steel plunger ( $19 \pm 0.125$ ) mm in diameter, with a hemispherical end, moving at a rate of 50 mm/min  $\pm$  2.5 mm/min.

## 7.3 Procedure

The plunger shall be forced into the tread perpendicularly as near to the centre line as possible, avoiding penetration into a tread groove. Five measurements of force and penetration at break shall be made at points equally spaced around the circumference of the tyre. Check the tyre pressure before moving to the next point.

If the plunger bottoms out without any break occurring, the tyre shall be considered to have passed the test.

## 7.4 Calculation

The average energy absorbed shall be calculated from the all valid values obtained by means of the following formula:

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

Where:

W = Energy at break, in Joule,

F = Force at break, (Newton)

P = Penetration at break, mm.

**8- ENDURANCE TEST**

## 8.1 Preparation of Tyre

The tyre shall be mounted on the specified rim, and inflated to the pressure shown in Table (2). It shall then be conditioned at a temperature of  $(38 \pm 3)^{\circ}\text{C}$  for a minimum of 3 h. Immediately prior to test, the inflation pressure shall be readjusted to the value specified in Table (2).

## 8.2 Apparatus (Fig. 2)

8.2.1 A steel drum  $(1700 \pm 1\%)$  or  $(2000 \pm 1\%)$  mm diameter in diameter and at least the same width as the tread width of the tyre to be tested.

8.2.2 An axle or spindle supporting a rim on which tyres of different sizes may be readily mounted. A means for loading the tyre against the drum and for holding a fixed tyre-to-drum centre distance during measurements.

8.2.3 A provision for rotating the spindle of either the tyre or the drum in at clockwise and counter clockwise directions within the specified testing speeds.

8.2.4 A system for measuring the radial forces at the tyre and the spindle at different speeds.

8.2.5 A means for rapid inflation and deflation of the tyre, and for control of inflation pressure during rotation.

8.3 A test room controlled at a temperature of  $(38 \pm 3)^{\circ}\text{C}$  during the test.

## 8.4 Procedure

The tyre shall be mounted on test axle, rotated at speed of 80 km/h and shall be pressed against the test drum with the required test load and test periods not less than those shown in the Table 3

**TABLE 3**  
**Stages of Endurance Test**

Test Stage	Test Load (N)		Test Time (h)
	Radial Tyres	Bias-Ply & T-Type Temporary Use Spare Tyres	
1	1 x max load capacity	0.85 x max load capacity	4
2	1.1 x max load capacity	0.90 x max load capacity	6
3	1.15 x max load capacity	1 x max load capacity	24

## 8.5 Result

The tyre shall be checked for evidence of tread, side wall, innerliner, cord, ply, belt or bead separation, tread chunking, open splices or broken cords.



**9- HIGH SPEED PERFORMANCE TEST****9.1 Preparation of Tyre**

The tyre shall be mounted on the specified rim and inflated to the pressure shown in Table (4). Then it shall be conditioned at a temperature not less than 38°C for a minimum of 3 h. Immediately prior to test, the inflation pressure shall be readjusted to that specified in Table (4).

**9.2 Apparatus**

A steel drum of (1700 ± 1%) or (2000 ± 1%) mm diameter and at least the same width as the tread width of the tyre to be tested.

**9.3 A test apparatus environment controlled at a temperature not less than 38°C during the test period.**

**TABLE 4**  
**Inflation Pressure - kPa**

Speed Symbol	Diagonal Tyres			Radial (1)		T-Type Temporary Use Spare Tyres
	Ply Rating			Standard	Extra Load (Reinforced)	
	4	6	8			
L, M, N	230	270	300	240	280	420
P, Q, R, S	260	300	330	260	300	
T, U, H	280	320	350	280	320	
V	300	340	370	300	340	
W, Y ZR not excess of 300 km/h	-	-	-	320	360	

(1) For CT tyres, increase test inflation 50 kPa.

**9.4 Procedure**

**9.4.1** The tyre shall be mounted on test axle, rotated at an initial test speed (ITS) equal to the tyre's speed category corresponding to the speed symbol marked on the tyre sidewall, less 40 km/h if tested on a 1700 mm steel drum, or less 30 km/h if tested on a 2000 mm steel drum and pressed against the test drum with 80 percent of the maximum application load capacity, as specified in Gulf Standard mentioned in item 2.1 and corresponding to the service description (load index and speed symbol) marked on the tyre sidewalls.

**9.4.2** Throughout the test the inflation pressure shall not be corrected and the test load shall be kept constant.

- 9.4.3 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 maintained at a temperature not less than 38°C.
- 9.4.4 The test shall be carried out without interruptions in accordance to the tyre's speed symbol as follows:
- 9.4.4.1 For tyres of speed symbol L to W, inclusive:
- 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.
- 9.4.4.2 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.
- 9.4.4.3 For tyres with "ZR" in the size designation intended for use at speeds greater than 300 km/h.
- 9.4.4.3.1 Test the tyre at the load and inflation for a Y rated tyre according to the procedures specified above in paragraph 9.4.4.2.
- 9.4.4.3.2 Test a further sample of the same type according to:
- Inflate the tyre to the inflation pressure specified in Table (4). Apply a load to the test axle that is equal to 80 per cent of the load 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.
- 9.4.4.4 If the tyre has no service description and has a maximum speed rating that is > 240 km/h and < 300 km/h, inflate the tyre to 300 kPa, load the test axle to 80 per cent of the load specified by the tyre manufacturer, and test the tyre according to the procedure specified in paragraph 9.4.4.1, with the initial test speed (ITS) equal to the tyre's maximum speed rating as specified by the tyre's manufacturer minus the speed specified in item 9.4.1.
- 9.4.4.5 No more than 15 minutes after running the tyre for the required time, measure its inflation pressure. Allow the tyre to cool for one hour. Then deflate the tyre, remove it from the test rim, and inspect it.

## 9.5 Result

The tyre shall be checked for evidence of tread, sidewall, innerliner, ply, cord, belt or bead separation, tread chunking, open splices cracking or broken cords.

**10- BEAD UNSEATING TEST (for Tubeless Tyres)**

## 10.1 Preparation of Tyre

The tyre shall be washed and dried at the two beads, mounted on a clean and painted rim without the use of lubrication, and inflated to the applicable pressure according to Table 1 at ambient temperature.

## 10.2 Equipment

10.2.1 A fixture used to support the mounted tyre-wheel assembly during the test as shown in Fig. 3 with a block of the dimensions shown in Fig. 4.

10.2.2 A hydraulic press or equivalent to press the block.

## 10.3 Procedure

10.3.1 The load shall be applied through the block to the tyre (assembly) sidewall at a rate of 50 mm/min  $\pm$  2.5 m/min with the load arm parallel to the tyre at the time of engagement. Increase the load until the bead unseats or until the specified load is met whichever happens first.

10.3.2 Repeat the test four times at least at four equally spaced points around the tyre.

## 10.4 Report

Report the load at which the bead unseats and whether this load is more or less than the minimum specified.

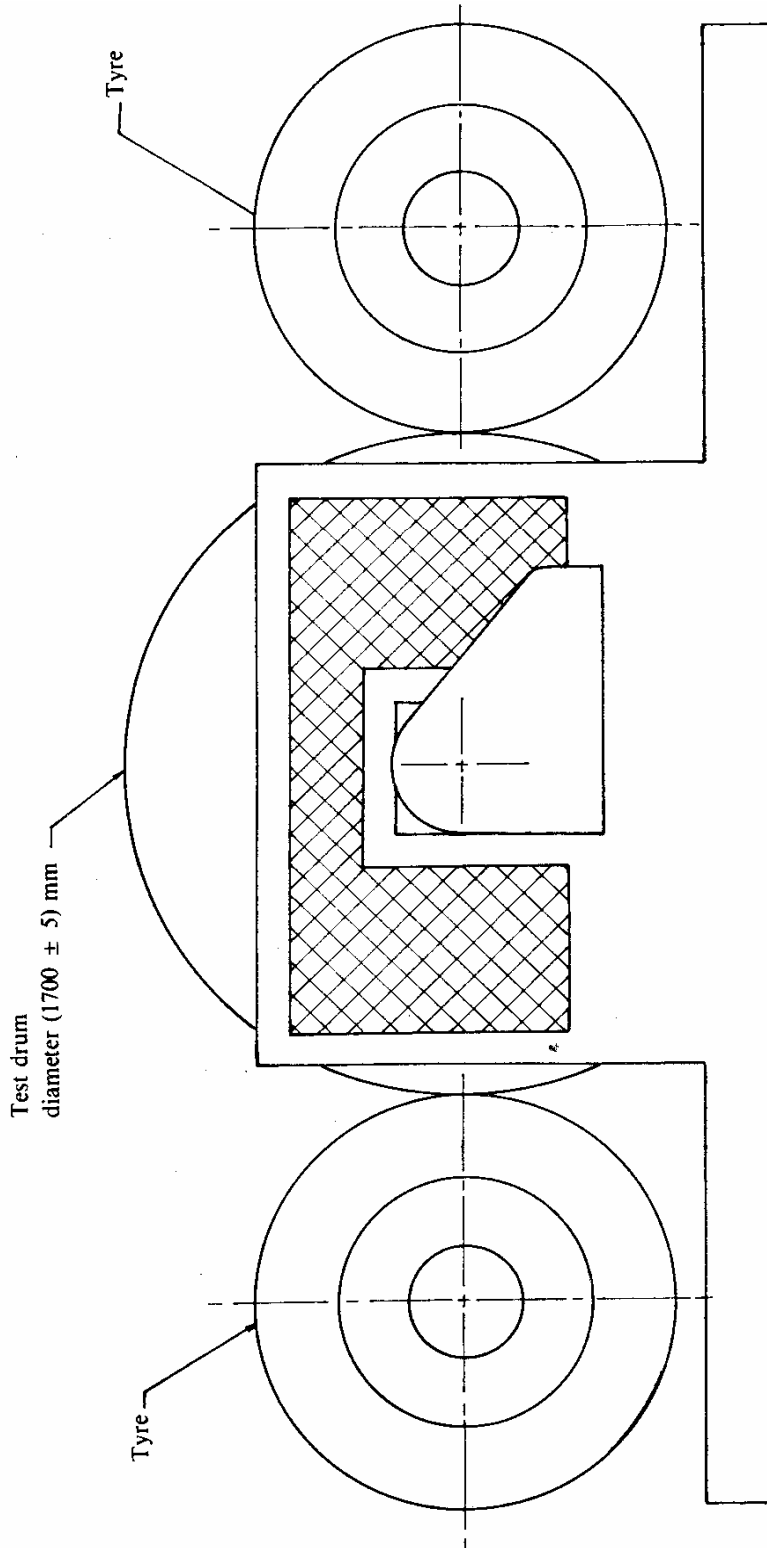
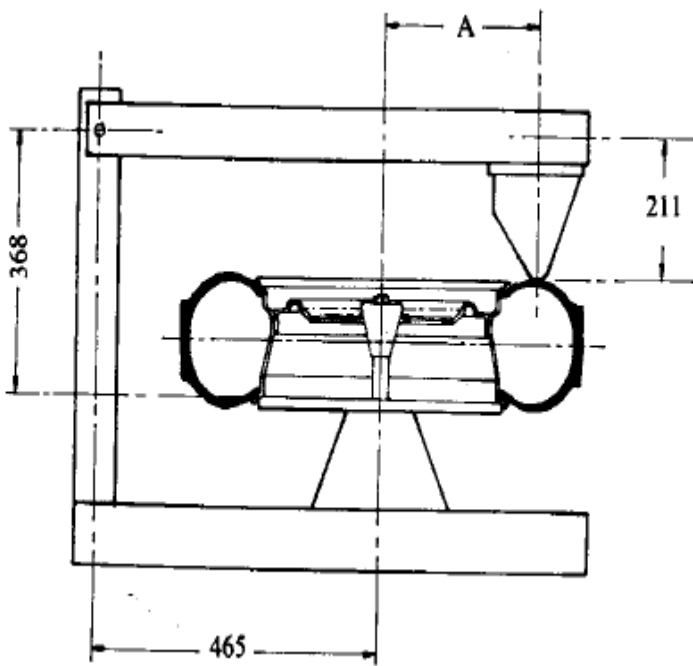


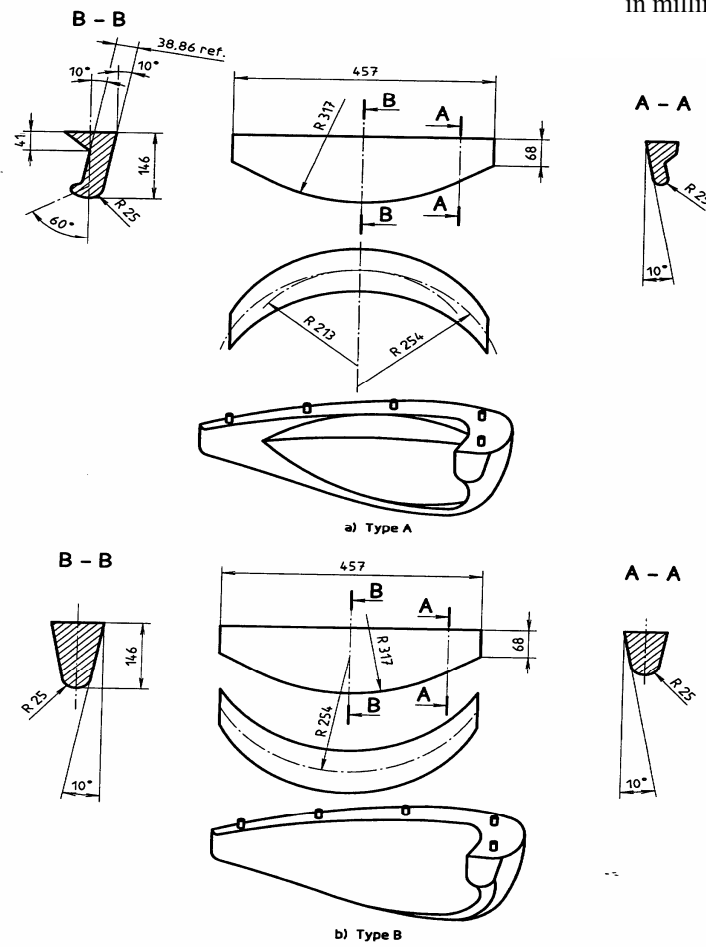
Fig. 2  
Apparatus for Endurance and High  
Speed Performance Tests



Nominal Rim Diameter	A, mm	
	All Other Tyres	T-Type Temporary Use Spare Tyres
19	330	305
18	318	290
17	305	269
16	292	251
15	279	239
14	267	226
13	254	213
12	241	-
10	216	-

**Fig. 3**  
**Bead Unseating Test Fixture**

(All dimensions  
in millimeters)



**Fig. 4**  
**Block Diagram**