

BS EN 13865:2017



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Surfaces for sports areas — Determination of angled ball behaviour — Tennis

National foreword

This British Standard is the UK implementation of EN 13865:2017. It supersedes BS EN 13865:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/57, Surfaces for sports areas.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Surfaces for sports areas - Determination of angled ball behaviour - Tennis

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rebond angulaire d'une balle - Tennis

Sportböden - Bestimmung des winkligen
Ballverhaltens - Tennis

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European foreword

This document (EN 13865:2017) has been prepared by Technical Committee CEN/TC 217 "Surfaces for sports areas", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2017 and conflicting national standards shall be withdrawn at the latest by September 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13865:2003.

In comparison with the previous edition, the following main modifications have been made:

- Figure 11 "Relationship between components of ball incidence and rebound" has been replaced by a formula;
- the test procedure sequence has been updated;
- the temperature range for the on-site testing has been deleted.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies a method for the determination of the behaviour of a tennis ball striking a sports surface at an angle.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12229, *Surfaces for sports areas - Procedure for the preparation of synthetic turf and needle-punch test pieces*

3 Principle

A ball is projected at an angle onto a sports surface and its velocity, angle and rebound are assessed.

4 Apparatus

4.1 Ball projector, providing a means of projecting a ball at a specified angle and velocity onto the surface without imparting spin greater than 3 rev/s.

Suitable ball projection machines are available commercially. The release characteristics of the ball from the machine should be checked specifically (e.g. by stroboscopic photography) to ensure that spin in excess of 3 rev/s does not occur.

4.2 Ball track monitor, providing a means of monitoring the track of the ball before and after impact so that its velocity can be measured to an accuracy of $\pm 0,05$ m/s and its angle of impact and rebound to $\pm 0,1^\circ$. The uncertainty in the precision of the measuring technique shall be no greater than 2 %.

NOTE The track of the ball can be monitored photographically or by timing its passage between light-sensitive receivers. In the latter case, the angle can be deduced from the vertical and horizontal components of velocity.

4.3 Balls in accordance with 4.3.2 are used in tests to demonstrate the conformity of a sports surface to a specification for the surface.

4.3.1 Balls in accordance with 4.3.3 are used to demonstrate the performance of a particular type of ball on a given surface, e.g. a particular brand of ball to be used in a tournament.

4.3.2 At least three test tennis balls, taken from a pressurized ball canister, each covered with cloth weft comprising (45 ± 5) % denier (6,67 dtex) polyamide and (55 ± 5) % wool, and which, when tested in accordance with procedures detailed in the International Tennis Federation (ITF) Rules of Tennis, exhibit the following properties:

- Ball mass: $(57,6 \pm 0,3)$ g;
- Ball diameter: $(66,0 \pm 0,50)$ mm;
- Forward deformation: $(6,40 \pm 0,40)$ mm;

- Return deformation ($9,40 \pm 1,40$) mm;
- Rebound (mean of five tests): ($1,41 \pm 0,01$) m.

4.3.3 When required, at least four commercially available tennis balls, taken from a pressurized ball canister, and which conform to the ITF Rules of Tennis.

4.3.4 Additional balls of either type (see 4.3.2 or 4.3.3), if necessary, for trial runs (see 8.2).

5 Test pieces

Test pieces of synthetic turf and textile sports surfaces shall be prepared in accordance with EN 12229.

Test pieces of sports surfaces shall have a minimum length 500 mm and minimum width 500 mm, and shall be tested in combination with the supporting layers to be used in service and using the method of attachment recommended in the manufacturer's instructions.

Ensure the test piece is not warped or bowed.

Loose laid test pieces shall be tested while anchored at the edges.

Experience has shown that it is extremely difficult to produce laboratory samples of mineral surfaces that have the same characteristics as actual facilities. Wherever possible, mineral surfaces should be tested *in situ*.

6 Conditioning and test temperature

6.1 Laboratory tests

Condition test pieces for a minimum of 3 h at the specified test temperature.

Unless stated otherwise in the product specification, the test temperature shall be (23 ± 2) °C.

6.2 On-site tests

Tests on site shall be conducted at ambient temperature, with temperatures ranging from +10 °C to +30 °C, and at ambient humidity.

7 Preparation of tennis balls

7.1 Conditioning

The balls shall be removed from their container at least 1 h prior to the test in order to ensure that they reach equilibrium with the prevailing ambient conditions.

7.2 Pre-compression

The balls shall be subjected to a pre-compression procedure, as described in detail in the ITF method, prior to being used in tests.

8 Procedure

8.1 Carry out all tests within 1 day of opening the ball canister (see 7.1).

8.2 Adjust the ball projector (see 4.1) to deliver a ball onto the test piece at an angle of incidence of $(16 \pm 2)^\circ$ and a velocity of (30 ± 2) m/s, if necessary employing trial runs using additional balls (see 4.3.4).

8.3 Measure and record the temperature of the test surface area.

8.4 Project the first ball, onto the test piece surface and, using the ball track monitor (see 4.2), monitor and record the velocity and angle before and after impact.

8.5 Slightly move the test equipment and repeat using next test ball ensuring the ball does not impact an area previously tested. Slightly move the test equipment and repeat using the third test ball.

8.6 Repeat the full sequence using each of the three balls a further two times so a total of nine tests are made (three with each test ball) ensuring each test is on a new area of the surface.

NOTE It is important that no ball is fired more than 10 times so as to avoid degradation of the ball.

8.7 If the surface has a directional pattern, such as the lay of the pile of synthetic turf, tests shall be made in the typical direction of play, i.e. parallel to the length of the court.

9 Calculation and expression of results

From the monitoring of the ball before and after impact, obtain the angles and resultant velocities of incidence and rebound and for each test calculate the Court Pace Rating using:

$$\text{CPR} = 100(1 - \mu) + a(b - e_T)$$

where

the coefficient of restitution (COR) is given by:

$$e = \frac{V_{fy}}{V_{iy}}$$

the coefficient of friction (μ) (COF) is given by:

$$\mu = \frac{V_{ix} - V_{fx}}{V_{iy}(1 + e)}$$

the adjusted COR for temperature (e_T) is given by:

$$e_T = e + c(23 - T)$$

and

V_{ix} = ball's horizontal inbound velocity (m/s);

V_{iy} = ball's vertical inbound velocity (m/s);

V_{fx} = ball's horizontal outbound velocity (m/s);

V_{fy} = ball's vertical outbound velocity (m/s);

- T = mean temperature of test specimen (°C);
- c = temperature coefficient (0,003);
- b = mean coefficient of restitution for all surface types (0,81);
- a = pace perception constant (150).

For each series of nine tests, calculate the mean values of coefficient of restitution and Court Pace Rating.

10 Test report

The test report shall contain the following:

- a) reference to this European Standard, i.e. EN 13865:2017;
- b) complete identification of the surface tested, including the manufacturer's reference and the type of supporting layers and their method of attachment;
- c) direction of test;
- d) test temperature;
- e) mean value of coefficient of restitution and mean value of Court Pace Rating;
- f) individual test results and Court Pace Rating, if required;
- g) condition of the surface at the time of test, i.e. wet or dry.

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