



SLOVENSKI STANDARD
SIST EN 13865:2004

01-februar-2004

Podloge za športne dejavnosti – Ugotavljanje obnašanja žoge pri odboju pod kotom – Tenis

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

Sportböden - Bestimmung des winkligen Ballverhaltens - Tennis

Sols sportifs - Détermination du comportement du rebond angulaire d'une balle - Tennis

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ICS:

97.220.10 Športni objekti Sports facilities

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13865

December 2003

ICS 97.220.10

English version

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

Sols sportifs - Détermination du comportement du rebond
angulaire d'une balle - Tennis

Sportböden - Bestimmung des winkligen Ballverhaltens -
Tennis

This European Standard was approved by CEN on 7 November 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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EN 13865:2003 (E)

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Foreword

This document (EN 13865:2003) has been prepared by Technical Committee CEN/TC 217 "Surfaces for sports areas", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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EN 13865:2003 (E)

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

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12229, *Surfaces for sports areas — Procedure for the preparation of synthetic turf and textile test pieces.*

International Tennis Federation (ITF) Rules of Tennis.

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.

NOTE 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 such that its velocity can be measured to an accuracy of $\pm 0,01$ 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 *Pressurized tennis balls*

4.3.1 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.

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 (33 ± 6) % denier (6,67 dtex) polyamide and (67 ± 3) % wool, and which, when tested in accordance with procedures detailed in the ITF Rules of Tennis, exhibit the following properties:

- ball mass: $(57,6 \pm 0,3)$ g;
- ring gauge diameter: minimum 67,072 mm, maximum 67,865 mm;
- forward deformation: $(6,413 \pm 0,317)$ 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 1 000 mm and minimum width 1 000 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.

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

NOTE 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 **iTeh STANDARD PREVIEW**

Condition test pieces containing materials which are sensitive to humidity for a minimum of 88 h at relative humidity (50 ± 5) % at the specified test temperature.

Condition all other 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 and 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 7 days 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 ± 2) ° and a velocity of (30 ± 2) m/s, if necessary employing trial runs using additional balls (see **4.3.4**).

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8.3 Project each ball, in turn, 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. Analyse the results and select the three balls that give the best reproducibility and repeatability.

NOTE If the balls are those specified in **4.3.2**, only three balls in total might have been used.

8.4 Project each of the three selected balls, in turn, onto the test piece, and monitor and record the velocity and angle before and after impact. Record the sequence of projecting the balls.

Examine the test piece and if the sports surface is disturbed or damaged as a result of the test, move the apparatus between each test to change the point of impact.

8.5 Using the same balls, repeat the procedure described in **8.4** a further two times, projecting each of the three balls in the same sequence.

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

8.6 If the surface has a directional pattern, such as the lay of the pile of synthetic turf, carry out five tests in one direction and four in the other direction to obtain a set of readings in directions giving maximum and minimum values of angle of rebound.

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 (see Figure 1).

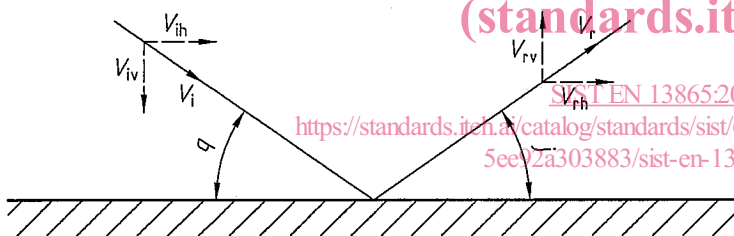


Figure 1 — Relationship between components of ball incidence and rebound.

The coefficient of restitution for each test is given by

$$e = \frac{v_r \sin j}{v_i \sin q} \quad (1)$$

where

e is the coefficient of restitution;

v_i is the incidence velocity, in metres per second (m/s);

v_r is the rebound velocity, in metres per second (m/s);

j is the angle of rebound, in degrees (°);

q is the angle of incidence, in degrees (°).