

The International Table Tennis Federation  
**The Ball (version for 40mm balls)**

**Technical Leaflet T3**

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## Introduction

This leaflet describes, for the benefit of manufacturers, the tests which are applied to table tennis balls by the ITTF, and gives details of the criteria used in granting or withholding approval (chapters A - D). All ball brands approved have to meet all appearance standards and all qualitative and quantitative criteria described in the following sections. The procedure for ITTF approval is described in Technical Leaflet T7.

## Laws

The Laws of Table Tennis relating to the ball are as follows:

### 2.3 The Ball

2.3.1 The ball has a diameter of 40mm and a weight of 2.7g.

2.3.2 The ball shall be made of celluloid or similar plastics material and shall be white or orange, and matt.

## International Regulations

Regulations for International Competitions (3.2.1.1) state that . . . the ball . . . shall be of a brand and type currently approved by the ITTF.

## Approval of Ball Brands

A manufacturer may have approved ball brands differing in:

- colour, i.e. white and orange
- material, i.e. celluloid and a different plastic
- brand name

## Material

Notwithstanding the instability and flammability of celluloid, it has always been the standard material for a table tennis ball. The Laws do not prescribe the material, leaving manufacturers free to experiment. We need a better material, and manufacturers are encouraged to search for one. Experience suggests, unfortunately, that the search will be a very difficult one.

The ITTF Equipment Committee will support balls with a playing performance similar or identical to that of celluloid balls. We are aware that some of the specifications given in this Technical Leaflet can be met only with difficulty by non-celluloid balls. The Committee is prepared to accept a compromise which makes an approval possible if the playing characteristics are similar or identical to those of currently approved balls.

## **A. Qualitative Criteria and Appearance**

### **A.1 General Appearance**

The ball shall be white or orange, and matt (see B. 12). Balls differing in colour may have the same trademark, but shall be otherwise identical in appearance.

### **A.2 Seam**

A ball must appear to be uniform. We accept that it is generally impossible to disguise the seam, but there must appear to be only one seam. After the two halves of the ball have been jointed in manufacturing, the ball may be subsequently moulded. If the equator of the ball - i.e. the joint - is not coplanar with the line of separation of the two halves of the mould, another line will be formed, looking like a second seam. This is not acceptable.

### **A.3 Stamp**

The stamp on a ball may cover an area no greater than 280mm<sup>2</sup>. It may be printed in one or two colours, but the same colour or combination must be used for all balls of the same brand. The wording used in the stamp has to be in compliance with ITTF regulations (see chapter "C. Marking")

### **A.4 Packaging**

The balls must be packaged appropriately, e.g. in paper or plastic boxes or in a blister pack. The wording used on this package has to contain "40" or "40mm" in order to clearly distinguish the 40mm balls from the 38mm balls. Any packing of the balls, even those for big quantities, must contain a date or a date code and must be in compliance with the ITTF regulations (see chapter "C. Marking").

## **B. Quantitative Criteria**

Tests are conducted on groups of 24 balls; the number normally purchased is one package more than is needed to provide this number (i.e. usually 30 balls). Statistical "outliers" are ignored when calculating means and standard deviations, but all values within a normal distribution but outside the permitted limits are included.

*Note: „Conformity“ means compliance with a specification set down in the Laws of Table Tennis or Regulations for International Competitions, and „regularity“ means degree of uniformity within a sample.*

Anyone wishing to know how we analyse test results statistically is invited to contact Dr. Joachim Kuhn / GER who is the member of the Equipment Committee in charge of ball testing, or the ITTF Headquarters in Lausanne /CH.

### **Test Procedures**

The ITTF equilibrates balls at 23<sup>0</sup> Celsius, 50% R.H. for at least three days (standard conditions). They are then tested as follows:

**Weight** is measured on an electronic analytical balance reading to 0.001g, and the results are rounded to the nearest 0.01g.

**Diameter** We use a calibrated electrical device with an accuracy of at least 0.001mm which measures the diameter with a precision of 0.01mm. The ball is slightly pressed by a vertical pin (diameter 10mm). For fixation the ball is supported by an annular ring whose upper inside

surface slopes at an angle of 45 degrees. The outer diameter of the ring is 40mm and the inner diameter at the bottom of this slope is 20mm. In this position the ball is placed between two lateral, horizontal flat measuring pins (diameter 6mm) which automatically adapt to the ball diameter by springs. The diameter of the ball is monitored while turning the ball with a mechanical device about the polar axis (1), an axis crossing the equator twice and comprising the center (2), and about further two arbitrary axes comprising the center of the ball (3,4). By (1) the seam line is monitored, by (2) a line including both poles and by (3) and (4) arbitrary lines on the balls surface. By rotating the ball in said directions the minimum and maximum diameters are determined. The difference between the two values gives the lack of sphericity.

*Alternatively, the following procedure can be applied:*

*The ball is placed arbitrarily between a flat and the measuring pin, and the diameter is observed. In order to guarantee that the measuring pin is vertically above the center of the ball we use two vertical flats with angle of 90° against which the ball is horizontally pressed during the measurement. By rotating the ball in various directions the minimum and maximum diameters can then be determined. The difference between the two gives the lack of sphericity.*

**Bounce** is measured by releasing the ball mechanically. After its bounce on a standard steel plate the ball is monitored with a digital camera with a calibrated mm scale in the background. The photos are evaluated. The geometric mean of three determinations then permits calculation of the maximum height of bounce.

*Alternatively the rebound height can be measured by other methods, which give the same results.*

**Veer** is a measure of the total sphericity of the ball, not merely its external aspect. It is measured by rolling the ball down a slight incline onto a horizontal surface, and measuring the distance by which it deviates from a straight line as it rolls across the surface. The incline is 100mm long at 14 degree to the horizontal; on a table that is 100cm long this gives a rolling time of about 3 seconds. Each ball is measured at least three times, rolling twice on the seam, and once about an arbitrary axis. A negative result is reported if the ball fails the test twice.

**Hardness** is measured on a fully automated and computerised Zwick tester (or equivalent). We use a preload of 0.5 N and testing starts 10 sec after preloading. A 20mm diameter pin presses against a pole of the ball with a 50 N force loaded at 10 mm/min, and the indentation is recorded with a precision of 0.01mm. The ball is supported by an annular ring whose upper inside surface slopes at an angle of 45 degrees. The outer diameter of the ring is 40mm and the inner diameter at the bottom of this slope is 20mm. Measurements are made on each pole and once on the seam; the average for the poles provides a measure of the hardness, and the difference between that and the seam indentation is a measure of the lack of symmetry.

**Colour** The ball colour is measured according to the CIE Lab system, giving three values L, a and b. L indicates the black/white value on a scale from 0 to 100; a indicates the green/red value; and b the blue/yellow value, both on a scale from minus to plus 100. The measurements are performed on the seam and two other points on the surface. 4 balls are selected from different boxes. The L, a and b values of the sample are determined by averaging over all 4 balls. "Dr. Lange Micro Color II" apparatus or equivalent is used.

## **Specifications**

For the calculation of the following values two digits are taken into account.

### **B.1 Weight Conformity**

Law 2.3.2 specifies 2.7g, but any weight between 2.67 and 2.77g is acceptable for any one ball. No more than 1 ball out of the 24 sampled may be outside this range. The sample mean must be between 2.69 and 2.76g. In carrying out statistical calculations we treat any weights less than 2.60g or greater than 2.85g as outliers.

### **B.2 Weight Regularity**

The standard deviation may not exceed 0.03g.

### **B.3 Size Conformity**

The minimum diameter of every ball must be at least 39.50mm, and its maximum diameter must not exceed 40.50mm. The sample mean average diameter, i.e. the mean of the average of the maximum and minimum diameters for each ball, must be in the range 39.60-40.40mm. Values below 39.25mm or above 40.75mm are considered in our calculations as outliers.

### **B.4 Size Regularity**

The standard deviation of the average diameter may not exceed 0.06mm.

### **B.5 Sphericity Conformity**

The sphericity of any ball must be less than 0.35mm, and the sample mean sphericity must be less than 0.25mm. (The sphericity of a ball - more correctly the lack of sphericity - is the absolute difference between its minimum and maximum diameters.) In our calculations values greater than 0.50mm are treated as outliers.

### **B.6 Sphericity Regularity**

The standard deviation of sphericity must be less than 0.06mm.

### **B.7 Bounce Conformity**

All 24 balls must rebound to a height of not less than 240mm or more than 260mm when dropped from a height of 305mm on to a standard steel block.

### **B.8 Bounce Regularity** *(to be examined)*

There is no specification for this property. Dynamic tests will be investigated.

### **B.9 Veer**

No more than two balls shall deviate by more than 175mm from the center-line.

### **B.10 Hardness Conformity**

The geometric mean pole hardness for any ball shall be in the range 0.71 – 0.84mm.

The geometric mean pole hardness for the sample shall be in the range 0.72 – 0.84mm

The mean seam hardness for the sample shall be in the range 0.75 – 0.85mm

The within-ball (uniformity) coefficient of variation of the measurements on each pole and once on the seam shall be no greater than 0.15mm.

The sample mean within-ball (uniformity) coefficient of variation shall be no greater than 0.06mm.

### **B.11 Hardness Regularity**

The coefficient of variation shall be not greater than 0.06mm.

## **B.12 Colour**

The specifications for the L, a and b values according to the CIE Lab system are

for white balls: a and b between -7 and +3

L exceeding 80

for orange balls: a between 10 and 35

b exceeding 40

L exceeding 70

All 4 balls tested have to meet these standards.

## **C. Marking**

If the grade of the ball is indicated by a numbering system, no number higher than 3 may be used, e.g. „Three Star“.

### **C.1 The Stamp**

The stamp on the ball must include the following four components:

- The ITTF Approval. This may be indicated by the initials ITTF or ITTFA, by "ITTF approved", or by the ITTF logo.
- the trademark or brand name
- the inscription “40” or “40mm”
- the name of the country where the company headquarters are registered, or the expression "made in ..." The same text must appear on all balls of an approved brand. I.e. it is not permissible to put one country name on some balls and a different one on others with the same brand name. Wrong claims will be penalized with a fine and can lead to immediate withdrawal of the ITTF approval.

No other text is permitted. The stamp may cover an area no greater than 280mm<sup>2</sup> described by a circle or a rectangle with a maximum side length of 25mm circumscribing all letters and symbols. It may be printed in one or two colours, but the same colour or combination must be used for all balls of one brand. All inscriptions must be easily readable. The trademark or brand name should be the most pronounced inscription.

### **C.2 Trademark or Brand Name**

The Approval of the ITTF, the country or the expression “made in .....” are not considered to be part of the trademark or the brand name. The trademark or brand name must be unique and may not be used for another type of ball, especially not for an unapproved one. All balls with the same trademark or the same brand name must have an identical quality.

An ITTF approved ball may lose its approval if the supplier markets another non-ITTF-approved ball with the same or similar appearance as the ITTF approved one, with which it could be confused.

The ITTF will see as good as possible if the trademark or brand name will interfere with those of already existing ball brands. The ITTF is not responsible for any illegal use of registered trademarks. Verifying the correct and legal use of trademarks is not part of the ITTF approval procedure.

### **C.3 Packaging**

The packaging must have the same information as is on the stamp and may also have additional information such as technical data or national approvals. The wording used on the packing may not contain false claims.

### **C.4 Date Code**

The packaging, but not the ball itself, must be marked with a date or a date code corresponding to the date of production (month / year). The date code must be readable without the need to destroy the packing. As long as the supplier uses his own datecode system the supplier must inform the ITTF Equipment Committee about the date code used and its decoding. From January 2004 on a uniform datecode system will be used.

The datecode consists of 4 characters: the first 2 for the month and the last 2 for the year. Month and year are encoded using the capital letters from A to I for the numbers 1 to 9 (A = 1; B = 2;.....I = 9; X = 0).

Examples: a) ABXC means 1203, which is decoded as December 2003.

b) XEAA means 0511, which is decoded as May 2011

This datecode system will be mandatory for all ITTF approved ball brands produced from 2004 onward.

Manufacturers are strongly encouraged to clarify the design of the stamp, the packaging and the datecode before production with the ITTF Equipment Committee.

A missing datecode is penalized with a fine (see T7).

## **D. Administrative Items**

### **D.1 Changes**

Any change of the trademark or the brand name, the date code, the stamp, the packaging, the ball quality, the source of supply and any other changes relevant for ITTF approval must be notified to the ITTF Equipment Committee. If the stamp or box design is changed two boxes must be sent to the ITTF Headquarters in Lausanne / CH. The changes must be confirmed by the ITTF.

The failure to announce changes to the ITTF will be penalized with a fine (see T7)

### **D.2 Publication**

A list of all ITTF approved ball brands is published in the Internet, the ITTF handbook and the ITTF Bulletin. The approval list is published in alphabetical order by trademark or brand name.

### **D.3 Approval Code**

The ITTF uses an approval code consisting of

- a serial number according to the date of application for ITTF approval and
- the month and year of application for approval.

Example: ITTF-21–B-06/00; meaning: 21<sup>st</sup> ITTF approved ball (B), approved in June 2000. The manufacturer is free to use the approval code in his advertisements.