



SLOVENSKI STANDARD

SIST EN 15947-4:2010

01-december-2010

Nadomešča:

SIST EN 14035-4:2003/AC:2005

SIST EN 14035-5:2006

Pirotehnični izdelki - Ognjemetni izdelki, kategorije 1, 2 in 3 - 4. del: Preskusne metode

Pyrotechnic articles - Fireworks, Categories 1, 2 and 3 - Part 4: Test methods

Pyrotechnische Gegenstände - Feuerwerkskörper, Kategorien 1, 2 und 3 - Teil 4: Prüfverfahren

Articles pyrotechniques - Artifices de divertissement, Catégories 1, 2 et 3 - Partie 4: Méthodes d'essai

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SIST EN 15947-4:2010
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Ta slovenski standard je istoveten z: EN 15947-4:2010

ICS:

71.100.30 Eksplozivi. Pirotehnika Explosives. Pyrotechnics

SIST EN 15947-4:2010

en,fr,de

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15947-4

September 2010

ICS 71.100.30

Supersedes EN 14035-9:2004, EN 14035-20:2005,
EN 14035-6:2004, EN 14035-7:2004,
EN 14035-31:2005, EN 14035-3:2004,
EN 14035-34:2003, EN 14035-5:2006,
EN 14035-15:2003, EN 14035-22:2004,
EN 14035-4:2003, EN 14035-23:2003,
EN 14035-33:2005, EN 14035-29:2004,
EN 14035-36:2004, EN 14035-8:2004,
EN 14035-19:2003, EN 14035-13:2004,
EN 14035-12:2003, EN 14035-17:2004,
EN 14035-35:2004, EN 14035-10:2004,
EN 14035-18:2004, EN 14035-38:2006,
EN 14035-24:2004, EN 14035-21:2005,
EN 14035-25:2005, EN 14035-28:2004,
EN 14035-27:2003

English Version

Pyrotechnic articles - Fireworks, Categories 1, 2 and 3 - Part 4:

Test methods
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Management Centre: Avenue Marnix 17, B-1000 Brussels

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EN 15947-4:2010 (E)**Foreword**

This document (EN 15947-4:2010) has been prepared by Technical Committee CEN/TC 212 “Pyrotechnic articles”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

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 14035-9:2004, EN 14035-20:2005, EN 14035-6:2004, EN 14035-7:2004, EN 14035-31:2005, EN 14035-3:2004, EN 14035-34:2003, EN 14035-5:2006, EN 14035-15:2003, EN 14035-22:2004, EN 14035-4:2003, EN 14035-23:2003, EN 14035-33:2005, EN 14035-29:2004, EN 14035-36:2004, EN 14035-8:2004, EN 14035-19:2003, EN 14035-13:2004, EN 14035-12:2003, EN 14035-17:2004, EN 14035-35:2004, EN 14035-10:2004, EN 14035-18:2004, EN 14035-38:2006, EN 14035-24:2004, EN 14035-21:2005, EN 14035-25:2005, EN 14035-28:2004, EN 14035-27:2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This European Standard is one of the series of standards as listed below:

- EN 15947-1, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 1: Terminology*
- EN 15947-2, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 2: Categories and types of firework*
- EN 15947-3, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 3: Minimum labelling requirements*
- EN 15947-4, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 4: Test methods*
- EN 15947-5, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 5: Requirements for construction and performance*

CEN/TC 212 is currently also developing European Standards for:

- Pyrotechnic articles — Fireworks Category 4;
- Pyrotechnic articles — Theatrical pyrotechnic articles;
- Pyrotechnic articles — Pyrotechnic articles for vehicles;
- Pyrotechnic articles — Other pyrotechnic articles.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies test methods. It is applicable to fireworks in categories 1, 2 and 3 according to EN 15947-2:2010.

2 Normative references

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

EN 15947-1:2010, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 1: Terminology*

EN 15947-3:2010, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 3: Minimum labelling requirements*

EN 15947-5, *Pyrotechnic articles — Fireworks, Categories 1, 2 and 3 — Part 5: Requirements for construction and performance*

EN 61672-1:2003, *Electroacoustics — Sound level meters — Part 1: Specifications (IEC 61672-1:2002)*

EN ISO 845, *Cellular plastics and rubbers — Determination of apparent density (ISO 845:2006)*

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003)*

EN ISO 2439, *Flexible cellular polymeric materials — Determination of hardness (indentation technique) (ISO 2439:2008)*

ISO 3599, *Vernier callipers reading to 0.1 and 0.05 mm*

ISO 6344-3, *Coated abrasives — Grain size analysis — Part 3: Determination of grain size distribution of microgrits P240 to P2500*

ISO 21948, *Coated abrasives — Plain sheets*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15947-1:2010 apply.

4 Test environment

4.1 General

The test area shall be a clean, flat, horizontal, non-flammable and sound reflecting surface (for example concrete). The test sample shall be placed in accordance with the instructions on the label in the centre of the test area.

4.2 Indoor

The test area shall be indoors.

The test area shall be inside a fume cupboard, or similar enclosed space, which is capable of preventing movement of air.

EN 15947-4:2010 (E)**4.3 Outdoor****4.3.1 General**

The test area shall be an outdoor site. If applicable, provisions shall be made at the centre of the test area for partially burying into the ground.

If applicable, insert support pole in the centre of the test area.

A means of measuring the wind speed at a height of 1,5 m above the ground shall be provided. No performance testing shall be carried out if the wind speed exceeds 5,0 m/s.

4.3.2 Category 1

A test area meeting the requirements given in 4.1, with a radius of at least 2,0 m and a circle, radius 1,0 m, shall be marked around the centre of the test area.

4.3.3 Category 2

A test area meeting the requirements given in 4.1, with a radius of at least 9,0 m and a circle, radius 8,0 m, shall be marked around the centre of the test area.

4.3.4 Category 3

A test area meeting the requirements given in 4.1, with a radius of at least 16,0 m and a circle, radius 15,0 m, shall be marked around the centre of the test area.

4.4 Monitoring height

Two positions for monitoring the height of ascent and angle of flight shall be provided, at a measured distance of at least 50 m from and at an angle of 90° to each other in relation to the testing point. If the monitoring positions are not in the same horizontal plane, appropriate corrections shall be made in the calculation of heights.

If necessary the measuring distance and the number of positions can be adapted to the firework.

5 Apparatus

NOTE The described apparatuses are only examples, any equivalent apparatus with the same accuracy or better can be used.

5.1 Timing device.

5.1.1 Timing device, capable of being read to the nearest 0,1 s.

5.1.2 Timing device, capable of being read to the nearest 1 min.

5.2 Calliper, flat faced vernier calliper reading to 0,1 mm, conforming to ISO 3599.

5.3 Ruler, reading to 1 mm.

5.4 Measuring tape, reading to 10 mm.

5.5 Wind speed meter, capable to measure with accuracy of at least 0,5 m/s.

5.6 Masses with clamping device.

5.6.1 (50 ± 1,0) g mass total.

5.6.2 (100 ± 1,0) g mass total.

5.6.3 (500 ± 1,0) g mass total.

5.7 Balance.

5.7.1 Balance, reading to 100 mg.

5.7.2 Balance, reading to 10 mg.

5.7.3 Balance, reading to 0,1 mg.

5.8 Abrasive sheet, large enough to permit striking of the ignition head, conforming to ISO 21948, grit P240 measured in accordance with ISO 6344-3.

5.9 Temperature chamber.

5.9.1 Up to (+ 130 ± 2,5) °C.

5.9.2 Up to (+ 75 ± 2,5) °C.

5.9.3 Up to (+ 50 ± 2,5) °C.

5.10 Test paper, 700 mm × 750 mm, (80 ± 3,0) g/m².

5.11 Clamping device.

Means of clamping to hold different test sample at different heights and/or angles.

5.12 Plate, non-flammable, with a diameter of (200 ± 5) mm.

5.13 Paper holder.

Means of clamping to fix the test paper in a horizontal or vertical plane in different heights.

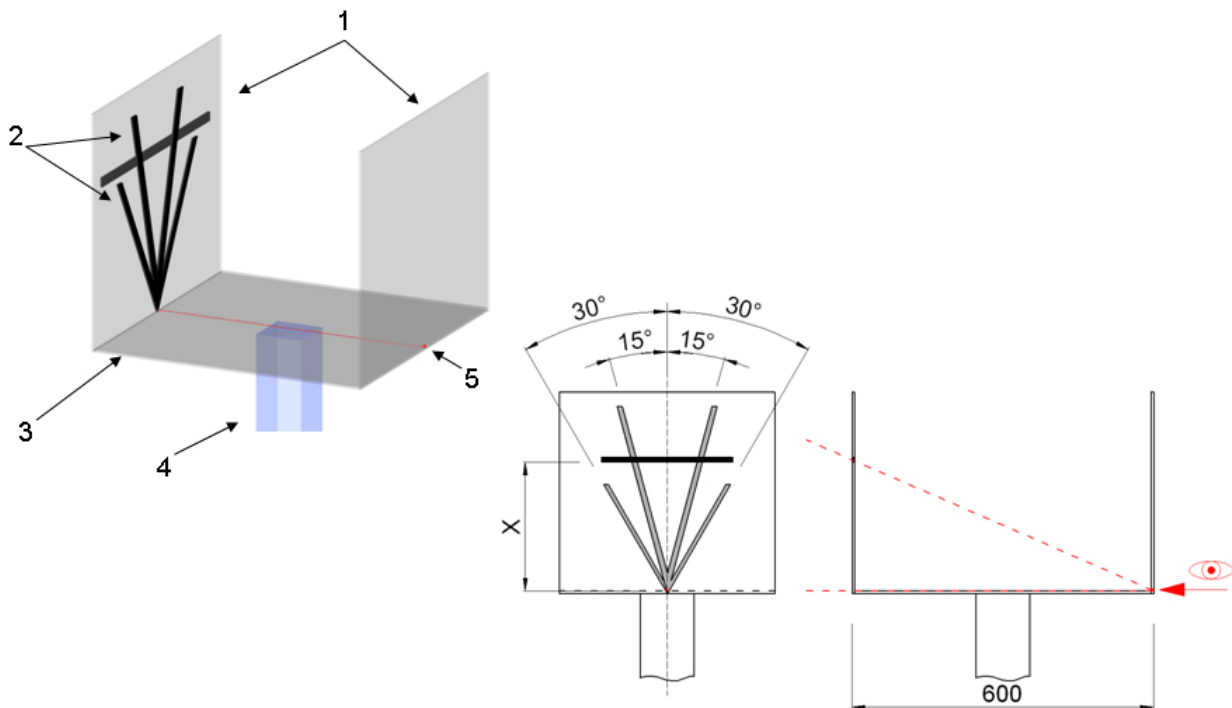
5.14 Viewing screen.

Suitable viewing screens, as shown in Figure 1, shall be provided for monitoring height and angle of flight criteria.

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Key

- 1 acryl glass
- 2 black tape, 10 mm to 20 mm wide
- 3 solid base
- 4 stand
- 5 position of observer

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Figure 1 — Viewing screen

Distance X is given in metres by the equation (with e.g. Y = 50 m):

$$\frac{20}{X} = \frac{Y}{0,6}$$

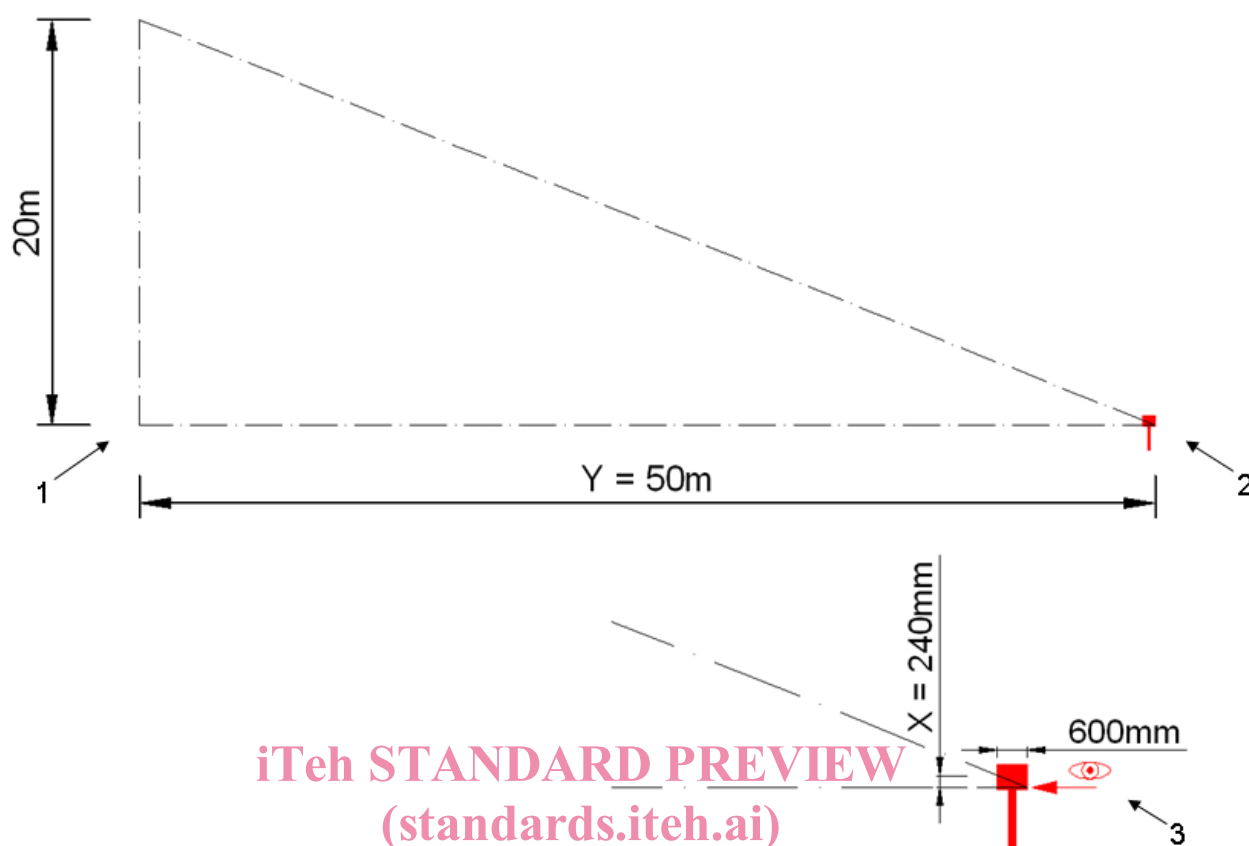
$$X = \frac{20 \cdot 0,6}{Y}$$

$$X = \frac{20m \cdot 0,6}{50m}$$

$$X = \underline{\underline{0,24}}$$

where

Y is the distance in metres from the viewing point to the testing point.



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Key

- 1 base of firework before firing
- 2 sighting device
- 3 position of observer

Figure 2 — Use of a viewing screen to monitor a height of 20 m

5.15 Poles, with 3 m height.

NOTE A vertical height of 3 m can be identified by the poles placed around the perimeter of the test area and the 8 m height can be estimated using the same poles.

5.16 Rack.

Horizontal plate with a central hole of 800 mm diameter, mounted in a height of 3,0 m above the ground in a mobile rack.

5.17 Sound level meter to class 1 of EN 61672-1:2003 with free-field microphone.

5.18 Shock apparatus, capable of providing an impulse of at least (490 ± 20) m/s² and an impulse-duration of at least (2 ± 1) ms at a frequency of $(1 \pm 0,1)$ Hz.

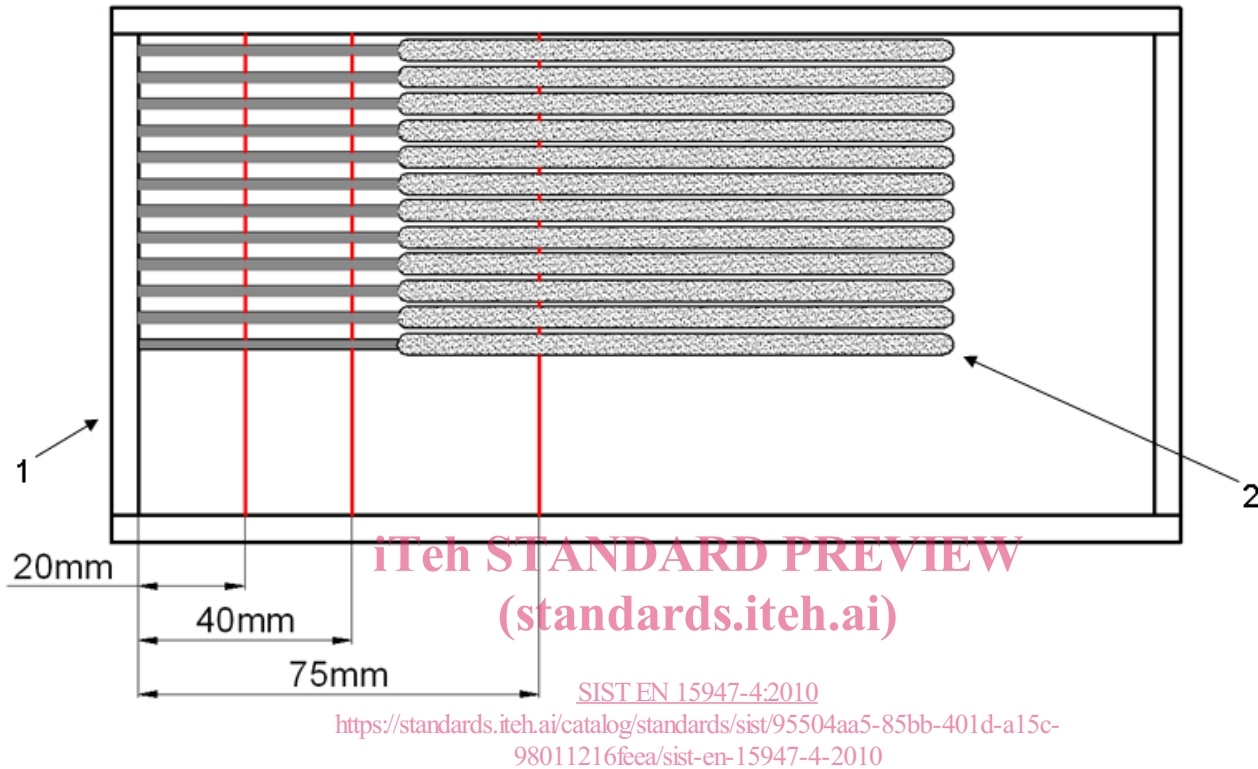
An example of an apparatus is shown in Annex A.

5.19 Goniometer, read to 1°.

EN 15947-4:2010 (E)**5.20 Frame.**

The frame shall retain the test sample consistently.

To gauge the length of the handles, clearly marked lines shall be marked at distances of 20 mm, 40 mm and 75 mm from the handle end of the frame.

**Key**

- 1 frame
- 2 sparkler

Figure 3 — Example for determining length of handles (Batch test)

5.21 Ignition source, capable of producing a small flame or of smouldering.

5.22 Transparent type size sheet.

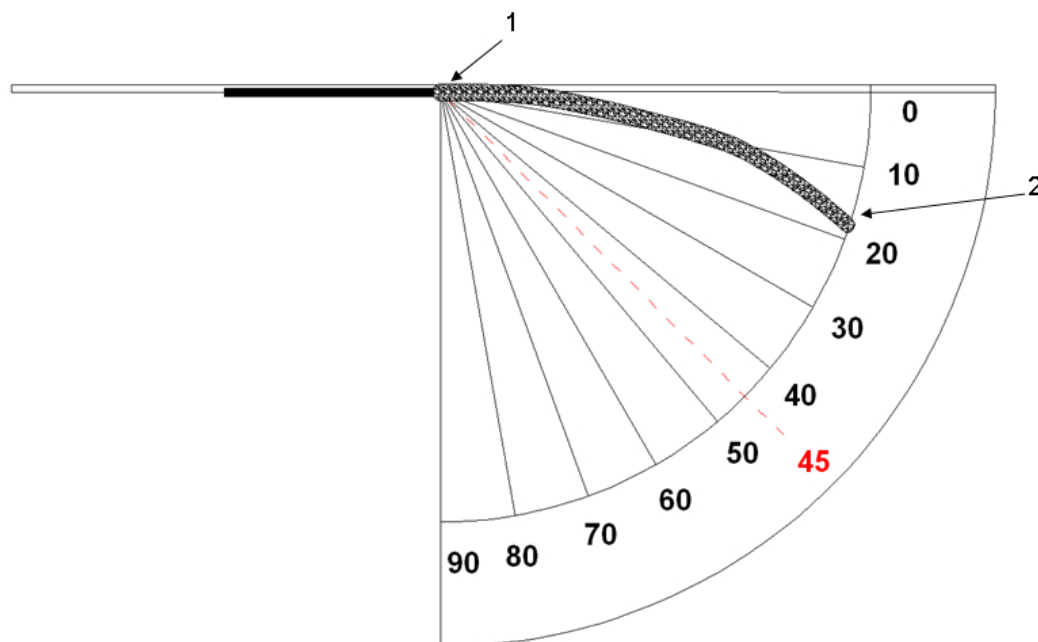
The printing, as required in 4.8 of EN 15947-3:2010, shall comply with the sizes shown in the figure below.

2,8 mm: ABC abc XYZ xyz 123

2,1 mm: ABC abc XYZ xyz 123

Figure 4 — Type sizes of print

5.23 Protractor.



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Key

- 1 junction of handle/pyrotechnic composition
- 2 tip of hand-held sparkler

Figure 5 — Measurement of droop

5.24 Striking surface.

The primary pack is supplied with a striking surface for safety matches.

5.25 Post, with a height of 0,5 m.

Place one or more posts inside the test area (4.3.2) with the related radius.

5.26 Cage, thin-wire cage with a mesh size of 10 mm to 15 mm.

The wire shall have a diameter of approximately 1,0 mm.

The inner length and width shall be (200 ± 10) mm. The inner height of the cage shall be (100 ± 10) mm.

6 Methods of tests

NOTE These methods are only examples. Any equivalent method with the same sensitivity and the same accuracy or better can be used.

6.1 Construction and stability

6.1.1 Length of handle