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Fireworks — Test methods for determination of specific chemical substances —

Part 1: General

Artifices de divertissement — Méthodes d'essai pour la détermination de substances chimiques spécifiques —
Partie 1: Généralités

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Foreword

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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).

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For an explanation of 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 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 22863 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Fireworks — Test methods for determination of specific chemical substances —

Part 1: General

1 Scope

This document specifies the preparation methods of the test samples for the qualitative and quantitative analysis of specific chemical substances in fireworks.

The document applies to the following substances to be tested using ISO 22863 (all parts):

— hexachlorobenzene;

— lead and lead compounds;

— arsenic or arsenic compounds;

— mercury compounds;

— chlorates;

— white phosphorus;

— picrates or picric acid;

— zirconium with a particle size of less than 40 µm;

— content of nitrogen in nitrocellulose.

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 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
qualitative analysis
method used to determine whether samples contain certain specific chemical substances through chemical analysis

3.2
quantitative analysis
method used to measure the content of certain specific chemical substances in samples through chemical analysis

4 Apparatus

4.1 General. The apparatus used in the different test methods are specific and defined in the corresponding parts of ISO 22863.

4.2 Test sieves, antistatic and spark free, mesh size 250 µm, in conformance with ISO 3310-1.

4.3 Test sieves, antistatic and spark free, mesh size 40 µm, in conformance with ISO 3310-1.

4.4 Temperature chamber, water bath or oil bath, capable of (50 ± 2,5) °C.

4.5 Desiccator, equipped with the appropriate desiccant (e.g. silica-based desiccant, such as "silica gel" or "silica xerogel").

5 Test procedure

5.1 General

Before the experiment, manufacturers or importers shall provide the operator with information about the design and pyrotechnic content of the fireworks to be analysed.

All actions should be implemented at ambient temperature of between 15 °C and 25 °C and ambient moisture between 40 % and 80 %.

WARNING — For all operations of 5.2 to 5.5, it must be reminded that pyrotechnic compositions are flammable and explosive dangerous goods, sensible to impact, friction and electrostatic discharge. Therefore, appropriate safety and protective measures should be established, and a suitable management system should be used with this document in its scope. Operators shall wear appropriate personal protective equipment, use appropriate spark-free tools and explosion-proof ovens, and keep the samples in conductive or dissipative containers. Equipotentiality and grounding shall be assured at any time at workplaces. The remaining and tested samples shall be eliminated in safe conditions.

5.2 Sampling of pyrotechnic compositions

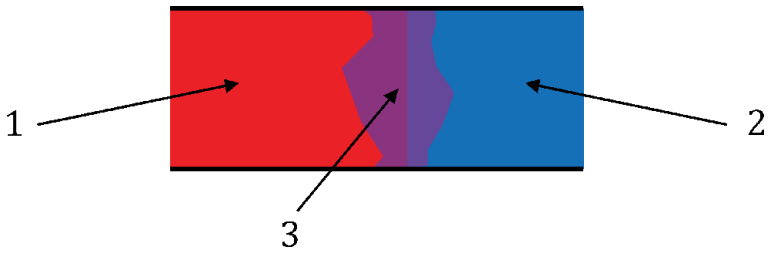
5.2.1 Extraction of pyrotechnic compositions

Carefully dismantle the firework article, remove the initial fuse, instantaneous fuse, ignition head, friction head, etc.

Carefully separate any pyrotechnic compositions or pyrotechnic units from any paper, cardboard, wooden, chipboard and plastic parts, wires and every other inert material such as aluminium tubes.

Collect a sufficient quantity of each pyrotechnic composition according to the required sample sizes of the different parts of ISO 22863 corresponding to the analyses to be carried out.

Some pyrotechnic compositions or pyrotechnic compositions and inert powders can be into mutual contact as schematized in Figure 1. In such cases, take samples from the parts 1 and 2 and mix them in the same proportions as in the article or the pyrotechnic unit from which they were extracted. No sample shall be taken from part 3.



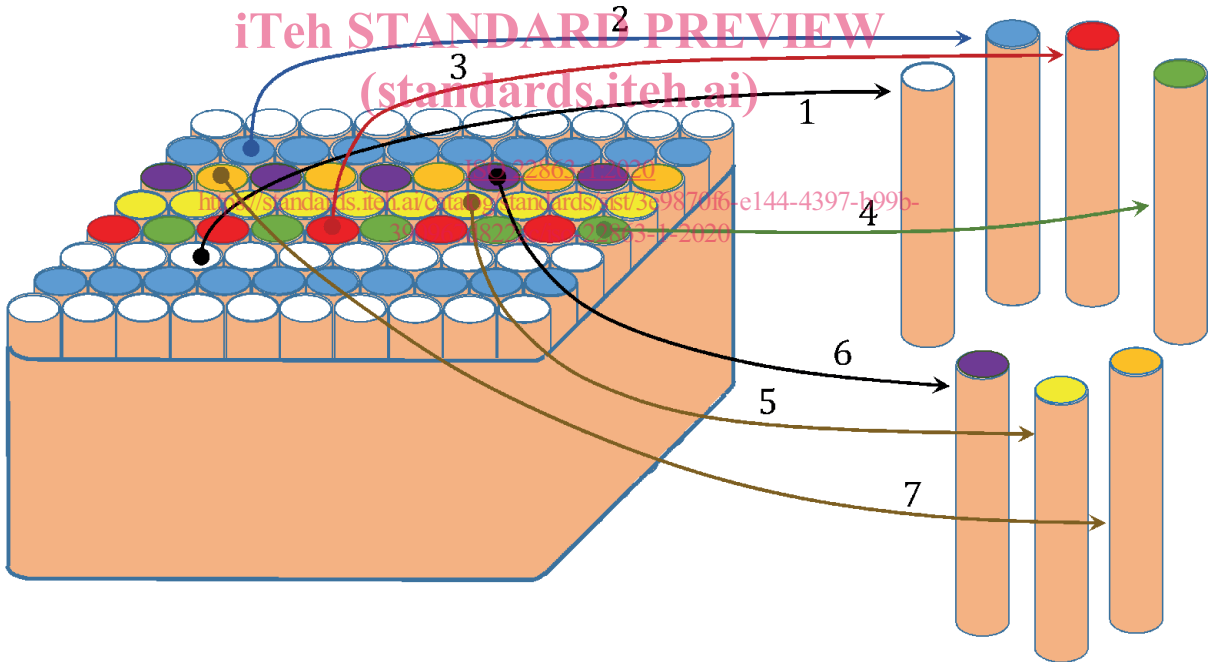
Key

1 pyrotechnic composition A
2 pyrotechnic composition B or inert material
3 contact zone of 1 and 2

Figure 1 — Contact of two compositions or composition and inert consolidated material

5.2.2 Multi-effect fireworks

When the firework article contains several pyrotechnic units that function simultaneously or sequentially (e.g. batteries and combinations, roman candles, multi-break shells, etc.), randomly select an appropriate number of units per distinct principal effect so that enough composition is collected for sampling and dismantle it (see Figure 2). Its composition(s) shall then be extracted according to 5.2.1.



Key

1 effect n°1
2 effect n°2
3 effect n°3
4 effect n°4
5 effect n°5
6 effect n°6
7 effect n°7

Figure 2 — Example of random selection

If chemically compatible, samples of composition(s) extracted from units of the same type shall be mixed together in the same proportions as in the article for further joint chemical analysis.

NOTE Determination of the chemical compatibility of compositions can be based on experimental results that are currently available in technical documentation or verified by appropriate test methods, e.g. VST (vacuum stability testing), DSC (differential scanning calorimetry), TG (Thermogravimetry).

5.3 Preparation of pyrotechnic composition

5.3.1 General

To ensure the efficiency of the detection of chemical substances from the sample that are taken from the articles, pyrotechnic compositions shall exhibit a loose aspect which will be checked by passing the composition through the standard sieve of mesh size 250 µm (4.2).

If the sample of composition is still in bulk or consolidated state, it shall be grinded to a particle size less than 250 µm. This shall be verified by passing the grinded composition through the standard sieve of mesh size 250 µm (4.2).

5.3.2 Grinding and mixing of pyrotechnic compositions

5.3.2.1 Compositions in bulk or consolidated state

For consolidated (e.g. bulk, stars, granules and pellets) pyrotechnic compositions, mix, crush and grind the compositions, regardless of the priming composition if any. Get rid of possible large pieces of paper or cardboard scraps, rice fillings and other non-pyrotechnic materials if any.

Then, carry out 5.3.2.2.

5.3.2.2 Loose compositions

For loose pyrotechnic compositions or after the grinding process of consolidated pyrotechnic compositions, pass the composition through the standard sieve with mesh diameter of 250 µm (4.2). If hard particles such as aluminium, magnesium, magnalium, titanium, iron and copper powders are found not to pass the sieve, add these particles into the sifted compositions and then mix three times to ensure the homogeneity of the mixture.

For the purpose of testing zirconium with a particle size of less than 40 µm, the sample shall be prepared individually in the same manner. Then pass the mixed sample through the standard sieve of mesh size 40 µm (4.3) and mix three times to ensure the homogeneity of the mixture.

5.3.2.3 Other forms of pyrotechnic compositions

For fireworks such as table bombs where nitrocellulose fibres are used, cut the sample into small pieces and keep it for further analysis.

For small Bengal matches, snaps, Christmas crackers, party poppers and throwdowns, etc. several items can be necessary to obtain enough composition for the analyses to be carried out. Extract the pyrotechnic composition from each item and record the number of items used.

5.4 Drying of pyrotechnic compositions

Place the sample into the temperature chamber (4.4), keeping the thickness of loose composition under 3 mm, for 4 h at a constant temperature of (50 ± 2,5) °C.

Then place the sample into the desiccator (4.5) for a minimum of 2 h (4 h is recommended), at room temperature and keep it until it is used for further analyses.

5.5 Spare backup samples

All samples shall be duplicated for possible backup and future uses.