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**Sport balls— Specification**

**Part 1:**

**Footballs**



Reference number

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# Contents

Page

Foreword .....	V
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	1
4 Requirements .....	2
4.1 General requirements .....	2
4.2 Materials requirements .....	3
4.3 The cover .....	3
5 Specific requirements .....	4
5.1 Stitching .....	4
5.2 Bladder .....	4
5.3 Cover .....	4
5.4 Performance requirements .....	4
6 Sampling .....	5
7 Test methods .....	6
7.1 General .....	6
7.2 Test Conditioning .....	6
8 Labelling .....	6
Annex A (normative) Testing the Circumference .....	7
A.1 Principle .....	7
A.2 Apparatus .....	7
A.3 Procedures .....	7
A.4 Calculations .....	7
Annex B (normative) Testing sphericity .....	8
B.1 Principle .....	8
B.2 Apparatus .....	8
B.3 Procedure .....	8
Annex C (normative) Testing the ball rebound .....	9
C.1 Principle .....	9
C.2 Apparatus .....	9
C.3 Procedure .....	9
C.3.1 Test with ball at ambient temperature: .....	9
C.3.2 Test with ball at cold temperature .....	9
C.4 Calculation and expression of results .....	10
Annex D (normative) Determination of water absorption .....	11
D.1 Principle .....	11
D.2 Apparatus .....	11
D.3 Procedure .....	12
D.4 Calculation and expression of results .....	12
Annex E (normative) Testing the ball weight .....	13
E.1 Principle .....	13

E.2	Apparatus .....	13
E.3	Procedure .....	13
E.4	Calculation and expression of results .....	13
Annex F (normative) Determination of the loss of pressure .....		14
F.1	Principle .....	14
F.2	Apparatus .....	14
F.3	Procedure .....	14
F.4	Calculation and expression of results .....	14
Annex G (normative) Determination of the shape and size retention .....		15
G.1	Principle .....	15
G.2	Procedure .....	15
G.3	Calculation and expression of results .....	16

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## Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS was prepared by Technical Committee RSB/TC 029 *Textile and Leather technology*.

In the preparation of this standard, reference was made to the following document:

*IS 417 ( Part 1 ): 2003 Footballs, volleyballs, basketballs, netballs, throwballs and water-polo balls—part 1: Footballs (Four Revision)*

The assistance derived from the above source is hereby acknowledged with thanks.

### Committee membership

The following organizations were represented on the Technical Committee on Textile and Leather technology (RSB/TC 029) in the preparation of this standard.

Ministry of Trade and Industries (MINICOM)

Federation Rwandaise de Football Association (FERWAFA)

Ministry of Health (MINISANTE)

LIXIL

Rwanda Standards Board (RSB) – Secretariat

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# Sport balls — Specifications Part1: Footballs

## 1 Scope

This draft Rwanda standard specifies the requirements, the sampling and the methods of test for outdoor footballs of size 3, size 4 and size 5.

## 2 Normative references

There are no normative references in this document

## 3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply

### 3.1

#### panels

different segments that make up the outside of the ball

### 3.2

#### sphericity

degree to which the shape of a football approaches a sphere

### 3.3

#### water absorption

amount of water absorbed by a material under specified test conditions

### 3.4

#### bladder

the chamber inside the inflatable ball filled with air to keep the ball inflated

### 3.5

#### cover

The outer surface of footballs

### 3.5

#### lining

layers of fabric placed between the cover and the bladder to give the ball strength, structure and bounce

### 3.6

#### thickness

small initial dimension of the rectangular cross-section in the central part of a test specimen, expressed in millimetres(mm)

## 4 Requirements

### 4.1 General requirements

The footballs shall fulfil the following general requirements:

- a) be spherical
- b) be of the correct size in accordance with the age of the player
- c) It shall present a neat, well-finished appearance and shall be free from all defects which might affect its functionality
- d) It shall be free from biological, chemical and physical contaminants.
- e) be of the right weight
- f) be properly inflated with the right amount of air pressure
- g) have a safety valve to prevent the loss of pressure; and
- h) be suitable for all weather conditions



## 4.2 Materials requirements

The materials used for making the footballs shall comply with the following requirements

- a) be clean
- b) less water-absorbent in accordance with Table 1
- c) not harmful to the player
- d) environmental friendly products to prevent pollution
- e) non banned on Rwandan market; and
- f) shock-proof

## 4.3 The cover

The cover of the footballs shall comply with the following requirements:

- a) be made of polyurethane (PU) or Poly Vinyl Carbonate (PVC), a combination of both or synthetic leather or other materials which comply with clause 4.2.
- b) be cleanable to remove dirt and grit from grass
- c) be non-fade
- d) be free from harmful materials, splits, holes, and protruding points when visually examined;
- e) be abrasion resistant
- f) be incredibly water-resistant
- g) the panels should be well sewn together
- h) the seams shall be intact; and
- i) have smooth surface

**NOTE** Strong water-resistance ensures that the best possible value from a new football is obtained. Extra water absorption makes the ball heavier to the foot, which increases the chance of injury to the player and prematurely degrades the materials of the ball itself.

## 5 Specific requirements

### 5.1 Stitching

The footballs shall be stitched with linen or cotton thread and shall have  $24 \pm 2$  stitches per decimeter. The stitches shall be well stretched. When the ball is inflated to the air pressure given the visible threads shall not be more than 2 mm deep from the surface of the ball.

### 5.2 Bladder

The bladder of the footballs shall comply with the following requirements:

- a) be properly inflated in accordance with Table 2; and
- b) retain the inflation pressure
- c) made from but not limited to latex, butyl

### 5.3 Cover

The cover of the footballs shall comply with the requirements given in Table 1 when tested in accordance with the methods specified therein.

**Table 1- physical requirements for the football cover**

S/N	Characteristics	Requirement	Test method
1.	Thickness, mm, min	2.2	ISO 2589
2.	Tensile strength, kg/cm <sup>2</sup> , min	200	ISO 3376

### 5.4 Performance requirements

The footballs shall comply with the performance requirements given in Table 2 when tested in accordance with the methods specified therein.

**Table 2- Performance requirements for footballs**

S/N	Characteristics	Size 3	Size 4	Size 5	Test method
1.	Age of the player	U7-U9 years	U10-U12 years	13 years and above	
2.	Circumference, cm	58.5 – 61	63.5-66	68-70	Annex A
3.	Sphericity, max	2%	2%	2%	Annex B

4.	Rebound At 20°C, cm At 5°C, cm, min	110-150 110	110-160 110	115-165 110	Annex C
5.	Water absorption	15-20%	15-20%	15-20%	Annex D
6.	Acceptable weight, g	312-340	350-390	410-450	Annex E
7.	Ball pressure, bar	0.8	0.8	0.8	Annex F
8.	Loss of pressure , max	25%	25%	25%	Annex F
9.	Size/shape retention with change of pressure  Increase in circumference Deviation on sphericity Change of pressure	  max. 1.5 cm max. 1.5% max. 0.1 bar	  max. 1.5 cm max. 1.5% max. 0.1 bar	  max. 1.5 cm max. 1.5% max. 0.1 bar	Annex G
U = under					

## 6 Sampling

6.1 In any consignment, all the balls manufactured under similar conditions from the same raw materials and having the same size shall be grouped together to constitute a lot.

6.2 Samples of balls shall be collected and tested separately for each lot.

6.3 Number of balls selected at random from the lot depends upon the size of the lot and shall be in accordance with Table 3.

**Table 3- Sample size**

S/N	Lot size	Dimension , mass and visual examination		For Prolonged Inflation Test Loss of Pressure, Water Absorption, Rebound test, Shape and Size Retention	
		Sample size	Acceptance size number	Sample size	Acceptance size number
i.	up to 500	13	1	5	0
ii.	501 to 1000	20	2	8	0
iii.	1001 to 3 000	32	3	13	0
iv.	3001 to 5000	50	5	20	1
v.	5001 and above	80	7	32	2

6.4 The number of balls in a sample shall be selected at random from the lot

6.5 Each ball in the sample shall be inspected for the tests given in Table 2. A ball failing in any one or more of these tests shall be considered as defective. The lot shall be considered as conforming to these requirements if the number of defective balls in the sample does not exceed the number given Table 3.

## 7 Test methods

### 7.1 General

A ball must successfully pass the seven tests such as the ball's weight, circumference, roundness/sphericity, bounce, water absorption, loss of pressure and shape and size retention. The methods of tests are described in Annex A-F.

### 7.2 Test Conditioning

The footballs are inflated with compressed air to a defined pressure of  $0.8\text{bar} \pm 0.01$ . The air pressure in the football is measured with a pressure gauge; a valve for the release of air is situated between the pressure gauge and the needle. The needle is to be lubricated with silicone oil or silicone lubricant spray or glycerin oil.

A pressure gauge of 1.5 bar with an accuracy of  $\pm 0.01$  bar is to be used for inflating. The footballs are conditioned for at least 24 hours in a standard atmosphere of temperature  $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and relative humidity  $65\% \pm 5\%$ .

## 8 Labelling

Each football shall be marked with the following:

- a) Ball size (size 3, 4, or 5)
- b) name of the cover material
- c) recommended air pressure
- d) the manufacturer's name, initials or trade-mark; and
- e) manufacturing date

## Annex A (normative)

### Testing the Circumference

#### A.1 Principle

The circumference test indicates the dimension of the ball as an average value based on different axes of measurement. This test is critical to ensure the ball is the correct size for the game of football. It requires the sample balls to be conditioned for at least 24 hours.

#### A.2 Apparatus

CM ruler will be used

#### A.3 Procedures

Below are the procedures followed to properly measure a football circumference

- a) inflate ball to the proper pressure as per 7.1
- b) place ball in the corner of a 90° angle. Example, place ball on a table top that butts up against a 90° wall, making sure the ball is touching both the table top and the wall. A large panel of the ball should be touching the wall and facing away from the wall towards you.
- c) then place a square up against a large panel of the ball, which is 180° degrees from the large panel of the ball which is touching the wall, as if you are using the square to hold the ball in place, against the wall. But do not apply any pressure against the ball, with the square, only very slight pressure, enough to hold the ball in place, without indenting the ball panel.
- d) then mark a spot on the table top, where the front of the square is touching both the ball and table. The distance from the wall to this mark is the diameter of the ball.
- e) now measure that diameter with a CM ruler in ten exactly defined points.

#### A.4 Calculations

The circumference is calculated for all the sample balls and then the mean circumference. The formula applied is  $C=D \times \pi$  where C=Circumference, D= Diameter and  $\pi = \frac{22}{7}$

## **Annex B** (normative)

### **Testing sphericity**

#### **B.1 Principle**

The sphericity test analyses how round the football is by means of an average of several measurements of the ball's diameter. If the ball is not completely round, it cannot develop a perfect flight path. This implies that a shot, even if and when exactly targeted at the goal, may miss the goal

#### **B.2 Apparatus**

CM ruler

#### **B.3 Procedure**

The conditioned balls are inflated to a test pressure of 1.0 bar and the diameter of the ball is measured on 16 different spots, with a high degree of accuracy and then the mean diameter is calculated.

The difference between the highest and lowest diameter is determined as a percentage of the mean diameter.

## Annex C (normative)

### Testing the ball rebound

#### C.1 Principle

For this test, the ball is dropped ten times onto a steel plate in a guided free fall with a defined velocity on to a fixed plate, from a height of 2 meters. The ball hits the surface at specific points in the middle of the panels, distributed over the surface of the ball. The panels will be selected such that the number of testing points are evenly distributed on the different panel shapes. Using a video camera, the height of rebound, from the underside side of the ball, can be determined. After the first rebound, the camera is moved to approximately the same height, and the height above anvil is noted. The difference between the highest and the lowest bounce shall be less or equal to 10 cm.

#### C.2 Apparatus

This test is performed by bouncing the ball ten times on a steel plate, from a height of  $2.00\text{m} \pm 0.01\text{m}$ , measured from the bottom of the ball without imparting any impulse of spin.

Guidance system with a ring for placing the ball on the anvil

Plane anvil (material see below) attached to a plate of metal and a base of concrete

Measuring device for the determination of the velocity at the impact of the ball

Fixed scale for the determination of the height of rebound (to the nearest 1cm)

Video camera (digital recording system)

#### C.3 Procedure

##### C.3.1 Test with ball at ambient temperature:

The ball is placed at the  $2.00\text{m} \pm 0.01\text{m}$  position and is released mechanically. The height is recorded. The procedure is repeated 10 times per football ensuring no two rebounds hit the same spot on the ball. Distribution of measurement points according to panel shape. Rebound on centre of panel.

##### C.3.2 Test with ball at cold temperature

The test procedure is repeated 5 times with footballs that were exposed to cold. The samples are inflated to 0.9 bar and stored for 11 hours ( $\pm 30$  min) at  $5^{\circ}\text{C}$ . The samples are then removed from the cooler, the pressure is adjusted to 0.82bar and they are replaced into storage at  $5^{\circ}\text{C}$  for another 1 hour (+15 min). Directly prior to testing, the pressure is adjusted to 0.80bar.

The tests are still performed at ambient room temperature. The time between the removal of the ball from the storage at 5°C and the beginning of the test shall not exceed 2 minutes. If the test is not completed within 2 minutes, the procedure must be restarted.

The ball is placed at the  $2.00\text{m}\pm 0.01\text{m}$  position and is released mechanically. The height is recorded. The procedure is repeated 5 times per football ensuring no two rebounds hit the same spot on the ball (whereby the first and fifth rebound are to be discarded from the calculation of the average).

#### **C.4 Calculation and expression of results**

The ball rebound height of any tested sample is the mean 3 rebounds performed from each ball in ambient conditions. The mean value of each of the samples must fall within the requirements. In addition, the difference between the highest and lowest means shall be compared and shall also fall within the respective requirement.

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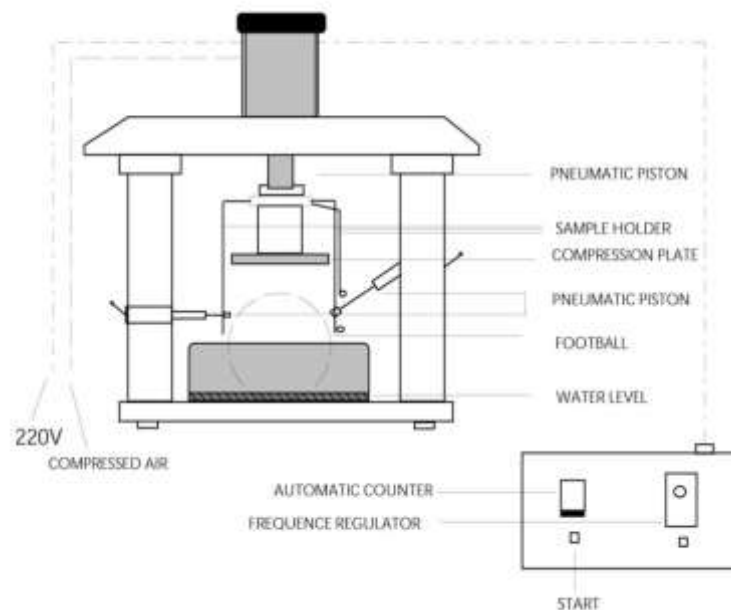
## Annex D (normative) Determination of water absorption

### D.1 Principle

The football is placed in a receptacle filled with water. The ball is then compressed into the water by means of a pneumatic piston and left to soak in the water. The ball is then weighed again after 250 compression cycles and compared to the original weight.

### D.2 Apparatus

The apparatus contains a variable pneumatic piston, which is capable of compressing to various depths. A system of three additional small pneumatic pistons turns the football in various directions between the compressions (one complete turn in approx. 20 compressions). Thus, the complete football comes in contact with the water during the test.



**Figure1-The apparatus used to measure water absorption**

The machine must be capable of achieving a compression of 25% of any tested football's diameter.

The piston shall be capable of a frequency of at least 40 compressions per minute. The receptacle shall be round and with a diameter of 30 cm  $\pm$ 2 cm. It shall be filled with 2cm  $\pm$ 0.2cm of water. If a pressure plate is used for achieving compression, the diameter shall be 16cm  $\pm$ 1.

### **D.3 Procedure**

Each of the samples is conditioned and weighed using electronic scales. The amplitude of compression is calculated from the mean diameter obtained from the circumference test. A compression equal to 25% of the diameter of the ball is applied at 40 compressions per minute. The compression can be measured by means of a compression plate of the distance between the plate and the piston. After 250 compressions the ball shall be removed quickly and wiped dry on the surface using a standard towel. Each ball is then reweighed again in the same manner as above. Its increase in weight is expressed as a percent of the original weight of the ball, defining precisely the amount of water that has been absorbed.

### **D.4 Calculation and expression of results**

A value is indicated for each of the tested samples reflecting the percentage increase in weight after the water absorption test using the weight before the water absorption test as benchmark. The results are rounded to one decimal. Each single value must fall within the requirements.

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## Annex E (normative)

### Testing the ball weight

#### E.1 Principle

In addition to the standard ball sample preparation and ambient temperature, this test should be done in a wind protected area to avoid any external influence.

#### E.2 Apparatus

Electronic scales with an accuracy of 0.01g are to be used for this test.

#### E.3 Procedure

The pre-conditioned football is inflated and weighed in a standard atmosphere, with a wind protected electronic balance. Once it has been ensured that there are no wind effect, record the weight. Repeat the procedure. Should the subsequent value vary by more than  $\pm 0.02\text{g}$ , discard the results and repeat the test. Five measurements shall be made per sample. The same procedure is to be followed for all three samples used during this test.

#### E.4 Calculation and expression of results

The average value from the 5 measurements is noted for each of the samples individually. Then the individual ball average weights are used to calculate the average weight of the ball.

## Annex F (normative)

### Determination of the loss of pressure

#### F.1 Principle

The football should not lose pressure over time, thereby remaining playable. This test measures the difference in pressure over time. The aim is to ensure that the ball does not deflate too quickly. The balls are inflated to a defined pressure, then left in a standard atmosphere after 72 hours a football's air pressure is measured and the ball should not lose more than 25% of its air pressure.

#### F.2 Apparatus

A pressure gauge of 1.5 bar with an accuracy of  $\pm 0.01$  bar is to be used for inflating.

#### F.3 Procedure

- a) unfold the football with both hands before inflating to make the football softer.
- b) ensure that the bladder has been pushed into the centre of the football.
- c) apply a drop of water/oil into the valve or needle before inflating the football.
- d) insert the needle only after holding the bladder firmly from the valve panel.
- e) place the needle accurately in the centre of the valve. Inserting it sideways can lead to damage.
- f) the football should be inflated to a lower pressure before it is inflated to the recommended pressure.
- g) the balls are inflated to a defined pressure as per 9.1, then left in a standard atmosphere after 72 hours a football's air pressure is measured and the ball should not lose more than 25% of its air pressure.

#### F.4 Calculation and expression of results

For each of the samples, the loss of pressure is to be expressed as a percentage loss between the second measurement and the initial measurement of pressure. The value for each of the three samples shall be reported.

## Annex G (normative)

### Determination of the shape and size retention

This test examines whether the form, the size and the air pressure remain stable during the play.

#### G.1 Principle

The ball is repeatedly shot by a canon against a metal surface before automatically being returned into the canon. The number of cycles simulates use over a period of time. The worn samples can then be rechecked for size, weight and shape in order to ensure they do not change significantly with use.

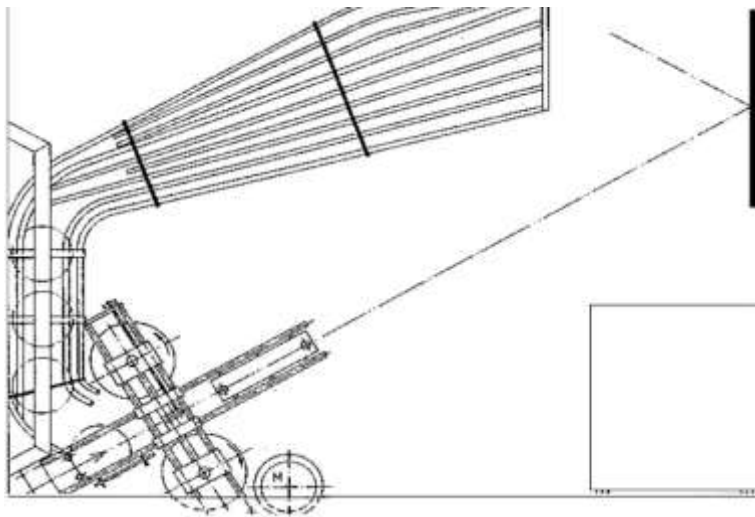


Figure2- Construction of the “Shooting device for footballs”

The apparatus used for this test fulfils the criteria below.

**Dimensions** L x W x H [mm]: 2,900 x 940 x 2,280

#### G.2 Procedure

The footballs are conditioned as per 7.1 , inflated and placed in the shooting machine. Two rotating cylinders accelerate the balls to a specific velocity, so that they hit a steel panel at a consistent speed and angle. Each of the three samples is shot with an exit speed of 50km/h  $\pm$ 1 against the steel plate at an angle of  $30^{\circ} \pm 2$  based on the horizontal line. The samples are shot 2000 times at a speed of 50km/hour.

Following shooter test the ball is placed in ambient laboratory conditions ( $20 \pm 2^{\circ}\text{C}$  and  $65 \pm 5\%$  R.H) for a minimum of one hour. Afterwards pressure measurement is made at laboratory conditions ( $20 \pm 2^{\circ}\text{C}$  and  $65 \pm 5\%$  R.H). The following tests are carried out (in the stated order) with all three ball samples:

- a) pressure of the samples after shooting
- b) visual inspection of seams and air valve
- c) circumference
- d) sphericity

### **G.3 Calculation and expression of results**

The results from the tests performed after the 2000 cycles are noted as follows:

- a) initial pressure of the samples (before shooting) minus pressure after shooting gives pressure loss expressed in bar with 2 decimal places; example -0.02 bar.
- b) visual inspection: evidence of any damage
- c) circumference: results as per test method
- d) sphericity : results as per test method

The values of circumference, sphericity and pressure are compared to the values from the previous tests according to Test 01, 02 and 06. The difference between the value obtained after the shooter test and prior to it is denoted as an absolute increase for circumference and pressure and a percentage for sphericity.

## Bibliography

[1] FIFA :2018 *Footballs-Test manual*

[2] FIFA :2006 *Testing and certification for footballs*

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