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**Fireworks — Categories 1, 2 and 3 —  
Part 4:  
Test methods**

*Artifices de divertissement — Catégories 1, 2 et 3 —  
Partie 4: Méthodes d'essai*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 264, *Fireworks*.

A list of all the parts in the ISO 25947 series can be found on the ISO website.

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# Fireworks — Categories 1, 2 and 3 —

## Part 4: Test methods

### 1 Scope

This document specifies test methods. It is applicable to fireworks in categories 1, 2 and 3 according to ISO 25947-2.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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*

ISO 25947-1, *Fireworks, Categories 1, 2 and 3 — Part 1: Terminology*

ISO 25947-3:2017, *Fireworks, Categories 1, 2 and 3 — Part 3: Minimum labelling requirements*

ISO 25947-5, *Fireworks, Categories 1, 2 and 3 — Part 5: Requirements for construction and performance*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 25947-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 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.

## 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 a 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 Weights with clamping devices.**

**5.6.1** Weight with clamping device,  $(50 \pm 1,0)$  g total.

**5.6.2** Weight with clamping device,  $(100 \pm 1,0)$  g total.

**5.6.3** Weight with clamping device,  $(500 \pm 1,0)$  g 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  $(+130 \pm 2,5)$  °C.

**5.9.2** Up to  $(+75 \pm 2,5)$  °C.

**5.9.3** Up to  $(+50 \pm 2,5)$  °C.

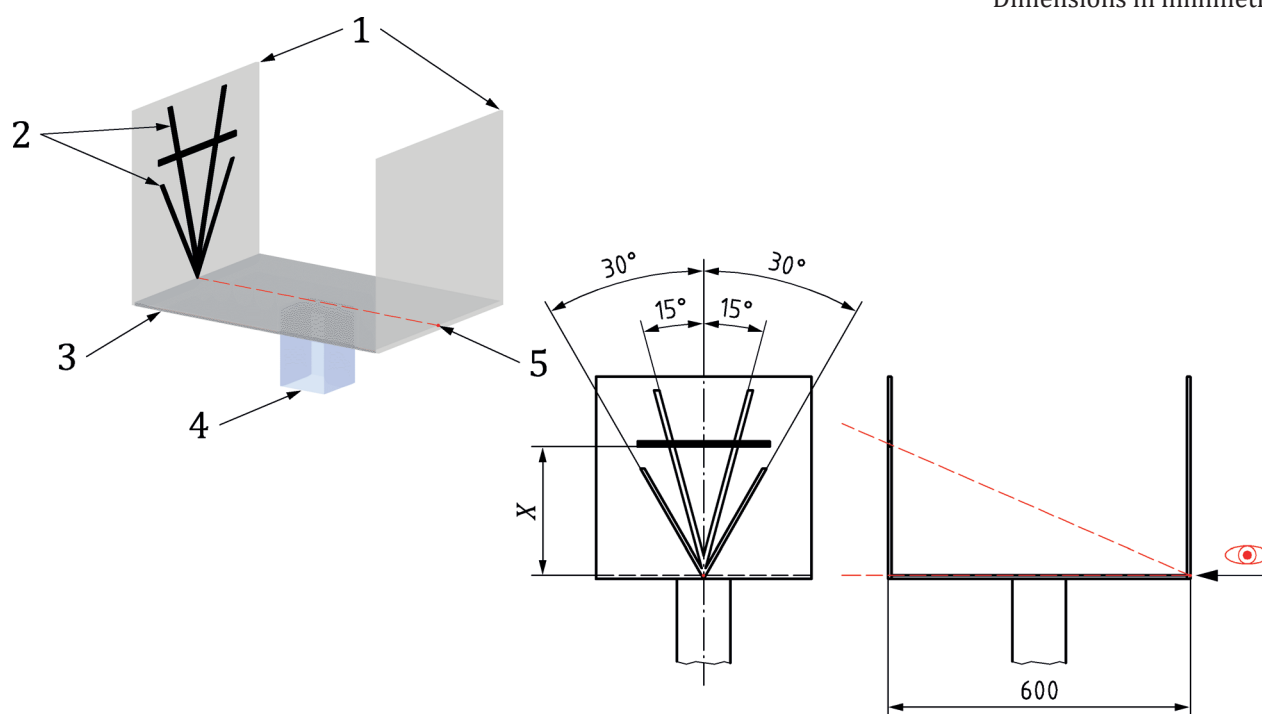
**5.10** **Test paper**, 700 mm × 750 mm,  $(80 \pm 3,0)$  g/m<sup>2</sup>.

**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  $(200 \pm 5)$  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.

**Key**

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

**Figure 1 — Viewing screen**

Distance  $X$  is given in metres using [Formula \(1\)](#) (with e.g.  $Y = 50$  m):

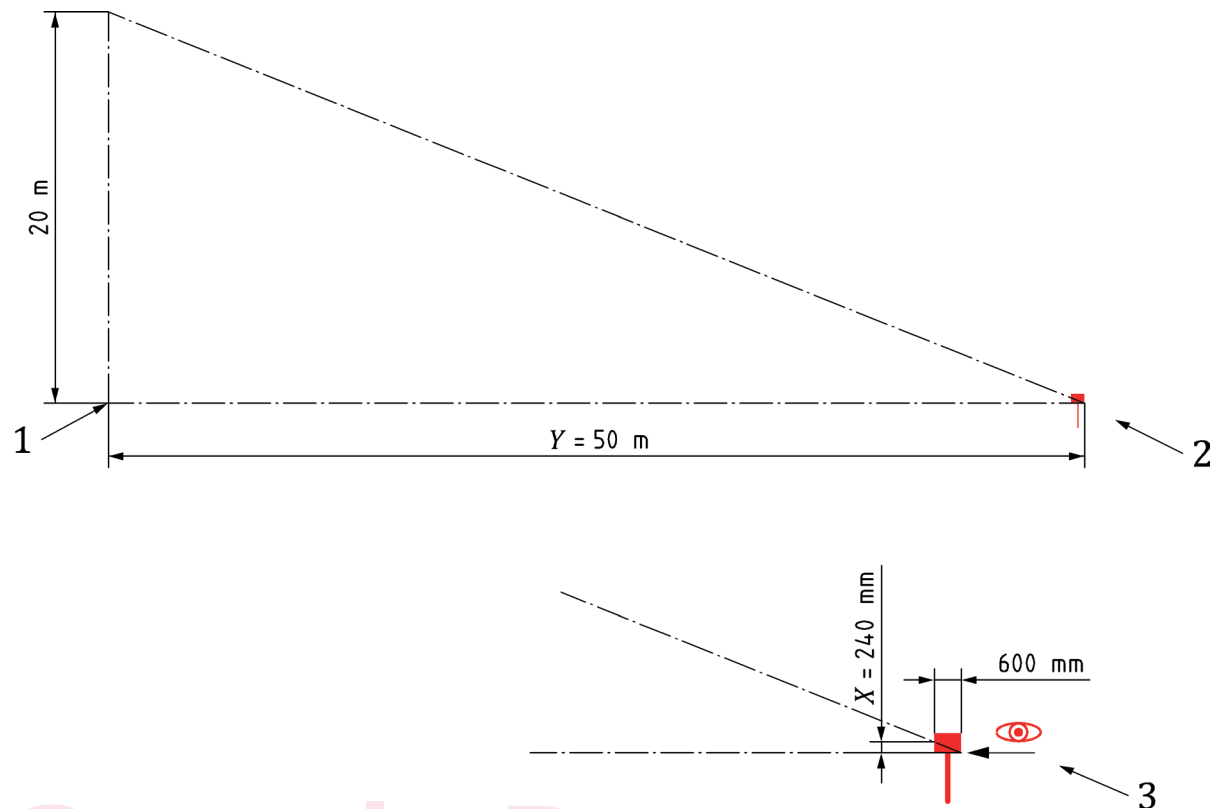
$$\frac{20 \text{ m}}{X} = \frac{Y}{0,6 \text{ m}} \quad (1)$$

where

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

EXAMPLE  $Y = 50$  m

$$X = \frac{0,6 \text{ m} \cdot 20 \text{ m}}{Y} = \frac{0,6 \text{ m} \cdot 20 \text{ m}}{50 \text{ m}} = 0,24 \text{ m} \quad (2)$$

**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 IEC 61672-1 with free-field microphone.

**5.18 Shock apparatus.**

The apparatus shall provide a deceleration of  $490 \text{ m/s}^2$  ( $-50/+100$ )  $\text{m/s}^2$  (when measured at the centre of an unloaded platform) and the mechanical conditioning impulse duration (time elapsed from the starting of the machine's deceleration to the time in which the deceleration reaches its maximum value during each first shock pulse) shall be  $(2 \pm 1) \text{ ms}$  working at a frequency of  $(1 \pm 0,1) \text{ Hz}$ .

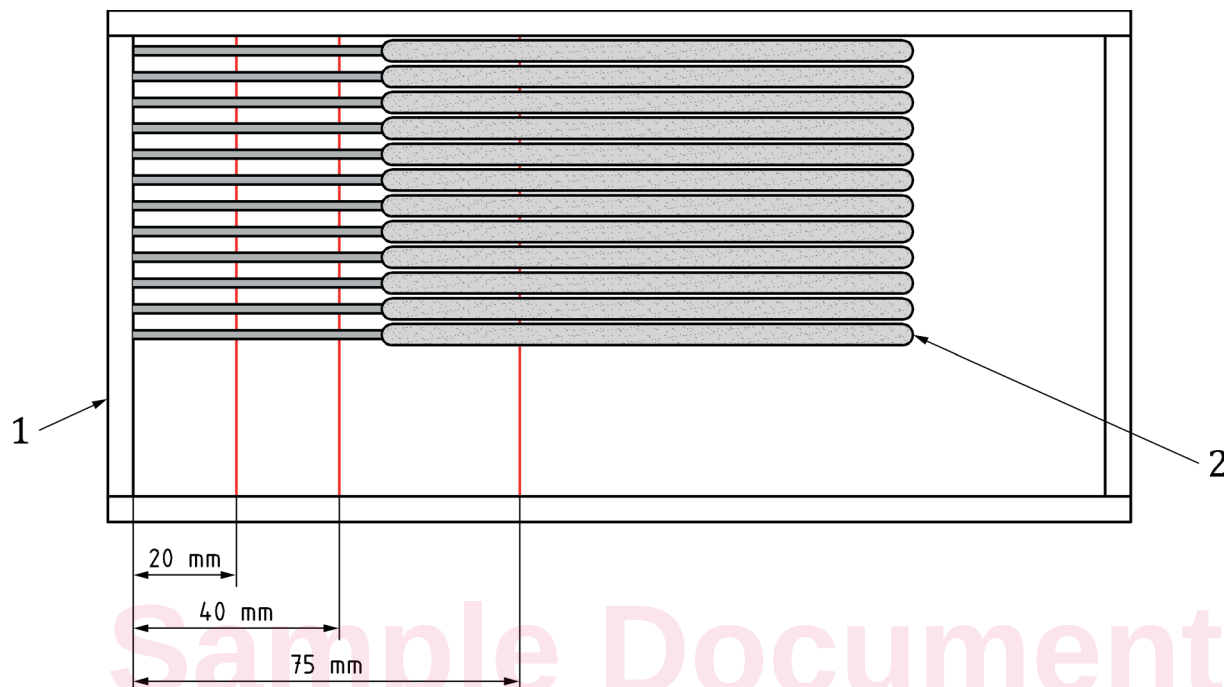
An example of an apparatus is shown in [Annex A](#).

**5.19 Goniometer**, read to  $1^\circ$ .

## 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 of Latin characters, as required in ISO 25947-3:—, 4.8, shall comply with the sizes shown in [Figure 4](#).

2,8 mm: ABC abc XYZ xyz 123

2,1 mm: ABC abc XYZ xyz 123

**Figure 4 — Type sizes of print**

For other languages, similar equipment shall be used in compliance with ISO 25947-3.