INTERNATIONAL STANDARD

ISO 26261-3

First edition
2017-02

Fireworks — Category 4 —

Part 3: Test methods

Artifices de divertissement — Catégorie 4 —

Partie 3: Méthodes d'essai

Reference number
ISO 26261-3:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

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).

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).

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 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.

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

A list of all the parts in the ISO 26261 series can be found on the ISO website.

Fireworks — Category 4 —

Part 3:
Test methods

1 Scope

This document specifies test methods for fireworks of Category 4.

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 13385-1, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Callipers; Design and metrological characteristics*

ISO 26261-1, *Fireworks — Category 4 — Part 1: Terminology*

ISO 26261-2:2017, *Fireworks — Category 4 — Part 2: Requirements*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 26261-1 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 for functioning test

4.1 General

The test environment shall be a large unobstructed area, which shall be wide open. The measuring points shall be positioned appropriately for the type of measurement being carried out.

For aquatic fireworks, a water test area shall be available for testing the resistance to moisture and functioning in the expected manner.

4.2 Wind measurement

The wind speed at a height of 1,50 m above the ground shall be measured and recorded using a wind speed meter (see 5.5). No performance testing shall be carried out if the wind speed exceeds 5,0 m/s.

5 Apparatus

Any equivalent apparatus with the same accuracy or better may be used.

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

5.2 Calliper, flat faced vernier calliper reading to 0,1 mm, conforming to ISO 13385-1.

5.3 Ruler, with a scale resolution of 1,0 mm or better.

5.4 Measuring tape, with a scale resolution of 10 mm or better.

5.5 Wind speed meter, accurate to at least 0,5 m/s.

5.6 Balance, with an accuracy of ±0,01 g or better.

5.7 Temperature chamber.

5.7.1 Up to (50 ± 2,5) °C.

5.7.2 Up to (75 ± 2,5) °C.

5.8 Sound level meter of class 1 conforming to IEC 61672-1 with a free-field microphone.

5.9 Shock apparatus, providing a deceleration of 490 m/s² (-50/+100) m/s² (when measured at the centre of an unloaded platform) and the shock 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 ms ± 1 ms working at a frequency of 1 Hz ± 0,1 Hz.

An example of an apparatus is shown in Annex A.

5.10 Devices for measuring heights.

Heights shall be measured using universal surveying instruments (USI) such as theodolites, electronic spirit levels or video (visible and/or infrared) systems.

Examples of measuring methods and the calculation of the height are given in Annex B.

5.11 Goniometer, reading to 1° or better.

5.12 Mortar.

The rising height of shells depends particularly on the clearance of the shell in the mortar [ratio of the maximum cross section area of the shell (A_{shell}) to the inner cross section area of the mortar (A_{mortar})], also designated as "Q". Q is the ratio of the outer diameter of the shell ($d_{o,shell}$, including the fuse to the lifting charge) squared over the inner diameter of the mortar ($d_{i,mortar}$) squared. The outer diameter of the shell shall be measured horizontally at the place of largest diameter including the fuse to the lifting charge. The conditions given in Formula (1) and Formula (2) shall be achieved:

$$0,9 \leq Q = \frac{A_{shell}}{A_{mortar}} = \frac{d^2_{o,shell}}{d^2_{i,mortar}} \leq 0,98 \quad (1)$$

$$\sqrt{1,02 \cdot d^2_{\text{o,shell}}} \leq d_{\text{i,mortar}} \leq \sqrt{1,1 \cdot d^2_{\text{o,shell}}} \quad (2)$$

For calibre ≤100 mm, a wider tolerance can be accepted. The conditions given in Formula (3) and Formula (4) shall be achieved:

$$0,83 \leq Q^*_{\leq 100} \leq 0,98 \quad (3)$$

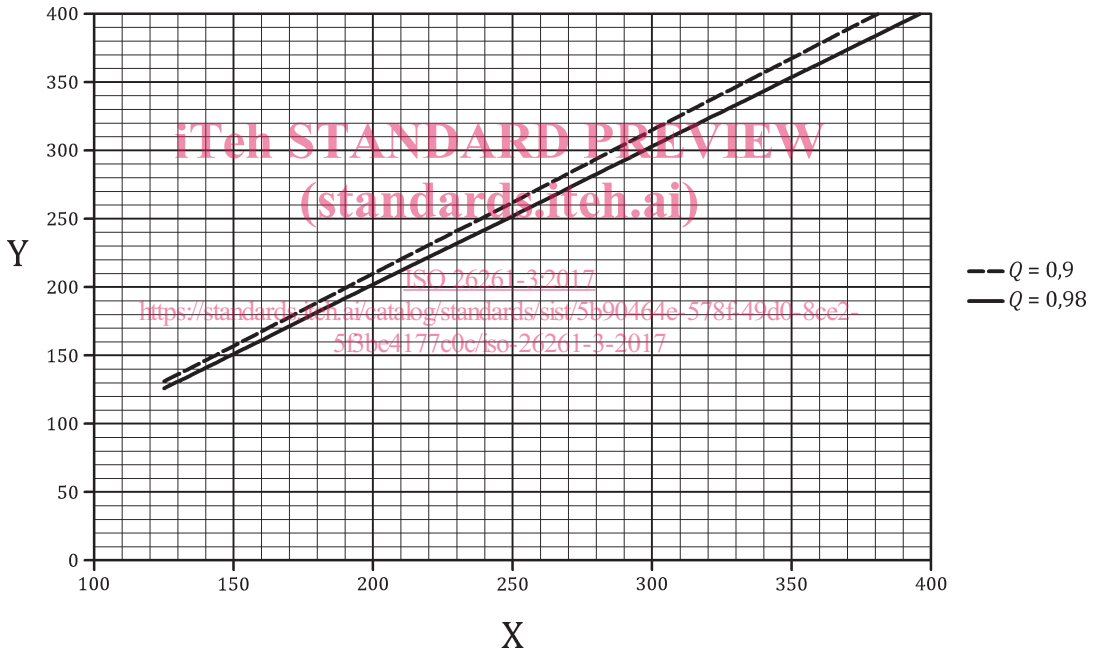
$$\sqrt{1,02 \cdot d^2_{\text{o,shell}}} \leq d^*_{\text{i,mortar}} \leq \sqrt{1,2 \cdot d^2_{\text{o,shell}}} \quad (4)$$

For calibre >400 mm, the clearances shall be determined according to the safety standard of manufacturer.

Another determining factor influencing the rising height is the length of the mortar (l_{mortar}) – length from the mortar muzzle to the mortar ground.

The dimensions of the mortar may also be determined from Figure 1, Figure 2 and Figure 3.

Dimensions in millimetres



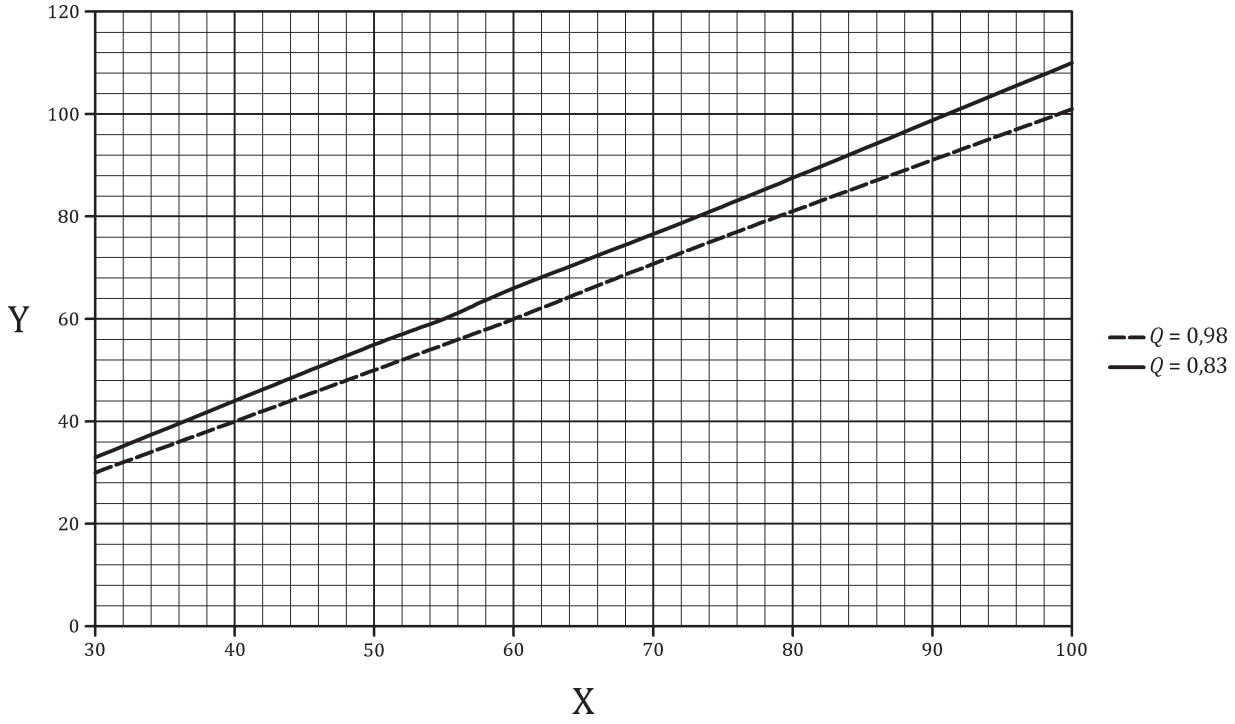
Key

X calibre of the shell

Y internal diameter of the mortar

Figure 1 — Dimensions of the mortars for spherical shells — Calibre above 100 mm

Dimensions in millimetres



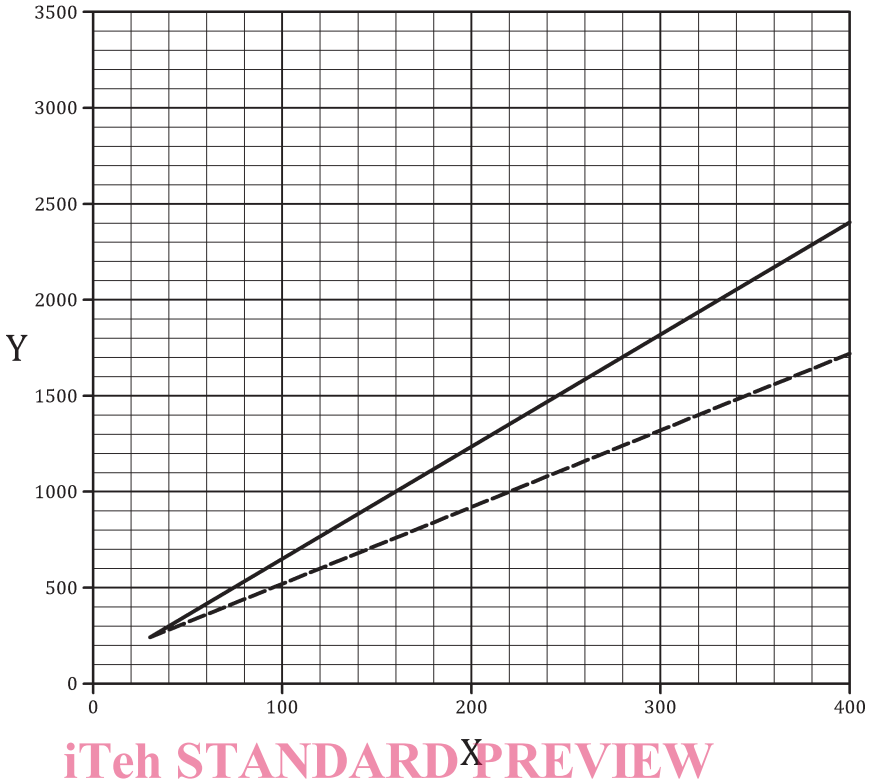
Key

X calibre of the shell

Y internal diameter of the mortar

Figure 2 — Dimensions of the mortars for spherical shells — Calibre up to 100 mm

Dimensions in millimetres



Key

X calibre of the shell

Y inside length of the mortar

— $l_{mortar} = 6 \times d_n + 70$

--- $l_{mortar} = 4 \times d_n + 120$

d_n nominal calibre

NOTE $4 \times d_n + 120 \leq l_{mortar}$ (mm) $\leq 6 \times d_n + 70$.

Figure 3 — Range of the mortar length for spherical shells

6 Test methods

NOTE Any equivalent method with the same sensitivity and the same accuracy or better might be used.

6.1 Construction and stability

6.1.1 Outer dimension of item

6.1.1.1 Apparatus

6.1.1.1.1 **Ruler** (see 5.3).

6.1.1.2 Procedure

Use the ruler to measure the outer dimensions of the tested article to the nearest of 1,0 mm and record the results.

6.1.2 Determination of calibre

6.1.2.1 Apparatus

6.1.2.1.1 **Calliper** (see 5.2).

6.1.2.2 Procedure

Use the calliper (5.2) to measure the calibre of the tested article at least three times at different positions on the article and to the nearest 0,1 mm and record the results.

6.1.3 Determination of gross mass

Use the balance (5.6) to measure the gross mass of the tested article and record the results.

6.2 Design – Verification

Compare the actual article with the detailed manufacturer's drawing.

Observe and record any nonconformity.

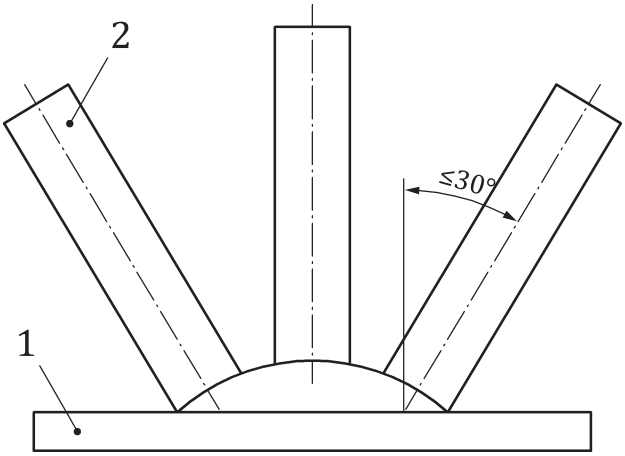
6.3 Determination of tube angle

6.3.1 Apparatus

6.3.1.1 **Goniometer** (see 5.11).

6.3.2 Procedure

For the determination of the tube angle, dismantle the functioned article (if necessary) in such a way that the angle of the tube against the vertical can be measured with the goniometer (see Figure 4) and record the results.



Key

1 base of firework

2 tube of mine, Roman candle or shot tube

Figure 4 — Determination of tube angle

6.4 Angle of ascent and burst height

6.4.1 General

The fireworks shall be fired vertically (firing device at 90° ± 2°).

The measurement of heights may be made according to one of the methods described in Annex B.

6.4.2 Dimensions of mortar

For type and batch tests, defined standard mortars (5.12) shall be used. Tables for the standardized inside diameter and inside length are given in 5.12.

When the height of a shell casing (excluding the lifting charge) is more than twice the calibre (for all shells with a calibre greater than 400 mm and for shells that are designed to be fired from a specific mortar), the mortar recommended by the manufacturer shall be used.

6.4.3 Support of mortar

The mortar shall be supported in such a way that it is not displaced by the firing of the tested article.

No deformable material shall be placed under the mortar.

6.5 Measurement of sound pressure level

6.5.1 Apparatus

6.5.1.1 Sound level meter (see 5.8).

6.5.1.2 Measuring tape (see 5.4).

6.5.2 Procedure

Set up the microphone of the sound level meter in the test area (see Clause 4) at a height of 1,0 m. The sound level meter shall be orientated to the firing point.

The distance between the measuring and firing point may be the same as for the measuring of the rising height according to 6.4.

Place and ignite the test sample in accordance with the labelled instructions and instructions for use, and record the maximum A-weighted impulse sound pressure levels as measured by the sound level meter (5.8) and the distance from the firing point (5.4).

NOTE An example of the calculation method for safety/protection distance is given in Annex C. The measurement set-up for sound pressure level is illustrated in Figure C.1.

6.6 Extinguishing of flames

6.6.1 Apparatus

6.6.1.1 Timing device (see 5.1).

6.6.2 Procedure

At the moment the tested article ceases to function (see 6.10.2), immediately start the timing device (5.1) and record the time until all flames caused by the functioning of the fireworks have extinguished.