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# Certification of pyrotechnic articles for vehicles according to the EU directive 2007/23/EC on the placing on the market of pyrotechnic articles

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## ABSTRACT

On May 23, 2007 the European Parliament and the Council adopted the Directive 2007/23/EC [1] on the placing on the market of pyrotechnic articles. Following the "new approach" this Directive aims at ensuring the free movement of such products within the European Union (EU), improving safety of both consumers and professionals and implementing harmonized safety requirements for these articles in all Member States. Therefore a European frame for the approval of pyrotechnic articles for vehicles is now set up by introducing harmonized Essential Safety Requirements (ESR), CE marking and certification procedures. For manufacturers and importers that had to comply with a different regulation in each country to get technical approvals of their products the principle "tested once, accepted everywhere" is a great achievement.

Although this EU directive will reduce the administrative burden for everybody, its substitution and application instead of the current national regulations may create difficulties at the beginning.

As Notified Body and Official Laboratory in France INERIS has gained lot of experience in testing, certifying and approving explosives and pyrotechnic articles. In this paper we give an insight of the different parts of the Directive 2007/23/EC and present the frame of the CE marking and certification procedures for pyrotechnic articles for vehicles.

## 1 INTRODUCTION

On May 23, 2007 the European Parliament and the Council adopted the Directive 2007/23/EC [1] on the placing on the market of pyrotechnic articles. This newly published text is another piece of the European regulation concerning explosives and pyrotechnic articles. It supplements the Directive 93/15/EEC of 5 April 1993 [2] on the harmonization of the provision relating to the placing on the market and supervision of explosives for civil uses. These two Directives following the "new approach" aim at ensuring the free movement of products within the European Union (EU), improving safety of both consumers and professionals and implementing harmonized safety requirements for such products in all Members States.

If pyrotechnic articles and ammunitions, identified in the Directive 2004/57/EC of 23 April 2004 [3], were explicitly excluded from the scope of the Directive 93/15/EEC, the Directive 2007/23/EC applies now specifically to pyrotechnic articles including fireworks and pyrotechnic articles for vehicles.

INERIS, who is Notified Body for the certification of the explosives according to the former Directive 93/15/EEC, has acquired experience as Official Laboratory in France (by order of February 11, 1994) in the approving of explosives and pyrotechnical automotive safety equipment, since 1990 and the publication of the French decree n°90-153 of February 16, 1990 [4].

This paper presents the different points of the Directive 2007/23/EC related to pyrotechnic articles for vehicles, although the Directive also deals with fireworks and other pyrotechnic articles. The certification procedures are reviewed, taking into account the regulation and the actual practices developed to assess the conformity to the Essential Safety Requirements (ESR) of this new Directive for the EC certification of pyrotechnic articles for vehicles.

## **2 DEFINITIONS AND GENERALITIES**

**Pyrotechnic articles for vehicles:** components of safety devices in vehicles which contain pyrotechnic substances used to activate these or other devices.

**Type:** sample representative of the production envisaged, placed at the disposal of the Notified Body by the applicant, in order to its evaluation according to the ESR in the annex I of the Directive.

For pyrotechnic articles for vehicles seven main kinds of products have been identified:

- Igniter (squib, initiator...),
- micro gas generator,
- seatbelt pretensioner (buckle, retractor...),
- airbag gas generator or inflator,
- airbag module (driver, passenger, side, knee...),
- actuator (retractor, pusher, circuit breaker, switch...),
- semi-finished assembly.

**Category P1 pyrotechnic articles:** pyrotechnic articles other than fireworks and theatrical pyrotechnic articles which present a low hazard.

**Category P2 pyrotechnic articles:** pyrotechnic articles other than fireworks and theatrical pyrotechnic articles which are intended for handling or use only by persons with specialist knowledge.

**Person with specialist knowledge:** person authorized by a Member State to handle and/or use on its territory, category P2 pyrotechnic articles.

Manufacturers, importers and distributors shall sell or otherwise make available pyrotechnic articles of category P2 only to persons with specialist knowledge. Pyrotechnic articles of category P1 shall be sold or made available only to consumers above 18 years.

However the Directive 2007/23/EC admits that pyrotechnic articles for vehicles are supplied exclusively to professional users.

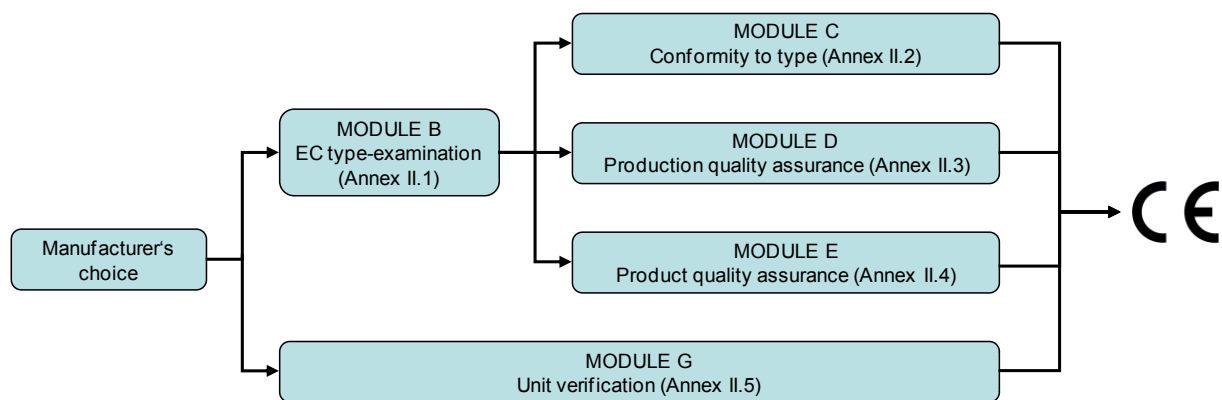
As far as it concerns pyrotechnic articles for vehicles the relevant date to be considered are the following:

- July 4, 2007: date of entry into force of the Directive 2007/23/EC
- January 4, 2010: Member States shall have adopted and published the laws, regulations and administrative provisions necessary to comply with the Directive 2007/23/EC;
- July 4, 2013: Member States shall apply the provisions of the Directive 2007/23/EC;
- Approvals issued before July 4, 2013 remain valid until their expiry date or up to July 4, 2017 whichever is shorter (by way of derogation from that, national approvals for pyrotechnic articles for vehicles issued before July 4, 2013 shall continue to be valid until their expiry).

### 3 CONFORMITY ASSESSMENT PROCEDURES FOR PYROTECHNIC ARTICLES

The manufacturer or the importer of the pyrotechnic articles, established in the Community, has to lodge its application for the assessment of conformity by the means of one of the following procedures allowed by the Directive 2007/23/EC:

- (a) the EC type-examination (Module B) procedure, and, at the choice of the manufacturer, either:
  - (i) the conformity to type (Module C) procedure,
  - (ii) the production quality assurance (Module D) procedure,
  - (iii) the product quality assurance (Module E) procedure;
- (b) the unit verification (Module G) procedure. This module is applied alone for each single article and therefore seems less appropriate for pyrotechnic articles for vehicles.



Schematic view of the procedures for conformity assessment (Modules described in the annex II of the directive 2007/23/EC)

#### 3.1 INITIAL CERTIFICATION

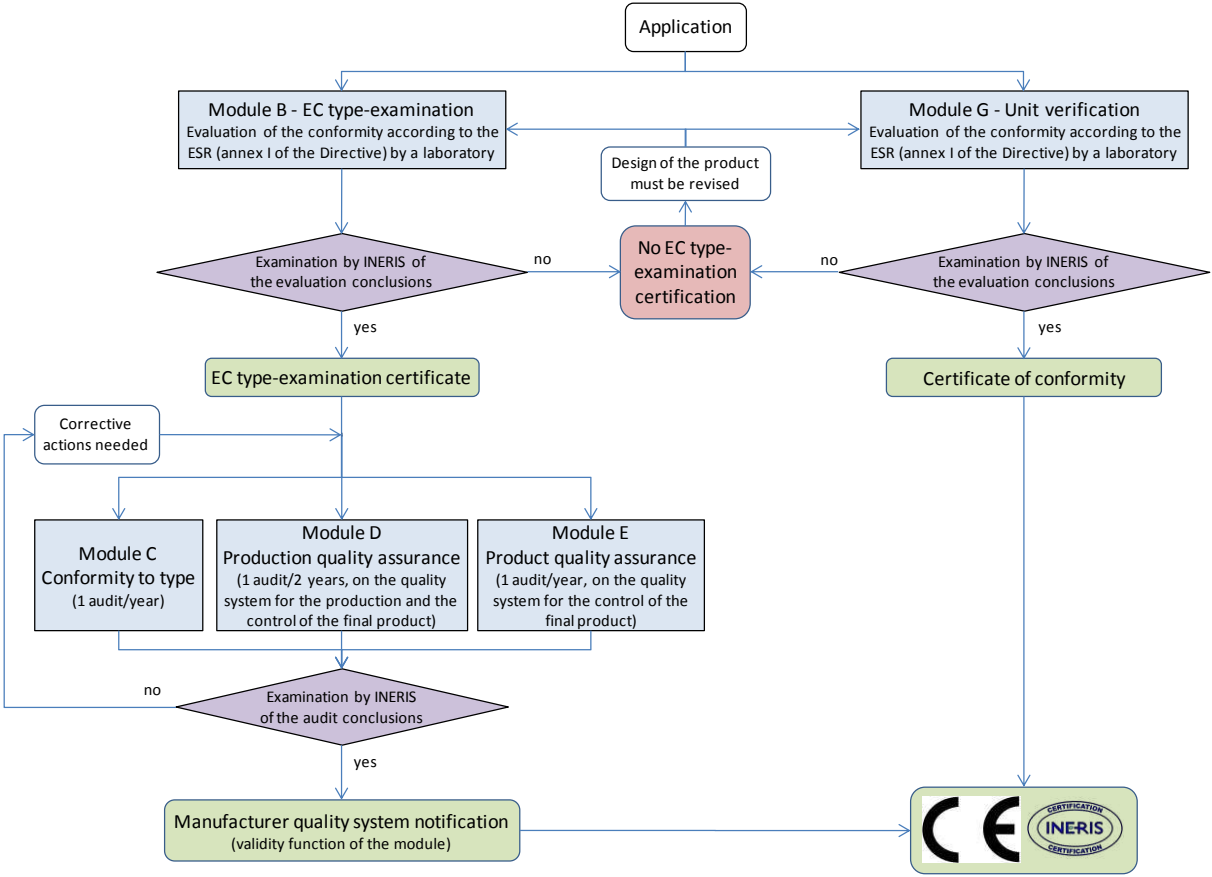
Application for initial certification of pyrotechnic articles for vehicles can be made directly to INERIS [5] or by use of an official application form available on request to INERIS. The initial application shall contain the following elements:

- ↪ name and address of the applicant or its proxy if not in the EU,
- ↪ name and address of the manufacturer(s),
- ↪ commercial name(s) of the product to certify,
- ↪ conformity assessment procedure selected by the applicant,
- ↪ declaration of the applicant saying that "the application for the EC certification under the Directive 2007/23/EC of May 27, 2007, for the products designated, has not been lodged with any other Notified Body".
  - a technical documentation covering the design (diagrams of components, subassemblies, composition and mass of each pyrotechnic element) of the article and its variants,
  - a technical documentation describing the manufacturing process and the controls (description of test procedures and sampling) applied during production and on finished products,
  - the instructions for use,
  - a safety data sheet,

For modules C, D or E, this application is to be supplemented with a documentation demonstrating the measures implemented the applicant or the manufacturer to ensure the conformity to the type, to declare the conformity to the type and to affix the CE marking.

On reception of an application INERIS makes a preliminary analysis of the documentation received to determine the validity of the application, the tests to be carried out, the number of samples needed, eventually the additional information necessary from the applicant. On that basis INERIS sends to the applicant a quote covering all the jobs for the assessment of the request (testing, audit visit of manufacturing plant, paperwork...), the cost is essentially depending of the number of products and of manufacturing plants to be assessed. A time schedule is also established after discussion with the applicant. The overall process from the reception of the application to the emission of the certification documents can take one month if everything goes smoothly.

The logical scheme applied by INERIS for an initial certification of a pyrotechnic article for vehicles can be represented by the following flow chart:



The first step consists of either the EC type-examination (module B) or the unit verification (module G). When it is passed successfully a certificate is issued for the product assessed. In case of the module B the applicant has to choose between the conformity to type (module C), the production quality assurance (module D) or the product quality assurance (module E) for the evaluation of the manufacturing phase. INERIS carries out the assessment according to these modules by the means of periodical audit visits. If the result of the audit is favourable, INERIS notifies to the manufacturer(s) its authorization for the EC marking according to the module chosen. This notification remains valid until the date of the next audit.

As far as it will concern pyrotechnic articles for vehicles most of the assessments will likely be carried out according to the combination of module B (EC type-examination) and

module D (production quality assurance) due to the fact that in the automotive industry the ISO 9001 and ISO/TS 16949 standards are widely implemented.

On the one hand, module B covers the design phase and is to be applied for each type to be defined (general design of a product), the examination is carried out to assess the conformity of a design with the ESR.

And on the other hand module D covers the production phase and is to be applied for several products, the evaluation is carried out to guarantee the conformity of manufactured objects with the corresponding type approved.

### **3.2 AMENDMENT OF A CERTIFICATION**

When an initial certification has been granted for a particular design of product and manufacturer, some situations may require amendment of this certification for example:

- transfer of certification from a Company to another one,
- addition and/or withdrawal of manufacturer(s),
- addition and/or withdrawal of commercial name(s),
- addition of a variant of the design certified. The variant will be evaluated following the same conformity assessment procedures as the initial model. But depending to what extend the variant differs from the initial design, parts of the initial test results will be reused for the assessment of the variant.

These kinds of amendments can be managed either by addition to the existing certificates (modifying and/or extending the type) or by issue of new certificates.

In some cases an audit of the manufacturer(s) is performed if:

- the new manufacturer(s) has never been audited,
- the manufacturing process of the variant has never been audited, or if the addition of the variant changes significantly the system of production and control of the products certified,
- the validity of the certification of the quality system matures.

### **3.3 CONVERSION OF FRENCH APPROVAL TO EC TYPE-EXAMINATION CERTIFICATION**

Companies that hold valid French approvals for pyrotechnic articles for vehicles will beneficiate of an adapted procedure for the conversion of them into EC type-examination certificates, but it will not be automatic and it will be done on request. A preliminary study of the application will be performed to verify if all the documents and test results available are sufficient to answer to the ESR of the Directive 2007/23/EC and allow INERIS to carry out the EC type-examination. In the case of no additional documents or tests is required the procedure will continue with the necessary paperwork. In the other cases (need of additional documents and/or test results) the petitioner will have to complete its application.

In addition, the quality system of the manufacturer will be assessed according to the module of its choice.

## **4 REQUIRED DOCUMENTS AND INFORMATION FOR THE APPLICATION OF CONFORMITY ASSESMENT**

### **4.1 EC TYPE-EXAMINATION (MODULE B)**

The application is constituted of the following elements:

- ↪ the name and address of the manufacturer,
- ↪ a written declaration that the same application has not been lodged with any other notified body,
- ↪ a technical documentation covering the design, manufacture and operation of the article and containing:
  - a general type-description,
  - conceptual design and manufacturing drawings and diagrams of components, sub-assemblies, circuits, etc.,
  - descriptions and explanations necessary for the understanding of the drawings and diagrams and the operation of the article,
  - a list of the harmonized standards referred to in Article 8 of this Directive, applied in full or in part, and descriptions of the solutions adopted to meet the essential safety requirements of this Directive where the harmonized standards referred to in Article 8 of this Directive have not been applied,
  - results of design calculations made, examinations carried out, etc.,
  - test reports.

### **4.2 CONFORMITY TO TYPE (MODULE C)**

This module is always applied with the module B. This module is applied when a manufacturer does not operate a quality system or has a quality system not externally approved. In this case, INERIS must perform or ask to perform a control of a sample of finished articles taken on the spot at random intervals.

### **4.3 PRODUCTION QUALITY ASSURANCE (MODULE D)**

This module is always applied with the module B. This module is applied when the manufacturer operates quality system externally approved (for example ISO 9001, ISO/TS 16949...) for production, final product inspection and testing. However, the manufacturer must lodge an application for assessment of his quality system with INERIS. The application must include

- ↪ all relevant information for the pyrotechnic article category envisaged,
- ↪ the documents concerning the quality system,
- ↪ the technical documents pertaining to the approved type and a copy of the EC type-examination certificate.

INERIS will ensure a monitoring to make sure that the manufacturer duly fulfils the obligations arising out of the approved quality system. For that INERIS carries out periodically audits to make sure that the manufacturer maintains and applies the quality system. During these audits the manufacturer must allow access to the manufacturing,

inspection, testing and storage premises and provide all necessary information, in particular:

- ↪ the quality system documents,
- ↪ the quality records, such as inspection reports and test data, calibration data, and qualification reports of the personnel concerned.

#### **4.4 PRODUCT QUALITY ASSURANCE (MODULE E)**

This module is always applied with the module B. This module is applied when the manufacturer operates quality system externally approved (for example ISO 9001, ISO/TS 16949...) for final product inspection and testing.

However, the manufacturer must lodge an application for assessment of his quality system with INERIS. The application must include

- ↪ all relevant information for the pyrotechnic article category envisaged,
- ↪ the documents concerning the quality system,
- ↪ the technical documents pertaining to the approved type and a copy of the EC type-examination certificate.

INERIS will ensure a monitoring to make sure that the manufacturer duly fulfils the obligations arising out of the approved quality system. For that INERIS carries out periodically audits to make sure that the manufacturer maintains and applies the quality system. During these audits the manufacturer must allow access to the manufacturing, inspection, testing and storage premises and provide all necessary information, in particular:

- ↪ the quality system documents,
- ↪ the technical documents,
- ↪ the quality records, such as inspection reports and test data, calibration data, and qualification reports of the personnel concerned.

#### **4.5 UNIT VERIFICATION (MODULE G)**

This module is always applied alone. This module is applied when the product to certify is unique. It is mainly carried out on the base of technical documents enabling the assessment of the conformity with the ESR, the understanding of the design, manufacture and operation of the pyrotechnic article.

The application consists of documents containing:

- ↪ a general description of the type,
- ↪ conceptual design and manufacturing drawings and schemes of components, sub-assemblies and circuits,
- ↪ the descriptions and explanations necessary for the understanding of the conceptual design and manufacturing drawings, the schemes of components, sub-assemblies and circuits and the operation of the pyrotechnic article,
- ↪ a list of the harmonised standards referred to in Article 8 of this Directive, applied in full or in part, and descriptions of the solutions adopted to meet the essential safety requirements of this Directive where the harmonised standards referred to in Article 8 of this Directive have not been applied,
- ↪ results of design calculations made and examinations carried out,
- ↪ test reports.



## 5 ESSENTIAL SAFETY REQUIREMENTS

The Essential Safety Requirements (ESR) are minimum requirements to be satisfied by the pyrotechnic articles in order to ensure a high level of protection of human health and safety and the protection of consumers and professional end users. Although the ESR do not really intend to guarantee any performance reliabilities in the final use of the articles, an adequate and complete operation of the articles according to what it is expected is in some way a basic condition for safety.

In order to facilitate the process of demonstrating compliance with the essential safety requirements, harmonized standards for the design, manufacture and testing of pyrotechnic articles are being developed by the CEN Technical Committee 212. With regard to pyrotechnic articles for vehicles, these standards are developed under the Vienna agreement to take into account the international orientation of the vehicle supply industry.

Pyrotechnic articles manufactured in compliance with harmonized standards will benefit from a presumption of conformity with the essential safety requirements provided for in the Directive 2007/23/EC.

However, the compliance with harmonized standards is never compulsory. In addition, the preparation and the complete adoption of these harmonized standards will required few years during which it will be necessary to carry out assessment procedure. Therefore, there is a necessity to use existing test procedures or standards during the transitory period.

The following table gives a list of existing methods used in the frame of the French approval of pyrotechnical automotive safety equipments [6], [7].

| Ref. | Title                             | Description                                                                                                                     |
|------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| A1   | Description                       | Description and comparison of the samples with the technical data or drawing submitted. Examination of technical documentation. |
| E1   | Stability                         | The article is submitted to a temperature of 75°C during 48 hours                                                               |
| E10  | Stability                         | The article is submitted to a temperature of 50°C and a relative humidity of 60% during 4 weeks                                 |
| F2   | Progressive heating               | The article is progressively heated (heating rate 5°C/min), the temperature of runaway is determined                            |
| I5*  | Fall                              | The article is dropped on a hard floor from a height of 1.20 m                                                                  |
| I10  | Fall                              | The article is dropped on a hard floor from a height of 1.20 m                                                                  |
| I11  | Impact                            | The article is submitted to the free fall of a 30-kg fallhammer dropped from 0.25 m and 0.50 m high on 2 different directions   |
| J8   | Vibration                         | The article is submitted to vibrations (frequency 50 Hz, amplitude 0.5 mm) during 60 minutes                                    |
| K1   | Sensitiveness to electrical spark | The article is submitted to electrical spark of different energy, a level of minimum energy of no-reaction is determined.       |
| K5   | Ignition                          | Determination of firing impulse (electrical, mechanical, optical)                                                               |
| M7   | Heating                           | The article is exposed to a gas burner until reaction                                                                           |
| N7   | Operation                         | Operation of the article is compared to what it is suppose to be                                                                |
| P8*  | Detonability                      | The ability of the article to initiate a cartridge of pentrite is tested                                                        |
| R8** | Combustion products               | Analysis of the nature and quantity of the products emitted when the article is initiated in a 2.5 m <sup>3</sup> chamber       |

\* Applied to igniter

\*\* Applied to gas generator

## 5.1 ESR WITH THE CORRESPONDING TEST METHODS ABLE TO EVALUATE THE CONFORMITY

The ESR of the Directive 2007/23/EC about the pyrotechnic articles for vehicles are listed with comments in the following table. The last column gives the references of examples of test methods that can be carried out by INERIS for the assessment of conformity of the product.

| §     | Essential Safety Requirements (ESR)                                                                                                                                                                                                                                                                  | Comments                                                                                                                                                                                                                                                                                                                                            | Test methods     |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 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.                                                                                                                           | Operation of the article is compared to what it is suppose to be.<br>Examination of the results of operation in conditions defined by the manufacturer (may require manufacturer's testing facilities).                                                                                                                                             | A1, N7, R8       |
| 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.                                                                                                                             | The way of disposal must be given in the documentation. The chemical composition of the different pyrotechnic mixtures must be given as well as information on their toxicity profile.<br>Compliance with Directive 2000/53/EC [8] is taken into account.                                                                                           |                  |
| 3.    | Each pyrotechnic article must function correctly when used for its intended purpose.<br>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. | Articles are tested with or without conditioning.<br>Function correctly can also signify no ignition or deployment for some articles in realistic conditions such as handling.<br>See also ESR 1.                                                                                                                                                   |                  |
| 3. a) | Design, construction and characteristic properties, including detailed chemical composition (mass and percentage of substances used) and dimensions.                                                                                                                                                 | These information have to be provided in the technical documentation and drawings.<br>Careful examination of the samples submitted allows checking of these data.                                                                                                                                                                                   | A1               |
| 3. b) | The physical and chemical stability of the pyrotechnic article in all normal, foreseeable environmental conditions.                                                                                                                                                                                  | Indications on what are the foreseeable environmental conditions have to be given in the technical documentation (minimum and maximum temperatures and hygrometry recommended for storage and use, shelf life time...).<br>Thermal stability tests and ageing have to be carried out as well as mechanical resistance tests (vibrations, impact...) | E1, E10, J8      |
| 3. c) | Sensitivity to normal, foreseeable handling and transportation.                                                                                                                                                                                                                                      | Description of the design, assembling and suitable packaging in the technical documentation together with results obtained in mechanical tests (shock, vibration, drop...) on bared or packaged article.                                                                                                                                            | I5, I10, I11, J8 |
| 3. d) | Compatibility of all components as regards their chemical stability.                                                                                                                                                                                                                                 | Needs no further examination if the contained pyrotechnic compound is certified. If not the case, the chemical composition is examined.                                                                                                                                                                                                             | A1, E1, E10      |
| 3. 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.                                                                                                              | The technical documentation should specify the environmental conditions where the article is intended to be use (minimum and maximum temperatures and hygrometry recommended for storage and use...).<br>Testing in harsh environmental conditions or after thermal cycles or ageing.                                                               | E1, E10, F2      |

| §       | Essential Safety Requirements (ESR)                                                                                                                                                                                                                               | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Test methods         |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 3. 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. | See ESR 3. b) and 3. e)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | E1, E10, F2, J8      |
| 3. g)   | Safety features intended to prevent untimely or inadvertent initiation or ignition.                                                                                                                                                                               | Needs no further examination if the igniter is certified. If not the case, the ESD tests are done either on the igniter or on the article itself.<br>Verification in the design of the presence of effective protection features (shunt, ESD/EMI protection...)                                                                                                                                                                                                                                                   | A1, I5, I10, I11, J8 |
| 3. 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.                                                     | Examination of the technical document.<br>See also article 13 of the directive 2007/23/EC.                                                                                                                                                                                                                                                                                                                                                                                                                        | A1                   |
| 3. i)   | The ability of the pyrotechnic article, its wrapping or other components to withstand deterioration under normal, foreseeable storage conditions.                                                                                                                 | Description of the design, assembling and suitable wrapping in the technical documentation together with results obtained in mechanical tests (shock, vibration, drop...) on bared or wrapped article.<br>See also ESR 3. b)                                                                                                                                                                                                                                                                                      | I5, I10, I11, J8     |
| 3. j)   | Specification of all devices and accessories needed and operating instructions for safe functioning of the pyrotechnic article.                                                                                                                                   | The technical documentation and/or specific instructions for the user have to described or give these information. This is important for articles handled as spare parts.                                                                                                                                                                                                                                                                                                                                         | A1                   |
|         | During transportation and normal handling, unless specified by the manufacturer's instructions, the pyrotechnic articles should contain the pyrotechnic composition                                                                                               | The description of the design, assembling and suitable packaging in the technical documentation has to be given.                                                                                                                                                                                                                                                                                                                                                                                                  | A1                   |
| 4. a)   | Pyrotechnic articles must not contain commercial blasting agents, except for black powder or flash composition.                                                                                                                                                   | Examination of the technical documentation on the base of an agreed resolution of CEN Technical Committee 212.                                                                                                                                                                                                                                                                                                                                                                                                    | A1, P8               |
| 4. b)   | Pyrotechnic articles must not contain military explosives.                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |
| 5.B. 1) | Pyrotechnic articles must be designed in such a way as to minimize risk to health, property and the environment during normal use.                                                                                                                                | The description of the design, assembling and of all necessary accessories for a correct operation must be given in the technical documentation.<br>Examination of the documentation and the results obtained in the different test procedures carried out.<br>The correct and complete functioning of the pyrotechnic article is checked to assess the conformity to the expected effect<br>Description (dimensions, mass, labelling) and comparison of the sample with the technical data or drawing submitted. | A1, N7               |
| 5.B. 2) | The method of ignition must be clearly visible or must be indicated by labelling or instructions.                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |
| 5.B. 3) | The pyrotechnic article must be designed in such a way as to minimize risk to health, property and the environment from debris when initiated inadvertently                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |
| 5.B. 4) | Where appropriate, the pyrotechnic article must function properly until the 'use by' date specified by the manufacturer.                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |

In addition, when ignition devices are concerned the following ESR have to be fulfilled:

| §       | Essential Safety Requirements (ESR)                                                                                                                                                                   | Comments                                                                                                                                        | Test methods              |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 5.C. 1) | Ignition devices must be capable of being reliably initiated and be of sufficient initiation capability under all normal, foreseeable conditions of use.                                              | Determination of the recommended firing current, percussion, friction or optical power level from statistical tests (Bruceton type or similar). | K5                        |
| 5.C. 2) | Ignition devices must be protected against electrostatic discharge under normal, foreseeable conditions of storage and use.                                                                           | The article is submitted to electrical spark of different energy, a level of minimum energy of no-reaction is determined.                       | K1                        |
| 5.C. 3) | Electric igniters must be protected against electromagnetic fields under normal, foreseeable conditions of storage and use.                                                                           | Verification in the design of the presence of effective protection features (shunt, ESD/EMI protection...) See also ESR 3. g)                   |                           |
| 5.C. 4) | The covering of fuses must be of adequate mechanical strength and adequately protect the explosive filling when exposed to normal, foreseeable mechanical stress.                                     | See ESR 3. b) and 3. c)                                                                                                                         | E1, E10, I5, I10, I11, J8 |
| 5.C. 5) | The parameters for the burning times of fuses must be provided with the article.                                                                                                                      | Determination of the burning time when applicable                                                                                               |                           |
| 5.C. 6) | The electrical characteristics (e.g. no-fire current, resistance, etc.) of electric igniters must be provided with the article.                                                                       | Verification of information provided by the manufacturer.                                                                                       | A1                        |
| 5.C. 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. | Verification of the resistance of insulation and the mechanical strength of the wires when applicable                                           | A1                        |

The technical documentation and/or the Material Safety Data Sheet (MSDS) have to describe or give enough information to allow the assessment of the ESR. In the case of pyrotechnic articles for vehicles Article 13 of the Directive specifies the minimum information for the labelling and refers to the Directive 2001/58/EC amending the Directive 91/155/EEC for the drafting of the MSDS [9].

## 5.2 SAMPLING FOR EACH TYPE

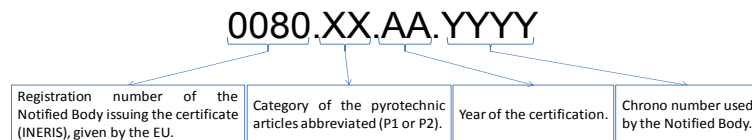
An analysis of the table listing the essential safety requirements in the previous paragraph gives a minimum sample number in order to cover all the testing for each article type, see table hereafter. These minimum sample number are given in the hypothesis that some tests perform at a sub-level can be reused at an upper level of integration. For example, if electrical test results carried out at the igniter level are available then they will be reused at the upper level.

| Article type           | Minimum sample number |
|------------------------|-----------------------|
| Igniter                | 75                    |
| Micro gas generator    | 20                    |
| Airbag gas generator   | 12                    |
| Seatbelt pretensioner  | 12                    |
| Actuator               | 12                    |
| Semi finished assembly | 15                    |
| Airbag module          | 12                    |

## 6 EC TYPE-EXAMINATION CERTIFICATE

If the conclusions of the evaluation are satisfying, INERIS issues an EC type-examination certificate. This certificate includes an identification number linked to the certified article, the date of the certification, the commercial name(s) of the article, the name and the address of the applicant and of the manufacturer(s), and the data necessary for the identification of certified type.

The identification number is as follow:



INERIS communicates to the other Notified Bodies the relevant information concerning EC type-examination certificates and additions issued or withdrawn, by means of a database published on its Website ([www.ineris.fr](http://www.ineris.fr)).

In the case of an addition to certification, INERIS issues an addition to EC type-examination certificate, including the update data. This addition has to be joined to the initial certificate.

## 7 CONCLUSION

In this document we have presented the important points of the Directive 2007/23/EC [1] related to pyrotechnic articles for vehicles and have given some of our interpretations.

For more than 15 years INERIS as Notified Body has demonstrated its competence and its know-how worldwide by taking a leading position in the field of certification of explosives for civil uses and is now ready to act for the certification of all pyrotechnic articles.

INERIS makes its services for certification accessible to all applicants whose activities fall within the scope of Directive 2007/23/EC [10]. The access is not conditional upon the applicant's nationality, size or membership of any association or group, nor the certification is conditional upon the number of certificates already issued.

## 8 REFERENCES

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1 EU Official Journal L 154, 14.6.2007, Directive 2007/23/EC of the European Parliament and of the Council of 23 May 2007 on the placing on the market of pyrotechnic articles.

2 EU Official Journal L 121, 15.5.1993, Council Directive 93/15/EEC of 5 April 1993 on the harmonization of the provisions relating to the placing on the market and supervision of explosives for civil uses.

3 Commission Directive 2004/57/EC of 23 April 2004 on the identification of pyrotechnic articles and certain ammunition for the purposes of Council Directive 93/15/EEC on the harmonisation of the provisions relating to the placing on the market and supervision of explosives for civil uses.

4 Decree n° 90-153 of February 16, 1990 French OJ n° 42 of February 18, 1990 (in French).

5 Application and documentation to be sent: by mail to INERIS Certification Division - Parc Technologique Alata BP2 - 60550 VERNEUIL EN HALATTE - France ; by fax to +33 (0)344 556 510 ; by E-mail to <lionel.aufauvre@ineris.fr>

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6 Aufauvre L., Branka R. “French Approval Procedures for Pyrotechnical Automotive Safety Equipment” presentation to International Pyrotechnic Automotive Safety Symposium, Bordeaux, November 22-23, 2005, Proc. (2005), p249-253.

7 Aufauvre Lionel “How to deal with the Essential Safety Requirements of the EU directive on the placing on the market of pyrotechnic articles” presentation to International Pyrotechnic Automotive Safety Symposium, Bordeaux, November 27-28, 2007, Proc. (2007), p173-181.

8 OJ L 269, 21.10.2000, p. 34. Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles.

9 OJ L 212, 7.8.2001, p. 24. Commission Directive 2001/58/EC of 27 July 2001 amending for the second time Directive 91/155/EEC defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations in implementation of Article 14 of European Parliament and Council Directive 1999/45/EC and relating to dangerous substances in implementation of Article 27 of Council Directive 67/548/EEC (safety data sheets).

10 INERIS is also Notified Body for the following EU Directives: 93/15/EEC Explosives for civil uses; 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres; 98/37/EC Machinery; 2004/108/EC - Electromagnetic compatibility; 2006/42/EC - Machinery.