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National foreword

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Pyrotechnic articles - Fireworks, category 4 - Overview of harmonized standards that will be developed by CEN/TC 212/WG 2

Articles pyrotechniques - Artifices de divertissement de catégorie 4 - Vue d'ensemble des normes harmonisées qui seront élaborées par le CEN/TC 212/WG 2

Pyrotechnische Gegenstände - Feuerwerkskörper, Kategorie 4 - Überblick über harmonisierte Normen, die von CEN/TC 212/WG 2 erarbeitet werden

This Technical Report was approved by CEN on 17 August 2009. It has been drawn up by the Technical Committee CEN/TC 212.

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Foreword

This document (CEN/TR 15951:2009) has been prepared by Technical Committee CEN/TC 212 “Pyrotechnic articles”, the secretariat of which is held by NEN.

This document (CEN/TR 15951:2009) has been prepared by Working Group Nr 2 “C4 Fireworks” of Technical Committee CEN/TC 212 “Pyrotechnic articles”, the convenor and secretary of which are respectively Italian and French. Experts from ten countries have participated to its elaboration: Belgium, Czech Republic, Denmark, France, Germany, Italy, Romania, Spain, The Netherlands and United Kingdom.

It has been approved by votes of all the members of CEN/TC 212 “Pyrotechnic articles” on August 2009.

Introduction

Directive 2007/23/EC of May 23rd 2007 on the placing on the market of pyrotechnic articles, has been published on June 14th 2007 in the Official Journal of the European Union. (Ref. Mandate M 416).

In its Annex 1, Directive 2007/23/EC gives the essential safety requirements (ESR) pyrotechnic articles shall comply with. In order to facilitate the process of demonstrating compliance with these ESR, harmonized standards for the design, manufacture and testing of pyrotechnic articles must be developed.

CEN has been mandated by the European Commission (EC) to develop these harmonized standards: Mandate M 416 describes the work that CEN shall perform.

CEN has entrusted coordination of this work to CEN/TC 212 'Pyrotechnic articles' with the following scope:

"Standardization of fireworks, theatrical pyrotechnic articles, pyrotechnic articles for vehicles and other pyrotechnic articles, particularly from the point of view of their safe use".

During its meeting in Delft on October 16th and 17th 2007, CEN/TC 212 has decided to share the corresponding work to be done between several Working Groups. Resolutions have been voted to establish five Working Groups, one of which is Working Group 2 (CEN/TC 212 / WG2) in charge of standardization of Category 4 Fireworks.

Because no European standards exist at present for Category 4 Fireworks, preliminary work needs to be performed before a list of standards to be developed by WG2 can be drawn up. It has been accepted by CEN/TC 212 and proposed to the European Community a one-year period will be allocated to WG2 to prepare a CEN Technical Report in which its future work program will be described and an overview of the harmonized standards it will develop will be given including the reasons why WG 2 propose to develop these standards.

Five work sessions have taken place, respectively in NEN – Delft – Netherlands on February 6th 2008, in BAM – Berlin – Germany on May 21st 2008, in NEN – Delft – Netherlands on September 10th 2008, in AFNOR – Paris – France on November 12th 2008 and in UNI – Milano – Italy on February 3rd 2009.

The present document is the final draft of the Technical Report for Category 4 Fireworks. It has been written in close coordination with the other working groups of CEN/TC 212 WG 1 "Fireworks, Categories 1, 2 and 3", WG 3 "Theatrical Pyrotechnic Articles", WG 4 "Pyrotechnic articles for vehicles" and WG 5 "Other pyrotechnic articles".

1 Scope

This Technical Report gives an overview of harmonized standards which will be proposed to be developed by CEN/TC 212 WG 2, Category 4 Fireworks. It also gives the interpretation WG 2 experts have made of some terms, definitions and requirements of Directive 2007/23/EC in order to assure future harmonized standards will encompass all varieties of fireworks, which are presently placed on the European market, in a consistent way and take the benefit of all the practical experience and usages of fireworks in the Member States.

2 Terminology

2.1 Definition of "C4 Fireworks"

Article 3 (a) of Directive 2007/23/EC gives the following definition of "C4 Fireworks":

"Fireworks which present a high hazard, which are intended for use only by persons with specialist knowledge (commonly known as fireworks for professional use) and whose noise level is not harmful to human health"

This definition raises the following comments:

— Exceptions can be found to this definition, because some "fireworks for professional use" – e.g. lances – cannot be considered as "presenting a high hazard" or generate a low noise level by themselves (e.g. less than C1 maximum noise level). But they have been designed for use in combination with other fireworks articles, mainly Category 4 Fireworks. Then they are only used by persons with specialist knowledge and never offered to the consumer market. Consequently WG 2 experts consider these articles belong to category 4.

— C1-C2-C3 fireworks articles will no longer be considered as belonging to categories 1, 2 or 3, if they do not comply with all the requirements of these categories. As soon as a potentially C1, C2 or C3 article definitively does not meet one of the requirements for C1-C2-C3 Fireworks, it will be categorized as a C4 article.

— Nothing in the definition of "pyrotechnic articles" in Directive 2007/23/EC means an article must be a complete product. Then the case of "incomplete" fireworks articles must also be considered. Such articles are commonly placed on the market. An example is a "roman candle without fuse". This article needs adaptation of a fuse for its ignition and different types of fuse may be used. This operation can be made by firers at the firing place, but limited to persons with specialized knowledge.

  Another example is a "shell without lift charge". This article can be used in two distinct ways. It can be placed in the mortar above a separate "bag charge" which will act as a lift charge and will have been placed first in the mortar – or – this "bag charge" can be fit to it first before placing the assembly in the mortar.

  Such products require "modification or preparation before use", which appears to be a better wording than "incomplete".

— Likewise, "components" of fireworks can be considered as "pyrotechnic articles" from the point of view of Directive 2007/23/EC, as far as they are placed on the market. Such pyrotechnic objects as rocket motors, drivers, delay fuses, shells to be included in more elaborated shells, etc. are used for the construction of fireworks. Some of them can have other applications than fireworks manufacturing and are "other pyrotechnic articles" as defined by Directive 2007/23/EC (See Clause 3 hereafter). The others – which are only used as components of fireworks – can be identified to "fireworks which are intended to be part of a more elaborate firework", then as "C4 Fireworks" to be used by persons with specialist knowledge in pyrotechnical factories.

NOTE The specific case of "stars" is discussed in 4.1.

— In the English language, “professional use” mainly means “paid at work” and the sentence between brackets must be considered as informative but not prevailing. The important term is “person with specialist knowledge”, which implies these persons are not necessarily paid to prepare and fire the fireworks.

To conclude and to assure their work will be fully exhaustive, WG 2 experts have adopted the following interpretation of the definition of C4 Fireworks of Directive 2007/23/EC:

“With respect to Article 3 (a) of Directive 2007/23/EC, Category 4 includes (1) fireworks which present a high hazard or (2) require modification / preparation before use or (3) are intended to be part of a more elaborate firework or (4) which do not meet all the requirements for C1-C2-C3 Fireworks, and which are intended for use only by persons with specialist knowledge (commonly known as fireworks for professional use) and whose noise level is not harmful to human health.”

Resolution TC 212 28/2008 has been approved by CEN/TC 212.

2.2 Other terms

The future C4 fireworks harmonized standard(s) will identify the design parameters and performance characteristics to be taken in consideration for the corresponding articles to meet the essential safety requirements of Directive 2007/23/EC. For each design parameter or performance characteristic it (they) will state requirements and criteria which shall be complied with.

According to the variety of articles usually observed during C4 fireworks shows, it is clearly noticeable these articles will not have all in common the same design parameters and performance characteristics. However, collections of articles sharing the same design parameters and performance characteristics exist. Then WG 2 experts have considered it was necessary to identify these collections of C4 fireworks articles and draw up their list.

The future harmonized standard(s) will state requirements and criteria for each identified homogeneous collection, which does not mean there may not exist requirements or criteria applicable to several collections as well as to all the C4 fireworks articles whatever their design or behaviour in normal use.

Word “type” has been proposed to name these collections of articles. But, this word is already used by Directive 2007/23/EC, in its Annex II, with another meaning. Then, because Directive 2007/23/EC cannot be modified, its definition of word “type” must be considered as imperative.

This does not exclude the possibility of using the word “type” in another meaning but – in that case – it has been suggested to add a qualifying term to it, as it is for the expressions “type of use” and “type of pyrotechnic article” in Directive 2007/23/EC itself. This proposal has been approved by CEN/TC 212 (See Resolution 43/2008).

Therefore, the following terms and definitions will be used hereafter and in the harmonized standard(s) to be developed by Working Group 2:

— **Type:** sample representative of the production envisaged.

NOTE 1 This definition corresponds to the use of the term ‘type’ in Annex II §2(c) of Directive 2007/23/EC for the purposes of type-examination.

— **Generic type:** set of articles with a common, very general, design feature and/or with a common characteristic effect.

— **Subtype:** set of articles within a **generic type** with specific design features.

— **Individual item:** article within a **generic type** or **subtype** for which every possible feature and characteristic has been fixed.

NOTE 2 Each feature and characteristic will be specified in the **technical name** or a technical data sheet, as appropriate.

— **Technical name:** general description of an individual item.

— **Trade name:** description of an individual item from a particular supplier.

— **Family:** set of individual items that will be considered together for the purposes of testing and approval.

NOTE 3 This last definition is fully compliant with Directive 2007/23/EC which states in "Whereas (18)": *"Groups of pyrotechnic articles that are similar in design, function or behaviour should be assessed by the notified bodies as product families".*

The figure hereafter shows how WG 2 experts intend to organize Category 4 Firework articles in "individual items" (samples of which will be "types"), "families" and "generic types", starting from the precise design level to the general design level. Example is given for "shells".

At the bottom are located the individual items submitted to conformity assessment procedures by the means of "types". As shown they are attributed a relatively long name to give information to the users on the typical calibre and effects (e.g. green ring) of the shell.

In the middle are set up "families" of individual items which may be considered together for the purposes of testing and certification (samples of which will be groups of the corresponding "types").

These families exhibit a first level of generalization of the characteristics of individual items and the corresponding types. For example, their colour and their possible tracing effect are not concerned by the essential safety requirements of Directive 2007/23/EC. So they can be neglected as far as compliance with these requirements is concerned and type tests may only be performed on one type and extended by similarity to others which share the same generalized characteristics.

At the top, a higher level of generalization of the characteristics of types is again possible. For instance, WG2 experts think all types of shells can be put together in a unique collection of groups because they have already noted that the essential safety requirements of Directive 2007/23/EC will only imply design and performance requirements which will be common to every type of shells and none at a lower level (e.g. that of a family). WG2 harmonized standard will only deal with these "generic types".

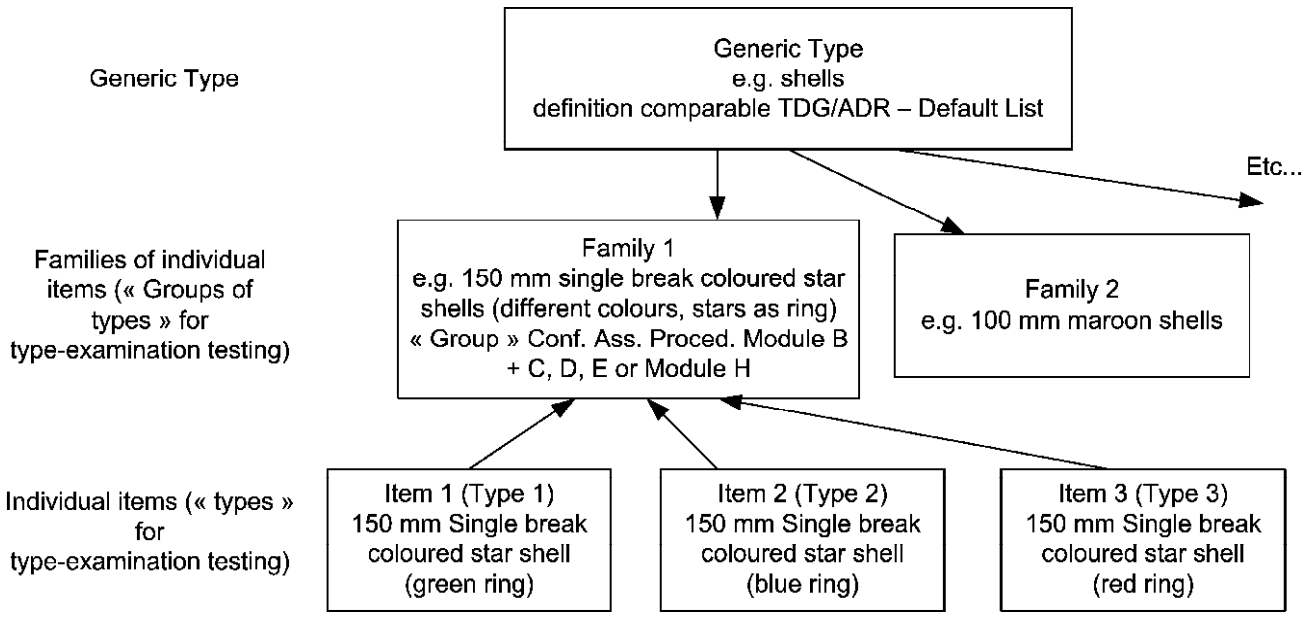

Figure 1 – Generic type, family and item

2.3 Technical terms

A list of technical terms which will possibly be used in setting design or performance requirements in the future harmonized standard(s) for C4 Fireworks has also been drawn up. Some of these terms which are presently used in standards developed by WG1 have strictly the same definition.

This list is given in Annex E.

It will be updated as far as it is necessary during the development phase of WG 2 harmonized standard(s).

3 Interfaces between CEN/TC 212 Working Groups

3.1 Interface between WG2 and WG1

Because drafts of WG 1 harmonized standards for “fireworks, categories 1, 2 and 3” already exist, they have been taken in account by WG 2 as far as it is necessary to prevent from conflicting situations (See Clause 4 hereafter) or useful when parts of these standards can be profitably applied to C4 fireworks (e.g. some test methods).

Indeed, WG 1 harmonized standards are not considered as prototypes of WG 2 harmonised standard(s). They will be distinct documents and requirements of WG 2 harmonised standard(s) will be limited to what is strictly necessary and sufficient from the point of view of their use by persons with specialist knowledge.

3.2. Interface between WG2 and WG3

WG 2 and WG 3 have exchanged their mutual opinions or solutions whenever they share the same questions or the same problems (e.g. use of high explosives or nitrocellulose with high nitrogen content in C4, T1 or T2 articles – See 5.1 hereafter)

3.3. Interface between WG2 and WG5

Components of firework articles are usually sold by manufacturers to other manufacturers in some European countries. WG 2 experts have considered “Category 4 firework articles” may include components of fireworks such as stars, crackers, volcanoes, tourbillions, quick match, black match, cord igniters, fuses or delays… from the point of view of Directive 2007/23/EC (See 2.1 here above).

WG 2 and WG 5 have met the following agreement:

— WG 5 will treat components of fireworks when they are used in other fields than fireworks (for example, electric igniters, quick match, black match, cord igniters, pressed fuses, stars).

— When these components are strictly relevant to the fireworks market, they will enter into the scope of work of WG2 (for example, crackers, volcanoes, tourbillions).

4 List of C4 Fireworks and definitions

4.1 Preliminary remarks

WG 1 dealing with “fireworks, categories 1, 2 and 3” has already elaborated drafts of harmonised standards dealing with “Terminology” and “Categorization”. These documents include definitions of some articles which will never have a C4 version and does not include definitions of articles which only exist as C4 fireworks (“shells” for instance). However, these documents have been taken in account by WG 2 to assure the same

definitions are used for the same types of articles by WG 1 and WG 2 as far as there are no justifiable technical reasons to create differences or additions.

WG 2 experts have met the necessity to create such differences and additions in a number of cases, because:

— Some WG1 definitions include requirements which are specific to C1-C2-C3 Fireworks and must not be imposed to C4 Fireworks as far as they are used by persons with specialized knowledge, e.g. cases of C1-C2-C3 Fountains must be non metallic and the corresponding WG1 definition states it, but metallic cases are already used for C4 Fountains and there is no major reason to forbid it.

— Requirements for C4 Fireworks do not need to be as precise, specific or numerous as for consumer fireworks for they will only be used by persons with specialized knowledge. Then several types of firework may be grouped under a more general type of firework or generic type, which simplifies the way design and performance requirements will be set in the future harmonized standard(s). WG 2 experts have decided to proceed to this grouping under some existing names of firework types and have consequently adapted corresponding definitions.

The final list and definitions of types of C4 Fireworks will be a separate document from WG 1 Consumer Fireworks Terminology and Categorization standards.

4.2 Criteria used to determine “generic types”

Criteria which have been used to determine “generic types” result directly from definition given here above to this term (See 2.2). A first list of possible C4 fireworks sharing similar, but general, design features and “space x time” performance characteristics has been drawn up. By “space x time”, WG 2 experts mean a pyrotechnic effect or a sequence of pyrotechnic effects spreading progressively in the air during a given time.

Considering this list was exhibiting too many entries (45 distinct C4 fireworks, 14 C1-C2-C3 fireworks and 12 components), WG 2 experts have decided to simplify their approach of “generic types” after having taken notice that:

— the essential safety requirements of Directive 2007/23/EC will only necessitate to determine requirements on a limited number of design and performance characteristics, as far as C4 fireworks are used by persons with specialist knowledge allowing them to assure safety of the public and protection of the environment by application of well mastered rules and instructions resulting from their experience and training;

— as a consequence of this limited number of design and performance characteristics, some possible generic types can be generalized to encompass other possible generic types which can then be considered as particular cases of these “generalised” generic types. For example, a “shot tube” is a “roman candle” the sequence of which is limited to a single shot.

Doing this, WG 2 experts have determined 12 “generalised” firework products which will become the “generic types” on which will be placed design and performance requirements in the future harmonized standard(s) for C4 fireworks.

The other 34 remaining firework products will only be particular variants of these “generic types”, consequently falling under the same design and performance requirements. To keep things clear, WG 2 experts have chosen to call them “sub types”.

The original list of firework products has then been split into three distinct lists: list of generic types (See 4.3), list if subtypes (See 4.4) and list of components (See 4.5)

4.3 Generic types: list and definitions

The following 12 generic types have been selected:

— *Aerial Wheel*

— *Aqua Firework (or: aquatic firework, nautical firework)*

— *Combination*

— *Components*

— *Fountain*

— *Guided Firework*

— *Mine*

— *Report*

— *Rocket*

— *Roman Candle*

— *Shell*

— *Smoke / Fog Generator*

For corresponding definitions, comments and description of principal effects, see Annex A.

4.4 Other types of firework: list, definitions and links to generic types

The following 33 firework products have been considered as subtypes of the previous generic types:

Aqua Shell (or Aquatic Shell, Nautical Shell), Bag Mine (or Mortar Mine), Battery, Bengal Flame, Cake, Daylight Shell, Flash Banger, Flight Rocket, Gerbs, Ground Maroon, Lance, Lancework, Maroon, Maroon Shell, Multibreak Shell, Parachute Rocket, Parachute Shell, Peanut Shell, Portfire, Preloaded mortar (or Shell in mortar), Repeater Shell, Saxon, Set Piece, Shell of shells, Shot tube, Signal Rocket, Strobe, Tourbillion, Underwater Firework (or Sub aquatic firework), Volcano, Waterfall, Wheel.

For corresponding definitions, links to generic types and description of principal effects, see Annex B.

4.5 Components: list and definitions

The following list is limited to pyrotechnic components which can be placed on the market and exchanged between industrialists throughout Europe. These components are not only intended for use by fireworks manufacturers, but can also be used – under given conditions – by persons with specialist knowledge which will be trained accordingly.

Bombette, Butterfly, Cracker, Fuse (including Delay Fuse), Motor, Serpent, Spinner, Star (including Comet, Crossette, Flash Pellet, Hummer and Whistle).

This list of components is not exhaustive.

For corresponding definitions, comments and description of principal effects, see Annex C.

For the specific case of “stars”, see Annex D.

4.6 Specific uses of articles

Special use of C1, C2 and C3 products:

C1, C2 and C3 articles may be used by persons with specialist knowledge in a different way that required and type-certified as “customer” fireworks. This possibility must be introduced as acceptable in a C4 standard, provided that the persons with specialist knowledge evaluate the new safety distances corresponding to their special use of the articles on the basis of performance characteristics to be supplied with the articles (label and/or “data sheet”).

Dual use:

Some products may have a dual use: outdoor fireworks and indoor / theatrical pyrotechnic articles, without any modifications or adaptations. In that case, it seems logical to WG 2 experts that they must be type-certified under the category corresponding to their most restricting use. For example, a T2 article may be generally used in a fireworks display as a C4 product without being C4 type-certified, but the contrary may not be possible.

4.7 Recommendations for integration of new items

Lists of generic types and subtypes given in Annexes A and B may not be fully exhaustive and correspond to the present knowledge of WG 2 experts. New items may be identified during the development phase or after the publication of C4 fireworks harmonized standard(s).

During the development phase:

Every new item will be compared by WG 2 experts to existing generic types and subtypes in the lists given in Annex A and Annex B. If it can be considered as a variant of an existing generic type or subtype, it will not be necessary to add it to these lists. In the opposite case and if it is not specific to one manufacturer or importer, the new item will lead either to the creation of a new subtype linked to an existing generic type or to the creation of a new generic type.

If the new item is specific to one manufacturer or importer, it will not be encompassed by the C4 fireworks harmonized standard(s) in development and its CE type-certification process will be determined by the Notified Body of one Member State.

After publication of harmonised standards:

If the new item is specific to one manufacturer or importer, its CE type-certification process will be determined by the Notified Body of one Member State.

Alternatively, the first Notified Body which will identify the new item will compare it to the lists of generic types and subtypes which will be part of C4 fireworks harmonized standard(s). If it can be considered as a variant of an existing generic type or subtype, no update of the harmonized standard(s) will be needed. If not, the Notified Body will propose to the Notified Bodies of the other Member States to ask CEN for a modification of the harmonized standards. Then the normal CEN process for updating standards will apply.

5 Parameters to be taken in consideration to meet the essential safety requirements

5.1 General aspects

Important parameters which rule the behaviour and performance of each type of firework in normal use must be identified and analyzed first. This approach does not need to be fully exhaustive, but limited to parameters which are influent from the strict point of view of compliance with the essential safety requirements of Directive 2007/23/EC. Therefore their precise liaison to each of these requirements must be determined.

Lastly these parameters will be split in two categories: “prescriptive” parameters – that is parameters submitted to requirements (limits, restrictions, tolerances...) and checked in the “type” examination or quality acceptance process – and “informational” parameters – that is parameters which will be given in parallel as information (e.g. to users). Examples of these “informational” parameters are calibres of mortars to be used, direction of ejection of projectiles, temperature limits, etc.

Following experience of WG 1 and what is more because C4 fireworks harmonized standard(s) deal with products to be used by “persons with specialist knowledge”, WG 2 experts have concluded that:

— Requirements must be limited to those which are strictly necessary and sufficient to ensure compliance with the essential safety requirements of Directive 2007/23/EC.

— The set of construction and performance requirements to be considered as relevant to these essential safety requirements will be minimized, taking in account they must be considered from the point of view of a person with specialized knowledge. A first approach shows the number of generic types (See 4.3) and involved parameters (See 5.2) will be low.

— Consequently it is not necessary to create a standard for each type of C4 fireworks, and then these requirements can be included in a **sole common standard which will encompass all generic types of C4 fireworks.**

— Some of these requirements will be common to every C4 Fireworks type; then they will be gathered in a common clause of the future standard.

— Specific requirements for a given type of C4 Fireworks will be written on a type per type basis in a “Specific requirements” clause.

— No requirements coming from other Directives or regulations (REACH for instance) will be part of the future WG 2 standard.

— Lists of generic types, sub types, components and corresponding definitions (See § 4.3, 4.4 and 4.5) will be included in this future WG 2 standard.

— Definitions of technical terms (cf. 4.7) will be added to this “Terminology” clause. Entries will be limited to terms which are essential to the good understanding of the requirements.

5.2 Recommended construction and performance parameters

List of forbidden substances:

From the point of view of Directive 2007/23/EC, “forbidden substances” are the only ones which may be harmful for the health of fireworks firers and attendance or cause environmental damages. Substances which may be dangerous during the manufacturing process have not to be taken in account.

A list of forbidden substances will be determined for C4 fireworks and, because they are intended for use by “persons with specialist knowledge”, it can be different from and less restrictive than the list which has been drawn up by WG1 for “consumer fireworks”. This list must not include substances which have no concern with fireworks.

REACH Directive will apply to chemical substances used in fireworks, but it is not necessary to refer to it in a C4 fireworks standard.

Other restrictive regulations might apply.

Use of blasting agents and military explosives:

In its Annex I § (4) (a) and (b), Directive 2007/23/EC of 23 May 2007 “on the placing on the market of pyrotechnic articles” states pyrotechnic articles must contain neither commercial blasting agents, except for black powder or flash composition, nor military explosives.

As some T1 and T2, P1 and P2 articles, some C4 Fireworks already contain small amounts of explosives (e.g. nitrocellulose with high nitrogen content, single base or double base propellants one component of which is nitroglycerine) and must not be excluded from the European market as far as they comply with all the other essential safety requirements, except this § (4) (a) (b) of Directive 2007/23/EC / Annex I. Hence they must be included within the scope of preparing Standards for C4 Fireworks and to prepare suitable guidance.

CEN/TC 212 will prepare a specific resolution on that topic.

Limitations in mass and calibre:

These limitations exist in several European countries (e.g. Italy and France), but not in all of them (e.g. Germany, Spain and United Kingdom) and not always for safety in use.

If limitations have to be fixed in the harmonized standard, they cannot result from a compilation of all the national applicable laws, but only from the necessity of complying with the essential safety requirements.

Local limitations applying to the manufacturing process or to transportation of dangerous goods are not relevant to Directive 2007/23/EC and must be ignored in the harmonized standard(s).

Recommended construction and performance parameters:

The table in Annex F lists construction and performance parameters which will preferably be taken in account to determine compliance of C4 Fireworks with the essential safety requirements of Directive 2007/23/EC. This list aims at giving initial guidelines for the development of the future C4 Fireworks harmonised standard; it will be updated if necessary to meet the best compromise between the needs of all Member States within CEN/TC 212.

6 Identification of test methods

6.1 General aspects

Test methods are required to prove compliance with the Essential Safety Requirements of Directive 2007/23/EC. They are intended to check and/or measure construction and performance parameters which will be eventually selected as relevant to one or more of the Essential Safety Requirements and submitted to requirements in the future C4 Fireworks harmonized standard. These test methods are meant for persons and institutions performing the tests and for the Notified Bodies.

It must be reminded of the following aspects of type-examination and batch testing:

— Tests will not always be performed by Notified Bodies, but by Authorized / Certified Laboratories, some of them possibly part of a manufacturer’s organization (cf. Modules in Annex II of Directive 2007/23/EC).

— A construction or performance parameter can be measured in various ways. Alternative test methods – if approved – can be used. Then it is important is to determine the minimum required to compare results obtained from different test methods (e.g. accuracy, vibration and temperature levels).

— All laboratories involved to apply these test methods shall be agreed by a Notified Body, plus certified by an independent Certification Body, specialized in test protocols, calibration... and corresponding EN or ISO standards.

Considering the above aspects, WG2 experts recommend:

— The harmonized standard will draw up the list of tests to be performed and corresponding requirements for the tests methods to be used.

— Approved test methods must be described in this standard.

— The test descriptions must enable all persons involved to perform the test in a safe and reproducible manner.

— Only Notified Bodies are authorised to use alternative test methods or to give derogation to a certified laboratory to use alternative test methods.

— Only Notifies Bodies are authorised – after agreement of all the other Notified Bodies – to ask CEN/TC 212 to add a new test method in C4 firework harmonized standard.

For a given type of C4 fireworks, there must be a link between the “type tests” and the “batch tests”. Indeed the “type tests” will prove that the design and performances of the product comply with the essential safety requirements of Directive 2007/23/EC. The “data sheet” of the product, which gives the corresponding performance and safety characteristics to be used by persons with specialist knowledge which will use the product, will be part of the type-examination process. The “batch tests” will be the manufacturer’s proof that the manufactured products comply with the characteristics given in this “data sheet” of the product. Then, these “batch tests” will be limited to perform some “type tests” – but not all of them – which will be considered as necessary and sufficient to prove compliance with characteristics announced by the manufacturer in its “data sheet”.

6.2 Links between ESR and test methods

In the future C4 Fireworks harmonized standard, the list of recommended test methods will be introduced by a table which will summarize the links between “Essential Safety Requirements”, “Construction or performance requirements”, “Corresponding parameters to be measured” and “Test methods”.

A first draft of such a table have been reviewed by WG 2 experts at their meetings on November 12th 2008 in Paris and February 3rd 2009 in Milan. No final decision has been taken about the selection of tests to be applied to C4 fireworks in type and/or batch testing. This will be done by WG2 experts during the development phase of C4 fireworks harmonized standard(s). In that perspective, Document CEN/TC 212 WG 2 N049 (See ref. [4]) will be taken in account as a starting document.

7 Labelling

Articles 12.2 and 12.3 of Directive 2007/23/EC states:

2. The labelling of pyrotechnic articles shall include as a minimum the name and address of the manufacturer or, where the manufacturer is not established in the Community, the name of the manufacturer and the name and address of the importer, the name and type of the article, the minimum age limits as indicated in Article 7(1) and (2), the relevant category and instructions for use, the year of production for category 3 and 4 fireworks and, where appropriate, a minimum safety distance. The labelling shall include the net equivalent quantity (NEQ) of active explosive material.

3. In addition, fireworks shall display the following minimum information: (...)

Category 4: ‘for use only by persons with specialist knowledge’ and minimum safety distance(s).

WG 2 experts have considered some terms in these articles must be interpreted because C4 fireworks are only intended for use by persons with specialist knowledge:

— Minimum safety distance

— Name and type of the article

7.1 Minimum Safety Distance

Requirement of Article 12.3 of Directive 2007/23/EC on “minimum safety distance” aims at providing users with basic information to assure protection of the public against every hazard resulting from normal use of pyrotechnic articles.

In the case of articles – such as e.g. C1-C2-C3 Fireworks – which are designed to be used by standard consumers who have no specialist knowledge in pyrotechnics, “minimum safety distances” should not be determined by users. Then following user’s instructions is mandatory. “Consumer articles” shall only be used according to these instructions and “minimum safety distances” are predetermined as fixed values by manufacturers or importers to cover every situation these non specialists might encounter while they strictly follow user’s instructions. Indeed, these “minimum safety distances” include a safety margin to take in account statistical dispersion of the performance characteristics of the articles and weather conditions in real use.

In the case of articles – e.g. C4 Fireworks – which are designed to be used by persons with specialist knowledge, “minimum safety distances” ought to be understood in a different manner. These articles may be used in non standard conditions – “non standard” meaning different from conditions determined for the type-examination performance tests. For example, according to the artistic spreading of visual effects which is needed in fireworks displays, some articles may not be fired vertically and other may be shot behind walls or natural slopes which may create an efficient protection for the attendance.

WG 2 experts have pointed out that:

— Safety distances may vary according to the firing conditions: trajectory drift caused by the wind, safety protections preventing from hazardous effects, non vertical firing, etc.

— “Safety data”, such as standard performance distance, would then be more advisable than safety distances;

— Safety data displayed on the product label must correspond to “standard conditions” (e.g. vertical firing and wind speed less than xx m/s) and commonly understandable by every person with specialist knowledge;

— Persons with specialist knowledge will evaluate, on the basis of appropriate data displayed on the label, the real safety distances corresponding to the real firing conditions.

As it is not possible to change the term “minimum safety distance” in Directive 2007/23/EC and because Directive 2007/23/EC says “a (and not the) minimum safety distance”, WG 2 experts have decided to submit to EC their interpretation of “minimum safety distance” on account of the fact C4 Fireworks are designed for use by persons with specialist knowledge.

Firstly, they have pointed out fireworks shooting activities lead to different situations within European Union:

— Some countries (e.g. France and UK) are confronted to peak periods of one or two days during which a lot of C4 fireworks displays are fired. For instance, 10 000 displays are fired on July 14th in France and around November 5th in UK. A large number of firers are needed and French WG 2 experts think one cannot assure the majority of these firers have a sufficient knowledge to calculate safety distances according to the firing conditions. On the contrary, British WG 2 experts think this difficulty can be solved by requiring firers should periodically prove their specialist knowledge, for example, by maintaining a log book and recommending a minimum of N shows per annum to maintain their status. This is presently done in UK as well as in France, but France and UK have not the same confidence in that procedure.

This explains why France prefers – as in present French regulations – C4 fireworks labels display a "minimum safety distance" determined on the basis of tests performed in standard conditions (e.g. vertical tests, wind speed below X m/s...). From this standard "minimum safety distance", charts can be used to determine new "safety distances" as a function of wind speed, firing angle, for example.

On the contrary, this also explains why UK considers reasonable every firer could easily have specialist knowledge to calculate, according to real conditions of firing, minimum safety distances from standard performance characteristics which would be displayed on the labels of every firework.

— In other countries (e.g. Italy and Spain), only firers who have a contractual link with manufacturers are authorised to use C4 fireworks and fire displays. They shoot several displays per year and their knowledge – mainly based on experience – is undoubted.

— In other countries (e.g. Denmark), true "professional" shows are much less numerous and the need of trained firers is limited to a few hundreds. In that case, it is easier to assure those firers will have the necessary knowledge to calculate safety distances from performance data. This can be done with the help of charts or appropriate software.

WG 2 experts have tried to find a compromise which would be acceptable by all Members States. This is the only way to assure (1) no Member State will impose its own national view of "minimum safety distances" as a pan-European requirement and (2) no Member State will be obliged to withdraw usages which have proved their efficiency for years to the satisfaction of the public and the different Administrations of the Member States. Adaptation of existing usages and/or regulations remain possible as far as it does not lead to question strongly training and practice of persons with specialist knowledge who already have a long and successful experience of fireworks firing and related safety.

After discussion they have adopted the following interpretation of the "minimum safety distance(s)" in Article 12.3 of Directive 2007/23/EC:

— Common information to be displayed on labels throughout EU:

  — "Article to be used in accordance with written instructions and national regulations."

  — "Minimum safety distances to be determined by users using supplied product data."

  — Product data: to be decided [1)].

— In the written instructions, it will be stated:

  "Minimum Safety Distance: to be determined by user (person with specialist knowledge) with best available safety measures according to effect, performance characteristics, specific parameters and surrounding conditions."

This proposal fixes the minimum which will be required throughout the European Union to comply with the requirement on "minimum safety distances" of Directive 2007/23/EC. It does not exclude the possibility of adding supplementary information on the label of C4 fireworks on a national basis (e.g. minimum safety distance in standard conditions of firing, other data and/or text required by national regulations).

Resolution 35/2008 has been approved by vote of CEN/TC 212.

1) by WG 2 during the development phase and in agreement with WG 3 and WG 5.

7.2 Name and Type

Article 12.2 states the labelling of pyrotechnic articles shall include the name and type of the article. Here "type" is used in the expression "name and type of the article". Its meaning is not fully clear. It can be interpreted in different understandings as follows: "name" may be a commercial designation and "type" a technical one – or – "name" may be a general technical designation and "type" a more detailed technical one or vice versa.

WG 2 experts express their preference for a technical meaning of "name" and "type".

For a specific pyrotechnic article, the name and type displayed on the label should describe precisely enough the product to prevent from any doubts regarding its main characteristics and shall contain elements not to let any confusions occur with similar products (from the same family) or with non similar products.

This is now the case of fireworks labels in a large majority of European Countries, but differences exist and harmonization is necessary.

WG2 experts propose the following interpretation of "name and type" in Article 12.2 of Directive 2007/23/EC:

— "Name" and "Type" shall have a technical meaning. If a commercial name is also used in addition on the label, it must be clearly identified with the words "commercial name" or "trade name", to distinguish it from the technical "name".

— Labels to be provided directly on the article (or on the smallest piece of packaging if the article does not provide sufficient space for the labelling requirements) will include the following information:

  — The "generic type" or "subtype" to which the article belongs (See paragraph 4.3), plus a concise designation of the field of use whenever it is necessary to assure a safe and correct use of the article.

    EXAMPLE "Firework Shell".

  — The name which has been given by the manufacturer or the importer to assure the user will unambiguously differentiate the article from another one. This name will be the same as the one given to the type submitted to type-examination (and to the corresponding "individual item"). It will preferably combine the designation of the group of types submitted together as a family of products (See Whereas (18) of Directive 2007/23/EC) to type-examination testing and registration number attribution, and complementary information for the user (e.g. colour, glittering effect, rainbow effect, crossette effect, etc.)

    This name will be made of the calibre (whenever appropriate), the "subtype" name (See paragraph 4.4) or equivalent and complementary terms which give users information on the specific artistic effect the firework will exhibit in real use. It may be a full description if it can be written in very few words (e.g. "blue ring") or, on the contrary, a specific "descriptive" name (e.g. "rainbow multicolour" or "kamuro") – all this does is to subdivide the "subtype" by differentiating artistic effects.

    EXAMPLE "150 mm Colour Shell – Rainbow Multicolour" (which differs from another individual item e.g. a "100 mm Maroon Shell" or a "75 mm Crossette Shell).

— These pieces of information will be considered as the "name and type" which are required by Directive 2007/23/EC.

  What must be considered is that these three pieces of information are necessary. It must be visibly displayed the article is a firework shell and what kind of shell it is (calibre, colour, effect...) to assure a good use of the article by the firers.

7.3 Registration Number

Article 12.2 does not require the registration number attributed to the firework article to be displayed on the label. But it may be required by some Member States to facilitate their market surveillance for all fireworks articles to be shot on their national territory.

WG 2 members propose the attribution of a unique registration number to the **whole family of products submitted together to type-examination** according to Whereas (18) of Directive 2007/23. No specific registration number will be attributed to each individual item within such a family. Then "type of pyrotechnic article" in Article 18 of Directive 2007/23/EC will mean the designation of each family of products, not each individual item within such a family. This proposal is submitted to the approval of the Notified Bodies of all Member States, at their next meeting on May 12-13 2009.

In every case, Notified Bodies must pay a special attention to the content of every family submitted to type-examination by manufacturers or importers. Selection of individual items within a given family must be clearly based on defendable technical arguments which clearly prove their similarity of design, function or behaviour.

8 Harmonized Standard

8.1 Existing documents

When they are not sold in mortars, shells will never be considered as consumer fireworks. Then, WG 1 has transferred to WG 2 the draft of a standard which has been historically prepared by CEN TC 212 before adoption of Directive 2007/23/EC by the European Council. This document – Draft prEN 14035-30 "Shells" – has been developed as "consumer oriented" and, from WG 2 experts' point of view, is too limitative and constraining for products to be used by "persons with specialist knowledge.

Another starting document is a proposal made by German experts under reference "CEN TC 212 N 689 – N681 Request for starting documents, German Answer – Fireworks – Part 6 – Fireworks Category 4" in September 2007. An updated version, modified in June 2008, has been circulated to WG 2 experts (See reference [6]).

Some elements developed in these documents can be agreed by a large majority of WG 2 experts and used in the final C4 fireworks harmonized standard. This will be discussed within WG 2 during the development phase of this standard.

8.2 Structure and Table of Contents

As already stated in 5.1, WG 2 experts propose to develop a sole common standard for all generic types of C4 fireworks. In order to make its future use and possible updates of this standard easier, this standard will be split in four parts corresponding to main themes to be treated in the standard, as WG 1 has done for "consumer fireworks".

Possible "Table of Contents" for the WG2 "C4 Fireworks Harmonized Standard":

Part 1: Terminology

1. Scope
2. References
3. Types of C4 fireworks
4. Technical terms

Part 2: Requirements

1. Scope
2. References
3. Construction requirements
   - 3.1. General
   - 3.2. Specific (per generic type[2)])
4. Performance requirements
   - 4.1. General
   - 4.2. Specific (per generic type[2)])
   - 4.3. Minimum safety distance
   - 4.4. Guidelines for determination of safety distances in real use
5. Other features related to essential safety requirements

Part 3: Test Methods

1. Scope
2. References
3. List of recommended test methods
4. Description of recommended test methods
5. Accuracy and statistical approach[3)]
6. Approval of alternative test methods

Part 4: Labelling and user's documentation

1. Scope
2. References
3. General
4. Specific (per generic type[2)])
5. Safety Data Sheets[4)]

Requirements for "electric igniters" will not be part of this standard (See WG5 "Other Pyrotechnic Articles").

WG 2 experts recommend distinguishing clearly "requirements" and "guidelines" in the future C4 Fireworks harmonized standard. They also invite to clearly show the link between the safety distances and the essential safety requirements they aim to comply with (See 7.1).

2) If necessary.

3) Type certification tests and batch tests.

4) Hazard description and related data.

8.3 Criteria used for selecting standards to be developed

As already stated in 5.1, following experience of WG 1 and because C4 fireworks harmonized standard(s) deal with products to be used by "persons with specialist knowledge", WG 2 experts have concluded there are no technical reasons to create a standard for each type of C4 fireworks. All types of fireworks will be submitted to the same storage, handling, transport and firing conditions and public safety will be approached in the same way whatever the type of firework (e.g. safety distances). Indeed construction and performance parameters will distinguish the selected generic types, but they will be checked and measured with the same or similar test methods. Specific requirements will be very few, when compared to common ones.

Then, for simplicity and consistency reasons, there is a real interest in developing a unique standard applicable to every C4 firework type. This is the choice all WG 2 experts have agreed with.

8.4 List and Titles of Harmonized Standards to be developed

The title of the harmonized standard which will be developed for C4 Fireworks will be:

Pyrotechnic articles — Fireworks, Category 4

Pyrotechnische Gegenstände — Feuerwerkskörper, Kategorie 4

Articles pyrotechniques — Artifices de divertissement, Catégorie 4

and its four parts will be:

Part 1: Terminology	*Teil 1: Begriffe*	*Partie 1 : Terminologie*
Part 2: Requirements	*Teil 2: Anforderungen*	*Partie 2 : Exigences*
Part 3: Test Methods	*Teil 3: Prüfverfahren*	*Partie 3 : Méthodes d'essais*
Part 4: Labelling and user's documentation	*Teil 4: Kennzeichnung und Benutzerinformationmaterial*	*Partie 4: Etiquetage et documentation utilisateur*

8.5 Justification of the list of harmonized standards

In addition to the arguments given in paragraph 8.3 here above, the choice of developing a sole harmonized standard for C4 fireworks results from:

— the limited number of generic types (See 4.3);

— the limited number of construction and performance parameters which are considered as strictly necessary and sufficient to check compliance of firework articles with the Essential Safety Requirements of Directive 2007/23/EC (See 5.2);

— the fact that, because C4 fireworks are designed for use by persons with specialist knowledge, mean that corresponding standards can be less restrictive as for customer fireworks;

— then the limited number of corresponding requirements resulting from the ESR.

9 Projects to be initiated within WG 2 (List and Mandates)

Following the splitting of the C4 fireworks harmonized standard in four parts, WG 2 experts propose to initiate four projects with the following mandates:

PROJECT Nr 1:

Title: Development of Part 1 "Terminology" of the harmonised standard for C4 fireworks.

Mandate:

Fix definitions of the main technical terms which will be used in the harmonised standard for "C4 Fireworks".

This project will limit the number of terms and corresponding definitions to what is strictly necessary to assure a correct understanding of the harmonised standard for "C4 Fireworks".

Because the same terms may be used by other Working Groups, this project will keep contact with WG 1, WG 3, WG 4 and WG 5.

Whenever a term is already defined by an existing CEN or ISO standard (e.g. Quality, Health and Safety, Statistics), this standardized definition will be preferably used.

This project will act as an advisor for the other WG 2 projects as far as terminology is concerned.

PROJECT Nr 2:

Title: Development of Part 2 "Requirements" of the harmonised standard for C4 fireworks.

Mandate:

Determine and fix construction and performance requirements for "C4 Fireworks" to comply with ESR of Directive 2007/23/EC.

This project will start from Document CEN/TC 212 WG 2 N049 Rev 1 which gives a preliminary draft of the necessary links between "Essential Safety Requirements", "Construction or performance requirements", "Corresponding parameters to be measured" and "Test methods".

It will keep this document updated until the harmonized standard is completed.

This project will keep close and frequent links with Project Nr 3 "Test Methods" and Project Nr 4 "Labelling and user's documentation".

The Project Leader shall keep in mind WG 2 standard addresses persons with specialist knowledge. Consequently, compliance with the ESR of Directive 2007/23/EC does not need the same level of requirements as for consumer fireworks. Construction and performance requirements shall be simpler and limited to what is strictly necessary.

PROJECT Nr 3:

Title: Development of Part 3 "Test Methods" of the harmonised standard for C4 fireworks.

Mandate:

Select, describe and fix preferred test methods to check compliance of the construction and performance characteristics of "C4 Fireworks" with the ESR of Directive 2007/23/EC.

Criteria which will be used to select these test methods will take into account technical efficiency, easiness, reliability and economical aspects.

This project will also fix criteria for alternative test methods, to take in account the foreseeable evolution of measurement techniques or the possible development of more cost-effective test methods.

This project will keep close and frequent links with Project Nr 2 "Requirements".

PROJECT Nr 4:

Title: Development of Part 4 "Labelling and user's documentation" of the harmonized standard for C4 fireworks.

Mandate:

Determine and fix labelling requirements for "C4 Fireworks" in compliance with the Directive 2007/23/EC.

This will include the determination of performance data to be displayed on the fireworks label according to resolution dealing with "safety distances" which has been approved by CEN/TC 212.

This project will keep close and frequent links with Project Nr 2 "Requirements".

10 Future Work Program (Objectives, Tasks, Time targets)

The following work plan has been determined:

Description of action	Deadline
Circulation of New Work Item Proposal	June 2009
Preparation of the working draft that will be send to the CEN/TC 212 members for internal enquiry ***(stage: 20.60).*** The project leader will prepare and send the working draft to the secretary of CEBN/TC 212 / WG 2 who will send it to secretary of CEN/TC 212.	March 2010
Circulation of the working draft to the members of CEN/TC 212. The secretary will send this working draft for comments to the members of CEN/TC 212 (***stage 20.60).***	March 2010
Collecting the comments of the CEN/TC 212 members during the internal enquiry and send these comments to the members of CEN/TC 212 and the secretary of WG 2.	April 2010
Sending the comments of the internal enquiry to the members of the WG 2	April 2010

Description of action	Deadline
Discuss the comments of the internal enquiry in the WG 2 meetings	May 2010, September 2010, November 2010
Adapt the text of the working draft and prepare the document that can be sent to the members of CEN/TC 212 for approval for CEN enquiry. This will consist of the following steps:	
Prepare new documents for the meetings of WG 2 in May 2010, September 2010 and November 2010 by processing the comments and if applicable, additional information. Send these documents to the secretary of WG 2	3 weeks before the WG meeting
Prepare the draft version that will be send to the members of CEN/TC 212 for approval for sending it for CEN enquiry. The project leader will prepare and send the working draft to the secretary of the WG 2 who will send it to secretary of the CEN / TC 212	November 2010
Prepare draft resolution for sending the draft version for CEN enquiry. Send this draft resolution to the members of CEN/TC 212	December 2010
Collect the votes and send the Result of voting to the members of CEN/TC 212	January 2011
Send the draft version to CEN for CEN enquiry ***(stage 30.99)***	January 2011
CEN will send the prEN version (draft version) to the members of CEN/TC 212 for comments	April 2011
The results of the enquiry will be send to the members of CEN/TC 212 and CEN/TC 212 WG 2	September 2011
The comments will be discussed by WG 2	September 2011 and November 2011
A final draft version will be prepared and send to the members of CEN/TC 212 for approval to launch for Formal Vote The project leader will prepare and send the working draft to the secretary of WG 2 who will send it to secretary of the CEN / TC 212	November 2011
Approval of CEN/TC 212 to launch the final draft version for Formal Vote. Document will be send to CEN CMC for	December 2011

Description of action	Deadline
Formal Vote . ***(stage 45.99)***	
CEN CMC will send the Formal Vote version to the members of CEN/TC 212 for Formal Vote (final approval)	March 2012
CEN will send the results of the Formal Vote to the members of CEN/TC 212	May 2012
Approval of the (editorial) comments by the secretary of CEN/TC 212	June 2012
Publication of the standard	August 2012
Harmonization of the standard	October 2012

The above dates are indicative and will be confirmed when the work items will be registered in CEN Work Program.

Annex A
(informative)

List of Generic Types and definitions

Generic Type	Definition	Comments	Principal effects
Aerial Wheel	Tubes containing propellant charges and sparks-, flame- and/or noise-producing pyrotechnic compositions, the tubes being fixed to a supporting structure, designed to rotate and ascend into the air	Some of the tubes (if not all) are fixed in such a way that the device ascend, in an unsupported manner, into the air by the action of the devices.	Rotation and ascent, with emission of sparks and flames, producing a visual and/or aural effect in the air
Aqua Firework, aquatic firework, nautical firework	A firework designed to be floated on or near the surface of water by means of a buoyancy device or by itself and to function on or below water		Same effects as bengal flames, fountains, mines, shells etc.
Combination	Assembly including several elements, of one or more types, each corresponding to one of the types of firework listed in this table, with one or more points of ignition	The fireworks may be fused together in series or parallel, with or without delay fuses, to give their effects in a sequence or at the same time. This is not necessary made at the manufacturing level and can be achieved at the display's firing place.	As for the individual elements
Component	Article usually included in other fireworks and generally without lifting charge and which requires further preparation		See “List of Components”
Fountain	Case containing sparks- and/or flame-producing pyrotechnic composition and designed to be placed on the ground, or to be fixed in the ground, or to be fixed to a support, or to be held in the hand	The pyrotechnic composition may be pressed or not in the tube, with or without a choke or other constriction incorporated into the tube.	Emission of sparks and flames with aural effect other than report or without any aural effect.
Guided Firework (Line rocket)	An article containing pyrotechnic composition equipped to function along a rope or other guide and to produce a visual and/or aural effect	For example, linerockets can also be used to put fire to other fireworks, generally fixed on a frame located at a distance from the firing place, e.g. at the top of a steeple or a tower.	Emission of a visual and/or aural effect.

"to be continued"

Generic Type	Definition	Comments	Principal effects
Mine	Article which may include integral mortar, containing propellant charge and more than one pyrotechnic units, having as main effect the discharge of all the pyrotechnic units in a single ejection	Pyrotechnic units can be stars, bangers, butterflies, crackers, hummers, spinners / tourbillions, whistles, etc.	Ejection of all the pyrotechnic units in a single burst producing a widely dispersed visual and/or aural effect in the air.
Report	Article containing pyrotechnic composition designed to produce a bang		Report - may also include a coloured delay element
Rocket	Article containing pyrotechnic composition and/or pyrotechnic units, equipped with a launching motor and stick(s) or other means for stabilization of flight, and designed to be propelled into the air		Ascent, with or without additional visual and/or aural effects, and production of visual and/or aural effects in the air
Roman candle	Tube containing a single charge or alternate propellant charges, pyrotechnic units and transmitting fuses	The pyrotechnic units may be bombettes, comets, hummers, maroons, mini mines, stars, whistles, etc.	Ejection of the pyrotechnic units in succession, producing a series of visual and/or aural effects in the air
Shell	A device with or without propellant charge, with one or more delays before bursting, pyrotechnic unit(s) or loose pyrotechnic composition and usually designed to be projected and burst at a distance from a mortar	Pyrotechnic units can be stars, butterflies, crackers, hummers, spinners / tourbillions, whistles, etc. as well as report shells or other shells to produce multiple bursts simultaneously or sequentially.	As for the individual pyrotechnic units
Smoke / fog generator	Article containing smoke producing pyrotechnic composition or heat /gas generating composition to evaporate a substance or disperse hygroscopic particles and designed to function on the ground or fixed to a support	Casing of the article can be made of different materials.	Emission of white or coloured smoke / fog without any aural effect

Annex B
(informative)

List of Subtypes and definitions

Subtype	Definition	Link to Generic Type / Comments	Principal effects
Aqua Shell, Aquatic Shell, Nautical Shell	A spherical, cylindrical or other shell designed to be floated on water by means of a buoyancy device and which is fired from a mortar	**See "Shell"**	Same effects as shells
Bag Mine, Mortar Mine	Container with propellant charge and pyrotechnic units, designed to be placed in a mortar and to function as a mine	**See "Mine"** Container is typically a cloth or paper or plastic bag or cloth or paper cylinder.	Ejection of all the pyrotechnic units as a single event producing a dispersed visual and/or aural effect in the air
Battery	Assembly including several elements, each of the same type and corresponding to one of the types of firework listed in this table, with one or more points of ignition	**See "Combination"** The fireworks may be fused together in series or parallel, with or without delay fuses, to give their effects in a sequence or at the same time. This is not necessary made at the manufacturing level and can be achieved only at the display's firing place.	As for the individual elements
Bengal flame	Tube containing slow-burning pyrotechnic composition	**See "Fountain"** The pyrotechnic composition may be pressed or not. The tube has no choke and optionally burns away during functioning.	Emission of white or coloured flame
Cake	Assembly including several elements either containing the same type or several types each corresponding to one of the types of fireworks listed in this table, with one or multiple points of ignition and in which the initial fuse transmits fire from one tube to the next to fire the devices sequentially or in some other pattern	**See "Combination"** This article differs from a battery or combination by the fact it is fully integrated in a unique pre-programmed product, at the manufacturing level, then cannot be dissociated.	As for the individual elements

"to be continued"

Subtype	Definition	Link to Generic Type / Comments	Principal effects
Complex Shell	A shell composed of several discrete elements designed to be projected from a mortar with a single lifting charge and to function sequentially or simultaneously This subtype include the following articles: — Multibreak Shell: A shell with several discrete elements and with or without propellant charge, with delay fuse and bursting charge, pyrotechnic unit(s) or loose pyrotechnic composition and designed to be projected from a mortar and to function sequentially or simultaneously by the lighting or multiple internal delay fuses — Peanut Shell: Device with two or more spherical aerial shells in a common wrapper propelled by the same propellant charge with separate internal delay fuses — Repeater Shell: A device with several discrete elements and with or without propellant charge, with delay fuse and bursting charge, pyrotechnic unit(s) or loose pyrotechnic composition and designed to be projected from a mortar and to function sequentially by the lighting of the internal delay fuses by the functioning (burst) or the previous device — Shell of shells (spherical): Device with or without propellant charge, with delay fuse and bursting charge, containing report or other shells as subcomponents and designed to be projected from a mortar	**See "Shell"**	As for the individual elements
Daylight Shell	A spherical, cylindrical or other shell designed to be fired from a mortar and which contains sub-components which are visible in the daylight and /or components which produce an aural effect	**See "Shell"**	Emission of coloured light and/or smoke, and/or aural effect.
Flash banger	Non-metallic case containing metal-based pyrotechnic composition	**See "Report"** May be used as pyrotechnic units in shells.	Report and a flash of light

"to be continued"

Subtype	Definition	Link to Generic Type / Comments	Principal effects
Flight Rocket	A collection of rockets designed to be propelled into the air from a frame or cone and ignited by a single or multiple fuses	**See "Rocket" and "Combination"**	As for the individual rockets
Gerbs	Another name for fountains	**See "Fountain"**	
Ground maroon	A maroon without propellant charge and with or without delay fuse, designed to produce its report on the ground	**See "Report"**	Emission of a loud "bang" report.
Lance	Small diameter tube containing a compacted pyrotechnic composition, burning in a cigarette way, intended to deliver a thermal output to ignite manually other fireworks or a small white or coloured flame to be used in lanceworks	**See "Fountain"** The pyrotechnic composition may be pressed or simply consolidated. The tube has no choke and generally burns away during functioning.	Thermal output and/or visual effect.
Lancework	Assembly of lances on a frame, which are fused together to one or more points of ignition and are fired simultaneously or in sequence to produce bright, multi-coloured, dotted decorative pattern	**See "Combination"** Lanceworks may include fixed and mobile parts. In that case, tubes containing propellant charge are used to give motion to the mobile parts.	Emission of a stable visual effect during a relatively long duration.
Maroon	A firework containing pyrotechnic unit(s) or loose pyrotechnic composition and designed to produce a loud "bang" report as main effect	**See "Report"** Not to be confused with bangers, as their design is similar to shells or bombettes, which is not the case of bangers.	Emission of a loud "bang" report.
Maroon Shell	A maroon with or without propellant charge and with delay fuse, designed to be projected from a mortar and to produce its report in the sky	**See "Shell" and "Report"** This article is strictly shell-type designed.	Emission of a loud "bang" report.
Parachute Rocket	Article containing pyrotechnic composition and/or pyrotechnic units, which contains subcomponents some or all of which will descend on parachutes to the ground and equipped with a launching motor and stick(s) or other means for stabilization of flight, and designed to be propelled into the air	**See "Rocket"**	As for the individual subcomponents

"to be continued"

Subtype	Definition	Link to Generic Type / Comments	Principal effects
Parachute Shell	A spherical, cylindrical or other shell designed to be fired from a mortar and which contains sub-components some or all of which will descend on parachutes to the ground	**See "Shell"**	As for the individual pyrotechnic units contained in the shell.
Portfire	Hand-held device containing slow-burning pyrotechnic composition which will emit a small flame	**See "Fountain"** Can be considered as a hand-held lance, as it is the case when used to ignite manually other fireworks.	Thermal output and/or visual effect.
Preloaded mortar, shell in mortar	Assembly comprising a spherical, cylindrical or other member of the shell generic type, inside a mortar from which the shell is designed to be projected	**See "Shell"**	As for the individual shell.
Saxon	Tube intended to be attached to a support in its middle so that it can rotate and containing two pyrotechnic compacted charges which burn opposite and eject their combustion products sideways so that rotation is obtained	**See "Fountain"** The two pyrotechnic charges may be merged in a sole one. In that case, this charge burns at its two free ends.	Rotation, with emission of sparks and/or flames, with or without aural effect
Set Piece	Assembly including one or multiple elements which is designed not to rotate	**See "Combination"** Generally these elements belong to the family of lances, fountains and cascades, but can also include bangers, ground maroons and/or whistles.	As for the individual elements
Shot tube	Tube containing a single propellant charge and a pyrotechnic unit, with or without a bursting charge, with or without a transmitting fuse	**See "Roman Candle"** The pyrotechnic unit may be a bombette, a comet, a hummer, a shell (including maroon shells), a whistle, etc.	Ejection of the pyrotechnic unit, producing a visual and/or aural effect in the air
Signal rocket	Tube containing pyrotechnic composition and/or pyrotechnic units, equipped with a stick or other means for stabilization of flight, and designed to be propelled into the air to produce predominantly an aural effect	**See "Rocket"** Signal rockets may also be coloured.	Constant or variable pitch sound or report.

"to be continued"

Subtype	Definition	Link to Generic Type / Comments	Principal effects
Strobe	Tube containing an intermittently-burning pyrotechnic composition to produce long and rapid series of flashes at a constant frequency	**See "Fountain"** The pyrotechnic composition may be pressed or not. The tube has no choke and optionally burns away during functioning.	Emission of series of flashes
Tourbillion	Tube or tubes containing pyrotechnic composition, which burns in a way that gives a rotary motion to the tube	**See "Fountain"** This article differs from a spinner by its design: no aerofoils, lateral ejection of the combustion products. It is in most instances used as “component”.	Rotation, with emission of sparks and/or flames, with or without aural effect
Underwater fireworks / Sub aquatic fireworks	Fireworks designed to function under the water near the surface	**See “Aqua fireworks”** These articles have the capacity to float at a few centimetres under the surface of water.	Essentially similar to Bengal flames: emission of coloured flame.
Volcano	Conical device containing consolidated or pressed composition in which the effect (height or intensity) increases as the device burns	**See "Fountain"**	Emission of an increasing visual effect.
Waterfall	Case containing pressed or consolidated pyrotechnic composition producing sparks and flame and generally to consume the tube whilst burning	**See "Fountain"** Combustion products are ejected from the flame zone at low speed, then drop downwards as water in a waterfall.	Emission of a bright white or coloured "waterfall" visual effect.
Wheel	Assembly including a tube or tubes containing pyrotechnic composition and provided with a means of attaching it to a support so that it can rotate	**See "Fountain" and “Combination”** This article is designed to rotate about a fixed point in either a vertical or horizontal plane.	Rotation around a fixed point or axis and emission of sparks and flames, with or without aural effect(s)

Annex C
(informative)

List of Components and definitions

Component	Definition	Comments	Principal effects
Bombette	Pyrotechnic component of a firework (e.g. roman candle or a shot tube), similar to a shell, which may optionally leave a trace as it ascents, and which bursts at or near the apex of its flight		Ejection of pyrotechnic units (e.g. stars, crackers, whistles, etc.), producing a visual and/or aural effect in the air.
Butterfly	A firework component that comprises a tube which is burst spreading stars or shining effects from both ends		Ejection of stars producing a visual effect in the air.
Cracker	A firework component that burns with a crackling sound and may optionally emits a glittering or sparkling effect		Crackling, glitter and sparkles
Fuse	Small tube or cord containing a pressed or compacted pyrotechnic composition which burns in a cigarette way and delivers a thermal effect to ignite a pyrotechnic charge located downstream	By extension, this term also applies to other types of fire transmission devices like quickmatch or blackmatch or pressed fuse. This component includes the following object: <u>Delay Fuse:</u> A fuse incorporated into the initial fuse of a firework to introduce a delay between firing and functioning OR the internal fuse in a firework to enable sequential firing of elements of the firework (e.g. in a shell).	Fire transmission and thermal output Delay, with or without visual effect, e.g. to leave a trace when a shell or a comet ascents.
Motor	Articles consisting of a charge of explosive, generally a solid propellant either contained or not in a cylinder fitted with one or more nozzles		
Serpent	Preformed shape of pyrotechnic composition with or without a support	Articles belonging to categories 1, 2 or 3. Can be used in "professional" fireworks displays as a subcomponent of, for instance, a mine or cake.	Generation of expanded residue. Functions by tumbling in flight.

"to be continued"

Component	Definition	Comments	Principal effects
Spinner	Tube or tubes containing pyrotechnic composition, and with aerofoils attached		Rotation and ascent, with emission of sparks and/or flames, with or without aural effect
Star	A small element of compacted pyrotechnic composition, intended to burn in the air and give an individual visual effect. NOTE Stars may have various shapes: spherical, cylindrical, cubic, rectangular, etc. and be obtained through various industrial processes: pressed, rolled, extruded, etc. Their surface may be partially covered by combustion inhibitors or not. They can include a pyrotechnic charge to break them in fragments during their combustion to improve or modify the visual effect ("fragmentation" stars).	This component includes the following objects (non exhaustive list): <u>Flash pellet:</u> Pellet of intermittently-burning pyrotechnic composition (May be used as pyrotechnic units in shells, bombettes, mines). <u>Comet:</u> Pyrotechnic component of a firework (e.g. roman candle or a shot tube), containing a single solid pyrotechnic composition, which leaves a trace as it ascents up to the apex of its flight. <u>Crossette:</u> A tailed star which breaks abruptly into burning fragments which exhibit a cross shaped expansion with tail effects.	Emission of white or coloured flame, sparkling, glittering, crackling or tracing effect, etc. Multiple flashes of light Emission of a long "comet-type" visual effect in the air. Expansion of white and/or coloured burning fragments with tail effects.
Tubular charges	Tube containing compacted (pressed, cast, etc.) pyrotechnic composition, with or without nozzle, with or without report-producing pyrotechnic composition. NOTE The tube shall be non-metallic in the case this article is designed to function in the air.	This component includes the following objects (non exhaustive list): <u>Hummer:</u> Tube containing pyrotechnic composition designed to burn in such a way that the tube rotates in the air producing a constant or variable pitch "note" with or without a final report. (... / ...)	Rotation and Emission of a constant or variable pitch sound
			"to be continued"

Component	Definition	Comments	Principal effects
Tubular charges (Cont[d])		Tourbillion (when used as component): Tube or tubes containing pyrotechnic composition, which burns in a way that gives a rotary motion to the tube, with or without aural effect. Whistle: Tube containing pressed, whistling pyrotechnic composition, with or without sparks, with or without report-producing pyrotechnic composition.	Rotation, with emission of sparks and/or flames, with or without aural effect Whistling, with or without sparks and with or without a report
NOTES (1) The list of components is not exhaustive. (2) These components are not only intended for use by fireworks manufacturers, but also by persons with specialized knowledge which will be trained accordingly.			

Annex D
(informative)

Specific case of "stars"

WG2 experts have debated whether stars (rolled, pressed, cut, for example) should be considered within the scope of Directive 2007/23/CE and then taken in account by WG 2 in the development of the future C4 Fireworks harmonized standard. The following reasons have been considered:

— Stars are neither substances, nor powdered or loose compositions, but **compact objects** as they result from specific manufacturing processes – consisting in pressing or compacting compositions (by press machinery, hand press, extrusion, rolling or other manufacturing process) – to produce objects with different shapes and sizes which are used to build more complicated fireworks and give them their final visual and/or aural effect. So **stars can be considered as elementary fireworks**.

— Stars are nowadays placed on the fireworks market by manufacturers in some European countries like Spain, Portugal, and Italy. They are commonly exchanged between fireworks manufacturers which may located in different countries within EU. They have no other use in the explosives industry, as they are only **intended to be part of a more elaborated firework**, then generating pyrotechnic effects and not explosions. For this reason, it has sense to consider stars within the scope of Directive 2007/23/EC and not of Directive 93/15/EEC.

— Furthermore, stars are available **exclusively for use by persons with specialized knowledge**, and so they shall be included within the scope of WG 2, which means stars are C4 fireworks.

— Stars belong to **compatibility group G**, as the majority of “pyrotechnic articles”, as far as they are “pyrotechnic substances, or articles containing a pyrotechnic substance, or articles containing both an explosive substance and an illuminating, incendiary, tear- or smoke-producing substance (…).” (See ADR – Part 2 - § 2.2.1.1.6)

— There are some requirements of Directive 2007/23/EC which seem difficult to be fulfilled by stars, as well as by other intermediate or elementary fireworks, for example Art.12.3.3 “fireworks shall display following minimum information (in the labelling): Cat. 4 (…) minimum safety distance(s)”. As safety distances depend upon the final firework type and its performances, it is impossible to state this kind of information for intermediate or elementary fireworks. Thus this kind of products should be excluded from the fulfilment of the corresponding ESR that makes no sense for them. This might be considered as complying with Article 12.2 which only asks for minimum safety distances “where appropriate”. In the specific case of stars, they are not appropriate: stars will never be used outside of more elaborated fireworks.

— There is no reason why “flash pellets” are “fireworks” and stars would not also be “fireworks” or “pyrotechnic articles”.

To conclude, WG 2 experts propose to consider stars as pyrotechnic articles. Because they can also be used in other pyrotechnic articles (e.g. signals, illuminating devices), stars will be included in a WG 5 harmonized standard and the existence of this standard will make easier conformity assessment of these articles with Directive 2007/23/EC.

NOTE “Fuses” and “Delay fuses” are also used in other applications than fireworks. These components are relevant from a standard to be developed by WG 5 “Other pyrotechnic articles” (See 3.3).

Annex E
(informative)

List of Technical Terms

Term	Definition	Comments
Acceptance Quality Level (AQL)	Quality level that is the worst tolerable process average when a continuing series of lots is submitted for acceptance sampling [ISO 2859-1:1999, including Technical Corrigendum 1:2001]	
All-fire current	The minimum current (expressed in amps DC) needed to ensure that all igniters in a circuit are fired within a given time frame	All-fire current is a characteristic given in the data sheet of every igniter. It is generally determined as a direct current characteristic and associated with a probability level (generally 99,9% @ 95% confidence level) within a specified time frame (e.g. 50 ms).
Ancillary equipment	Any device which does not form part of a firework but which is supplied with the firework and is required in order that the firework may function correctly when used in accordance with the instructions	
Ascent time	The flight time for an aerial device (e.g. Shell or Rocket) from launch to functioning	Whereas ascent time is easy to determine for a single-break firework, it must be more precisely defined for a multi-break firework (e.g. a shell of shells). See "burst time".
Audience distance	The minimum distance from the firing point of a firework and the audience	
Batch test	Test performed on a sample of products taken at random from a production batch to check compliance with a given standard	Batch testing needs all products in the production batch comply with the characteristics the standard requires to assure homogeneity of the whole batch. It aims at proving all products which are placed on the market are in conformity with the type which is described in the EC type-examination certificate and have been successfully submitted to type tests determined by the standard.
Black powder	Intimate mixture of charcoal and sodium nitrate or potassium nitrate with or without sulphur	
Blind	Shell failure mode without burst	
Burst time	The time from launch of a firework until it bursts	Synonymous with "ascent time" in the case of a single-break firework. A multi-break firework may have a sole ascent time (corresponding to the first functioning) and several burst times (corresponding to the successive bursts).

"to be continued"

Term	Definition	Comments
Burst charge / Bursting Charge	Pyrotechnic composition which will burn to evolve gas which, in turn, is intended to burst open the firework case, in order to expel one or more pyrotechnic units, and which can also transmit ignition	
CAD Number	The number allocated by the National Competent Authority	
Calibre	The external diameter of a firework designed to be fired from a mortar tube (e.g. shell) or the internal diameter of a tube which contains pre-assembled items (e.g. a Roman candle)	The internal diameter of the mortar tube must be close to the external diameter of the firework, enabling the existence of a peripheral gap which must be a compromise between the necessity of a free motion of the firework in the tube and a lowest escape of lift gases passing by the firework during its motion in the tube.
Category 1 firework	Firework which presents a very low hazard and negligible noise level and which is intended for use in confined areas or inside domestic buildings	
Category 2 firework	Firework which presents a low hazard and low noise level and which is intended for outdoor use in confined areas	
Category 3 firework	Firework which presents a medium hazard, which is intended for outdoor use in large open areas and whose noise level is not harmful to human health	
Classification	The assignment of a 4-digit hazard code ("classification code") to an item as presented for transport according to the United Nations Recommendations on the Transport of Dangerous Goods	Fireworks belong to Class 1 "Explosives" and, according to their explosive behaviour (the three first digits, named "division") and their compatibility group (last digit), can be assigned one of the following codes: 1.1G, 1.2G, 1.3G, 1.4G or 1.4S. See "European Agreement concerning the international carriage of dangerous goods by road (ADR)" - §2.2.1.
Company	The manufacturing or importing company (for labelling purposes)	
Composition length	Length of the section of a firework which is coated with pyrotechnic composition	
Critical nonconformity	Nonconformity that judgement and experience indicate is likely to result in hazardous or unsafe conditions	NOTE This type of nonconformity is referred to a 'class A nonconformity' in ISO 2859-1.

"to be continued"

Term	Definition	Comments
Critical nonconforming unit	Nonconforming unit with one or more critical nonconformities, with or without major or minor nonconformities	
Debris	Any part of the firework which remains after the firework has ceased to function	Chemical products resulting from the combustion of the pyrotechnic compositions are not considered as "debris".
Delay fuse duration	The time delay of a delay fuse	
Effect charge	Pyrotechnic composition, other than propellant charge or bursting charge, which upon functioning will burn or explode to produce a visual and/or aural pyrotechnic effect	
Electric firing	The process of initiating fireworks by the application of an electric current to an igniter attached to the firework or a combination of fireworks	
Effect height	See "Height of effect"	
Effect time	The total duration of effect from its visible and/or aural emergence until it entirely vanishes	
Electronic firing	The process of firing a Firework Display by computerised or other means that leads to sequential firing of fireworks in a pre-determined manner	
End closure	Component or crimp which is designed to seal one end of a firework case	
Explosion	Sudden release of energy accompanied by a report with or without a flash	
Fallout area	The area in which normal fallout from a firework is expected to fall in standard firing conditions (including the prevailing meteorological conditions)	See below
Fallout distance	The maximum distance that any piece of debris or slag may fall from a firework in normal use under the standard firing conditions	It means the maximum dimension of the fallout area when the firework is fired in standard firing conditions. See also "maximum fallout distance".
Family	A set of individual items / articles which will be considered together for the purposes of testing and certification	Synonymous with "group".
Firework	Device containing pyrotechnic composition which, upon functioning, will burn and/or explode to produce a visual or aural effect or movement, or a combination of such effects, intended as a direct form of entertainment	

"to be continued"

Term	Definition	Comments
Firework case	Container which is designed to retain pyrotechnic compositions within a firework	According to its mechanical strength, this container may intentionally (by design) influence the firework's behaviour.
Firework display / Firework show	The sequential or simultaneous firing of a number of fireworks in a given area (or close and connected areas) over an extended time period	
Firing angle	The angle (measured from the vertical) of an item as prepared for firing	
Firing area(s)	The area(s) in which fireworks are functioned	
First principal effect	Principal effect of a firework which is the first actually to occur during the functioning of the firework	
Flash Powder	A powdery pyrotechnic composition used to produce an aural effect, with or without emission of an intense and short flash light, or used as a bursting charge or lifting charge	The use of flash powder as a lifting charge may cause unacceptable dispersion in functioning heights, unless specific requirements on the time taken for the pressure rise are complied with by design.
Flowerpot	The premature functioning of a firework shell within a mortar leading to an upward ejection of stars (to produce a visually similar effect to a mine)	
Friction head	Ignition head designed to be ignited by friction	See "ignition head"
Functioning time	The total duration of a firework (or a sequence of fireworks which are fused together beforehand) from initial functioning (ie not including the fuse time) until the functioning is complete	
Functioning height	The height at which a firework (e.g. a shell) bursts above the ground	In the case of multi-break fireworks or sequenced effects, it can be observed several functioning heights, then introducing notions of "initial functioning height", "final functioning height", etc.
Generic type	Set of articles with a common, very general, design feature and/or with a common characteristic effect	
Gross mass	The total mass of the firework (not including any ancillary equipment (e.g. frames)	
Group	A set of individual items which will be considered together for the purposes of testing and certification	Synonymous with "family"

"to be continued"

Term	Definition	Comments
Hangfire	A partial break in the initiation train of a single firework or between multiple fireworks (or components) that results in unpredictable subsequent functioning outcomes	Functioning time will be strongly affected and functioning can occur at any time during the firework display or a long time after. Firework behaviour can also be modified if the initiation break leads to a possible fire bypass (e.g. functioning of a hangfired shell in a mortar).
Hazard classification	See "Classification"	
Height of effect	The maximum height achieved by the firework	For a shell this would equate to the functioning height plus the burst radius of the shell. See "minimum height of effect".
Igniter	Article containing one or more explosive substances designed to produce a deflagration and initiate fire transmission in an explosive train	It may be actuated chemically, electrically or mechanically but, in firework use, it will be considered as synonymous with "electric igniter".
Ignition head	Initial fuse consisting of pyrotechnic composition only	
Ignition time	Time to ignite the initial fuse with the ignition source	
Individual item	Article within a generic type or sub type for which every possible feature and characteristic has been fixed	
Initial fuse	Component of a firework which is ignited in order to start the firework functioning	
Initial fuse burning	Burning which immediately follows ignition and precedes any effect	
Initial fuse time	Burning time of the initial fuse	
Invisible burning	Burning occurring within the firework which is not visible to the person who ignited the firework	
Invisible burning time	Time between preliminary effect and first principal effect	
Label	An information panel on the firework itself, or provided separately to the firework if this is not possible	
Length	The overall greatest dimension of a firework not including fuse or stabilising device (e.g. rocket stick)	
Lift charge / Lifting Charge	An explosive charge used to propel the firework as a whole or a sub component of the firework into the air (e.g. in mine or shell)	

"to be continued"

Term	Definition	Comments
Major nonconformity	Nonconformity, other than a critical nonconformity, which is likely to result in failure, to reduce materially the usability of the firework, or to increase the potential hazard	NOTE This type of nonconformity is referred to a 'class B nonconformity' in ISO 2859-1.
Major nonconforming unit	Nonconforming unit with one or more major nonconformities, with or without minor nonconformities, but with no critical nonconformities	
Manual firing	Ignition of a firework by application of a hand held flame source to a fuse attached directly to the firework	
Maximum fallout distance	The maximum distance that any piece of debris or slag may fall from a firework under any foreseeable circumstances (i.e. if the mortar discharges at 45 degrees etc.)	It means the maximum dimension of the fallout area when the firework is fired in non standard (intentional or not) but foreseeable conditions.
Minimum height of effect	The minimum height achieved by the firework	For a shell this would equate to the functioning height minus the burst radius of the shell. For a comet it may be ground level.
Minimum Safety Distance	Minimum Audience Distance in standard firing conditions	In non standard firing conditions, a specific minimum safety distance shall be determined on a case by case basis by user (person with specialist knowledge) with best available safety measures according to effect, performance, specific parameters and surrounding conditions.
Minor nonconformity	Nonconformity that is not likely to reduce materially the usability of the firework	NOTE This type of nonconformity is referred to a 'class C nonconformity' in ISO 2859-1.
Minor nonconforming unit	Nonconforming unit with one or more minor nonconformities, but with no critical or major nonconformities	
Misfire	The incomplete or unintentional functioning of a firework	
Mortar	Tube which is closed at the lower end and from which a firework is projected	
Mortar rack	An assembly containing a number of individual mortars	
Muzzle Break	The premature functioning of a shell at the mouth of the mortar from which it is fired	
Net Explosive Content (NEC)	Mass of pyrotechnic composition in the firework, excluding the pyrotechnic composition of the initial fuses and any transmitting fuses	

"to be continued"

Term	Definition	Comments
No-fire current	The current (expressed in amps DC) which causes no igniters in the circuit to function within a specified time period	No-fire current is a characteristic given in the data sheet of every igniter. It is generally determined as a direct current characteristic and associated with a probability level (generally 99,9% @ 95% confidence level) within a specified time frame (e.g. 50 ms).
Nonconforming unit	Firework or assembly of fireworks fused together at the manufacturing level with one or more nonconformities	
Nonconformity	Non-fulfilment of a requirement (ISO 9000:2000, 3.6.2)	
Other Pyrotechnic device	Pyrotechnic article other than firework and theatrical pyrotechnic article	
P1/P2 Pyrotechnic device	Synonymous with "other pyrotechnic article"	Category P1 means "which presents a low hazard". Category P2 means "which is intended for handling or use only by persons with specialist knowledge".
Packaging	Wrapping in which an item is presented for sale	
Person with Specialised knowledge	A person, to whom a Category 4 firework may be sold according to the regulations in a specified Member State	
Preliminary effect	Visual effect which follows the initial fuse burning and precedes the first principal effect of a firework	
Principal effect	Visual and/or aural effect the firework has been designed to display and/or emit into the air or on the ground or above a water surface, for entertainment or artistic purposes	
Propellant	Pyrotechnic composition which will burn to evolve gases which, in turn, are intended to propel the firework as a whole or to expel one or more pyrotechnic units without bursting the firework case, and which can also transmit ignition	
Protruding fuse	Initial fuse that extends from the fireworks case and used to ignite the article with a given time delay	
Pyrotechnic composition	Substance or mixture of substances which is designed, on ignition or initiation, to produce an aural and/or visual effect and/or to evolve gases and/or hot reaction products	

"to be continued"

Term	Definition	Comments
Pyrotechnic delay	Any type of pyrotechnic device designed in such a manner it generates a delay in the transmission of fire in an explosive train	This device may be a delay fuse, a safety fuse or cord, a blackmatch, a quickmatch, etc.
Pyrotechnic train	A set of pyrotechnic components which are functionally linked and, from an initial input of energy, function in an organized sequence to transmit, enhance and/or distribute ignition to one or several final effects (light, noise, pressure, motion, heat, etc.)	
Pyrotechnic unit	Discrete pyrotechnic component of a firework, included inside the firework case, which - upon functioning - will burn or explode to produce a visual and/or aural effect	The effect produced by a pyrotechnic unit is normally part of a combination of effects produced by the firework.
Report charge	Pyrotechnic composition which - upon functioning - will produce a report	
Rocket cone	A conical or other geometry device intended for the simultaneous ignition of a number of rockets	
Rocket launch frame	A frame designed to support one or more rockets and orient their initial flight direction	
Rocket launch tube	A device designed to support a single rocket and orient its initial flight direction	
Rocket launcher	Tube, frame or base from which a rocket may be launched	
Safety Fuse / Safety cord	A flexible cord consisting of an envelope generally containing a black powder core which burns at a velocity of approximately one centimetre per second	Other names: Fuse cord, mine or mining fuse
Screecher	Tube containing pressed, screeching pyrotechnic composition, with or without report-producing pyrotechnic composition	Similar in functioning to a whistle
ShellCalc©	A computer programme used to model the effects of wind, mortar orientation and other effects on the trajectory and functioning of shells and Roman Candles	
Slag	Condensed reaction products resulting from the combustion of pyrotechnic compositions	Not to be confused with "debris"
Storage	The process of storing items prior to functioning or transport	
Sub type	Set of articles within a generic type with specific design features	
Supply	The provision of articles by sale, barter, or exchange - or provided without charge by one individual or company to another	

"to be continued"

Term	Definition	Comments
T1 / T2 Pyrotechnic article / device	Synonymous with "theatrical pyrotechnic article / device"	Category T1 means "which presents a low hazard". Category T2 means "which is intended for handling or use only by persons with specialist knowledge".
Testing point	Location in the test area where the firework is placed at the beginning of a performance test	
Theatrical Pyrotechnic article / device	Pyrotechnic article for stage use	
Transmitting fuse / Transmission fuse	Component of a firework which is intended to transmit ignition from one part of a firework to another, with or without a delay	
Transport	Every operation which consists in taking or carrying a product or a package of products from a place to another distant place, by means of vehicle, aircraft or ship	
Type	Sample representative of the production envisaged	See Annex II §2(c) of Directive 2007/23/EC
Type test	Test performed on a sample of products, representative of the production envisaged, in order to demonstrate they meet the relevant provisions of Directive 2007/23/EC	The successful submission to type tests leads to the attribution of a type-examination certificate.
UN Number	Four-figure identification number of a substance or an article in the UN Dangerous Goods List according to the UN Model Regulations on the transport of dangerous goods	In the UN Dangerous Goods List, Fireworks have been assigned the following UN Numbers: 0333 "Fireworks 1.1G", 0334 "Fireworks 1.2G", 0335 "Fireworks 1.3G", 0336 "Fireworks 1.4G"and 0337 "Fireworks 1.4S".
Use	The erection and functioning of a firework by an individual or company	
Width of effect	The horizontal dimension of the firework effect	
Wind Direction	The compass direction of the wind at the relevant height	
Wind Speed	The measured speed of the wind at the relevant height	

Annex F
(informative)

Parameters to comply with ESR

N°	Essential Safety Requirements	Parameters to comply with E.S.R.
1	Each pyrotechnic article must attain the performance characteristics specified by the manufacturer to the notified body in order to ensure maximum safety and reliability.	General design. Dimensions. Pyrotechnic train. Masses of each pyrotechnic charge. Detailed chemical composition of pyrotechnic charges (mass and percentage of substances used).
2	Each pyrotechnic article must be designed and manufactured in such a way that it can be disposed of safely by a suitable process with minimum effect on the environment.	No forbidden substance.
3	Each pyrotechnic article must function correctly when used for its intended purpose. Each pyrotechnic article must be tested under realistic conditions. If this is not possible in a laboratory, the tests must be carried out in the conditions in which the pyrotechnic article is to be used.	Performance characteristics in normal standard firing according to the type of firework: e.g. burst height, burst diameter, time to shell burst, effect duration, fuse delay time, for shells.
The following information and properties — where applicable — must be considered or tested:		
a)	Design, construction and characteristic properties, including detailed chemical composition (mass and percentage of substances used) and dimensions;	See 1 here above.
b)	The physical and chemical stability of the pyrotechnic article in all normal, foreseeable environmental conditions;	No forbidden substance. No weight loss in thermal and mechanical solicitations.
c)	Sensitivity to normal, foreseeable handling and transportation;	No damage during tests representative of normal conditions normal of transport and handling. Performances (See 3) after these tests
d)	Compatibility of all components as regards their chemical stability;	No forbidden substance. No chemically incompatible substances. Physical separation of incompatible compositions.
e)	Resistance of the pyrotechnic article to moisture where it is intended to be used in humid or wet conditions and where its safety or reliability may be adversely affected by moisture;	For aquatic fireworks only: performances in normal firing and moisture conditions (e.g. burst range and height, burst diameter, time to shell burst, effect duration, fuse delay time).

"to be continued"

N°	Essential Safety Requirements	Parameters to comply with E.S.R.
f)	Resistance to low and high temperatures, where the pyrotechnic article is intended to be kept or used at such temperatures and its safety or reliability may be adversely affected by cooling or heating of a component or of the pyrotechnic article as a whole;	Performances (See 3) after tests representative of storage and firing at high or low temperatures.
g)	Safety features intended to prevent untimely or inadvertent initiation or ignition;	Fuse ignition: See C 1, 2, 3, 4 and 5. Electric ignition: See C 1 , 2, 3, 6 and 7.
h)	Suitable instructions and, where necessary, markings in respect of safe handling, storage, use (including safety distances) and disposal in the official language or languages of the recipient Member State;	Labelling and/or user's instruction.
i)	The ability of the pyrotechnic article, its wrapping or other components to withstand deterioration under normal, foreseeable storage conditions;	No damage during tests representative of normal conditions of storage and handling, and of normal shelf life. Performances (See 3) after these tests
j)	Specification of all devices and accessories needed and operating instructions for safe functioning of the pyrotechnic article.	User's instructions.
	During transportation and normal handling, unless specified by the manufacturer's instructions, the pyrotechnic articles should contain the pyrotechnic composition.	Neither damage nor loss of pyrotechnic composition during and after tests representative of normal conditions normal of transport and handling.
4	Pyrotechnic articles must not contain:	
a) b)	- Commercial blasting agents, except for black powder or flash composition; - Military explosives.	See "Use of blasting agents and military explosives" here above.
5	The various groups of pyrotechnic articles must at least also comply with the following requirements:	
A	Fireworks:	
1)	The manufacturer must assign fireworks to different categories according to Article 3 characterised by net explosive content, safety distances, noise level, or similar. The category must be clearly indicated on the label.	Net explosive content Performances (See 3) used to calculate safety distances. Noise level.

"to be continued"

N°	Essential Safety Requirements	Parameters to comply with E.S.R.
2)	Fireworks may only be constructed of materials which minimise risk to health, property and the environment from debris.	Type of materials and components. Distance at which debris are thrown.
3)	The method of ignition must be clearly visible or must be indicated by labelling or instructions.	Labelling or user's instructions.
4)	Fireworks must not move in an erratic and unforeseeable manner.	Performances (See 3)
C	Ignition devices:	
1)	Ignition devices must be capable of being reliably initiated and be of sufficient initiation capability under all normal, foreseeable conditions of use.	Ignition time (and fuse delay time if any) in normal standard firing conditions.
2)	Ignition devices must be protected against electrostatic discharge under normal, foreseeable conditions of storage and use.	Electric shunt on the ignition device when appropriate. Compliance with WG5 standards. CE marking of remote firing equipments.
3)	Electric igniters must be protected against electromagnetic fields under normal, foreseeable conditions of storage and use.	See C 2 here above.
4)	The covering of fuses must be of adequate mechanical strength and adequately protect the explosive filling when exposed to normal, foreseeable mechanical stress.	Mechanical resistance of the fuse cover.
5)	The parameters for the burning times of fuses must be provided with the article.	Labelling or user's instructions. Fuse delay time.
6)	The electrical characteristics (e.g. no-fire current, resistance, etc.) of electric igniters must be provided with the article.	Labelling or user's instructions. Compliance with WG5 standards.
7)	The wires of electric igniters must be sufficiently insulated and must be of sufficient mechanical strength, including the solidity of the link to the igniter, taking account of their intended use.	Compliance with WG5 standards. Mechanical strength of the link to the igniter.

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[6] CEN TC 212 WG2 N018, *Pyrotechnic articles — Fireworks Category 4 — 1. Proposal 13. June 2008*

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