K23001/05

October 1th, 2018

Final

Certification Scheme

Product Certification Scheme for non-pressurized condensed aerosol generators and components used in fixed fire extinguishing systems

Trust
Quality
Progress

Preface

This certification scheme further named as evaluation guideline has been accepted by the Board of Experts Fire Safety, wherein all the relevant parties in the field of for fixed dry aerosol fire extinguishing components are represented. These Boards of Experts also supervises the certification activities and where necessary require the evaluation guideline to be revised. All references to Board of Experts in this evaluation guideline pertain to the above mentioned Boards of Experts.

This evaluation guideline will be used by Kiwa in conjunction with the Kiwa-Regulations for Certification. This regulation details the method employed by Kiwa for conducting the necessary investigations prior to issuing he product certificate and the method of external control. The inspection frequency is determined by the above mentioned Boards of Experts.

This guideline is drawn up and verified by the Technical Workgroup Aerosol which resides under the Board of Experts.

This guideline should be validated by the Board of Experts with a minimal frequency of 5 years.

Information about product of performance requirements based public demands based on European regulation is laid down in chapter 2 of this evaluation guideline.

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Validation
This evaluation guideline has been validated by the Director Certification and Inspection of Kiwa on October 1th, 2018

Information

This evaluation guideline BRL-K23001 shall be used in conjunction with evaluation guideline BRL-K23003.

The evaluation guideline BRL-K23001 covers following aspects;

- Product certification of Condensed Aerosol Generators and separate components.
    - The certification covers the production and the delivery to a certified supplier according evaluation guideline BRL-K23003.

The evaluation guideline BRL-K23003 covers following aspects;

- This is a process certificate for the assessment of the following application areas (i.e. secondary processes in four modules):
    - Basic Design of the system, drafting of specifications
    - Detailed Design of the system, component selection and system design according the Basic Design (engineering).
    - Installation of the fire protection system in accordance with the Basic and Detailed Design and commissioning of the fire extinguishing system.
    - Support and Maintenance. Providing for after care to the customer or end user.

Inspection protocol design, installation, commissioning and servicing is incorporated in BRL-K23003. The implementation protocol is addressed to independent inspection bodies (ISO17020).

General

The intention is that a fire extinguishing system is established according evaluation guideline BRL-K23003. Therefore this system is covered by the entire certification process:

- manufacturing of the condensed aerosol generators and components according evaluation guideline BRL-K23001
- Detailed design and installing of the fire extinguishing system by the certified supplier according evaluation guideline BRL-K23003.

Contents

1 Introduction

1.1 General

This Evaluation Guideline (BRL) contains all relevant requirements on the basis of which Kiwa issues and maintains the Kiwa Product Certificate for condensed aerosol generators and components. Product certification in this Evaluation Guideline is based on IEC/ISO 17065.

This evaluation guideline replaces the following BRL:

BRL	Title	Dated
BRL-K23001/04	Product certificate for fixed dry aerosol fire extinguishing components	2010-07-01

This BRL replaces BRL K23001/04. As of 01-01-2015 any previous versions shall no longer be used for new initial assessments. Holders of current certificates based on older versions of this evaluation guideline shall comply with the new version as of the third audit after commencing date of this BRL K23001/05.

During the performance of the certification work, Kiwa is bound to the requirements as laid down in the chapter “Agreements on the implementation of certification”.

1.1.1 Revision Table

Version	Replaces	Implementation / remark	Commencing date
23001/05	23001/04	ISO15779 and general structure of document	2019-01-01
23001/04	23001/03	CEN/TR15276	2010-07-01
23001/03	23001/02	General enhancement and tests	2004-11-30
23001/02	23001/01	General enhancement and tests	2003-11-04
23001/01	---	Initial version	

1.2 Applicable standards

Applicable standards in this BRL-K23001/05 are:

Standard	Title	Dated
CEN/TR 15276-1*	Fixed fire fighting systems - Condensed aerosol extinguishing systems - Part 1: Requirements and test methods for components	February 2009
ISO 15779	Condensed aerosol fire extinguishing systems - Requirements and test methods for components and system design, installation and maintenance - General requirements	December 2011

* Also see prEN15276-1 in case this certification scheme is referring to CEN/TR 15276-1.

The application of the components for fixed fire extinguishing systems using dry aerosols is a responsibility that belongs to specialists in fire safety.
The design, installation and maintenance are laid down in the Evaluation Guideline for the Kiwa process certificate for design, installation, acceptance and aftercare of fire-extinguishing systems based on aerosol.

The procedures and qualification requirements of technical staff applying these products is also laid down in this evaluation guideline.

This document requires, as a precaution, that the room is evacuated and sealed off whenever a generator is activated. Precautions include evacuation of the proximity area, criteria for re-entering and other safeguards as stated in Clause 5 of CEN/TR 15276-2:2009.

1.3 Terminology

In this Evaluation Guideline the following definitions shall apply:

- Aerosol compound: solid material which is transformed into an aerosol by heat.
- Aerosol: colloidal mixture of a substance and a gas.
- As-received condition: reflects the condition of the product under test; this can be a new product or a product which has been tested according environmental tests in this guideline.
- Assessment matrix: the audit report
- Attachment (of the product certificate or declaration): a product certificate consists of a front page “the certificate” and accompanying pages “the attachment”. The attachment contains the listed tests and the test results. The test results are the declared values by Kiwa
- Board of Experts: the Board of Experts “Fire Safety”;
- BRL: Evaluation or Certification Guideline;
- BRL-K: Certification Guideline of Kiwa Nederland BV
- Colloidal: the condition of materials which are finely divided in a liquid or gas, in particulates larger than a molecule and smaller than those in a suspension.
- Density: concentration (gr/m3)
- Dispersal: ability to spread evenly in a room
- Efficiency calculation: calculation for the determination of the actual produced density (or concentration) in the enclosure by the generator in the enclosure.
- Efficiency: smallest amount of aerosol extinguishing agent, actually produced by the generator in the enclosure, related to the generator’s solid aerosol-forming compound mass
- EN: European standard.
- Evaluation Guideline: arrangements concerning the subject covered by the certification, as agreed by the Board of Experts.
- Fire extinguishing mechanism (chemical): after the activation of the dry fire extinguishing agent it is discharged as a dry aerosol consisting of finely divided particles (e.g. 40% of the mass), specifically alkali salts, and gasses (e.g. 60% of the mass) primarily consisting of nitrogen, carbon dioxide and water vapour. The dry aerosol has a chemical extinguishing action by interfering with the chain reactions in the flames by binding to free radicals as well as a physical extinguishing action by cooling the seat of the fire. Both reactions largely occur at the surface of the microscopically small particulates in the dry aerosol. The smaller the particulates, the more effective the mechanism will be.
- Fire extinguishing system: arrangement of components which are incorporated into a fire extinguishing system. Examples: smoke detectors, fire detectors, manual call points, cables, signals and alarm annunciators, fire extinguishing components and other auxiliary components such as an automated function of doors and ventilation systems.

- Fire extinguishing system: system consisting of a number of components to detect a fire, communicate it to the premises manager and possibly to others, and independently activate other components to extinguish the fire.
- Follow-up assessment: assessment after the initial certificate is issued. This assessment is to verify if the certified products continues to meet the requirements in the evaluation guideline.
- Free-burn time: time for a material to burn freely after pre-burn; fuel-off condition during pre-burn
- Generator family: a generator family can consist of one or more sizes of generators with the same preliminary design.
- Generator type: the type of generator regarding preliminary design. Generator types can be distinguished from each other by preliminary design. Most variations can be found in the cooling system and design of the discharge port.
- Housing; a non-pressurized structure containing the condensed aerosol forming compound and components from which the aerosol is discharged into the surroundings through a discharge port.
- IMO: International Maritime Organisation.
- Initial assessment: assessment to determine if all the requirements defined in the evaluation guideline are met.
- Internal quality monitoring plan: definition of the quality inspections undertaken by the supplier as part of their quality system.
- IQC-scheme: a description of the quality inspections carried out by the supplier as part of his quality system.
- ISO: International Standardization Organization.
- MBO: Dutch senior secondary vocational education qualification.
- MVK: Dutch qualification for intermediate level safety experts.
- NEN: Netherlands standard.
- NFPA: National Fire Protection Association.
- Non-electrical thermal activation device: e.g. thermo cord or similar
- Non-pressurized: compartment or container at normal air pressure
  Note: the 'Supplier' may also be the manufacturer of the certified product(s).
- Pre-burn time: time for a material to be ignited by a (certain amount of) catalyst fuel or gas burner; fuel-on condition during pre-burn.
- Product certificate: a product certificate consists of a front page "the certificate" and accompanying pages "the attachment". The attachment contains the listed tests and the test results regarding the product. The test results are the declared values by Kiwa
- Product declaration: a product declaration consists of a front page "the declaration" and accompanying pages "the attachment". The attachment contains the performed tests and the test results regarding the product. The test results are the declared values by Kiwa and do not imply any type of "certification" according the applicable standard.
- Product under test: samples for testing
- Solid Aerosol forming Compound: solid material which is transformed into an aerosol by heat.
- Supplier: the party responsible for ensuring that the products continuously fulfil the requirements on which the certification is based;
- Test protocol: document regarding the assessment and testing according this guideline; the test protocol shall be validated by all involved parties
- Test protocol: document regarding the assessment and testing according this guideline; the test protocol shall be validated by all involved parties
- Total pre-burning time: combined time of pre-burn and free-burn

1.4 Field of application

The condensed aerosol generators and components consist of a bracket, housing, Solid Aerosol forming Compound and an activator which upon activation is

discharges the compound in the form of an aerosol which extinguishes the fire. They are intended for incorporation into a fire extinguishing system. The condensed aerosol generators are activated by the fire detection system. The arrangement of components is called the aerosol fire extinguishing system.

A general explanation of aerosol is:
- Solid Aerosol forming Compound : solid material which is transformed into an aerosol by heat.
- Aerosol: colloidal mixture of a substance and a gas.
- Colloidal: the condition of materials which are finely divided in a liquid or gas, in particulates larger than a molecule and smaller than those in a suspension.

Other names for the Solid Aerosol forming Compound are i.e. Solid Fire Extinguishing Agent, Solid Bound Compound or Aerosol Compound.

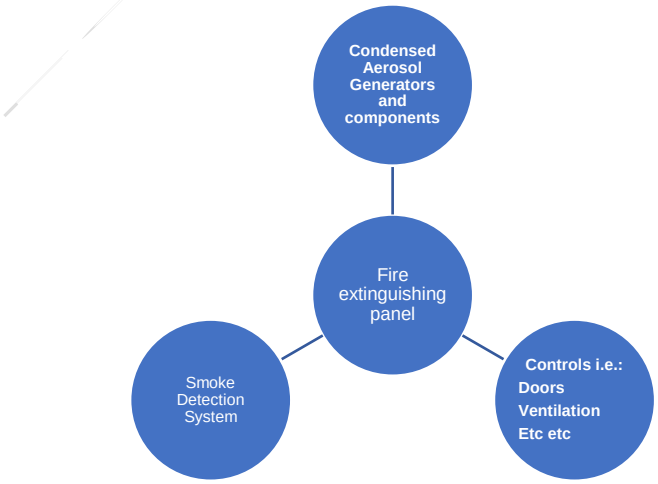
The condensed aerosol generators shall be (minimal) capable to extinguish fires of the following classes according EN 2:
- Class A (solid materials);
- Class B (liquid materials).

The application of fire extinguishing systems using condensed aerosol generators is a responsibility that belongs to specialists in fire safety. The design, installation and maintenance and the procedures and qualification requirements for technical staff, working with and applying these products, is laid down in this evaluation guideline and evaluation guideline BRL-K23003.

This document requires, as a precaution, that the room is evacuated and sealed off whenever a generator is activated. Precautions include evacuation of the proximity area, criteria for re-entering and other safeguards as stated in EN12094-1, Clause 5 of CEN/TR 15276-2:2009 and paragraph 5.1 of NEN-ISO 15779:2011.

1.4.1 Scope of BRL-K23001 and BRL-K23003

Scope of BRL-K23001: manufacturing and certification of Condensed Aerosol Generators and components
Scope of BRL-K23003: basic design, detailed design, installing and maintenance of the aerosol fire extinguishing system.



Aerosol fire extinguishing system according evaluation guideline BRL-K23003.

1.5 Tests for certification by Kiwa

Condensed Aerosol Generators intended to comply with this guideline shall be tested according the tests described in this guideline (if applicable).

1.5.1 Additional testing according a standard or guideline

Additional testing is possible for a wider scope and application. Additional to the tests in paragraph 1.5 are the tests described in this paragraph and paragraph 1.5.2

The additional tests will be listed in the attachment of the product certificate.

Possible tests are:

- Class B (large liquid fires);
  - See 2.21
- Class C (gasses);
  - See 2.22
- Class F (Cooking oils and fats);
  - See 2.23

1.5.2 Additional listing according a standard or guideline

Additional listing is possible for a wider scope and application.

The additional tests will be listed in the attachment of the product declaration.

Possible standards or guidelines are:

- MSC.1/Circ.1270 based on IMO-regulations.
  - See 2.24
- UL subject 2775, outline of investigation for fixed condensed aerosol extinguishing system units, November 5, 2008
  - See 2.25
- NFPA 2010, Standard for Fixed Aerosol Fire-Extinguishing Systems, 2010 Edition
  - See 2.26

1.5.2.1 Remarks additional listing

Additional listing in the attachment of the Kiwa product declaration does not imply any type of certification according the applicable standard. It provides in information for the end-user or local authorities about the results of performed tests under supervision of Kiwa.
Also, the Kiwa product declaration does not imply any type of certification according the full applicable standard. Typically, the Kiwa product declaration is based on parts of a guideline or standard.

1.6 Comparison of fire classes

Comparison of fire classes			
Europe	**America**	**Australia & Asia**	**Fuel/Heat source**
Class A	Class A	Class A	Ordinary combustibles
Class B	Class B	Class B	Flammable liquids
Class C		Class C	Flammable gases
Class A/B/C	Class C	Class E	Electrical equipment
Class D	Class D	Class D	Combustible metals
Class F	Class K	Class F	Cooking oils and fats

Note:

- Applicable for America, Europe and Australia & Asia:
  - Melting plastics are assigned to Class A.
- Applicable for Europe:

- Fires ignited due to electrical short-circuits cause Class A, B or C fires. This is because when the power supply is turned off an electrical fire falls into one or more of the other classes.

1.7 Parts of a Condensed Aerosol Generator

The Condensed Aerosol Generator typically consists of the following parts:

- Housing;
- Mounting device;
- Solid Aerosol forming Compound ;
- (electrical) activator;
- Cooling material;
- packaging;
- instruction manual

The required parts to build an aerosol generator are specified in:

- Paragraph 1 and 4 of CEN/TR 15276-1

There are requirements for all parts and for the assembled product, which are described in this evaluation guideline.

1.8 Requirments and assesments methods

This Evaluation Guideline defines requirements and assessment methods, including:

1.8.1 Requirements SMART

Performance requirements are:

- quantitative requirements concerning specified functional properties of the component , the Condensed Aerosol Generator , defining a limit which can be unambiguously calculated or measured.

Product requirements are:

- quantitative requirements concerning identifiable properties of the products used in the Condensed Aerosol Generator, defining a limit which can be unambiguously calculated or measured.

Performance requirement testing and Product requirement testing provide in unambiguously calculable data and therefor need to be SMART:

- **S**pecific
- **M**easurable
- **A**ttainable
- **R**elevant
- **T**imed

The requirements in this guideline are very **S**pecific, describing both the scenario in which the Condensed Aerosol Generator is being used, and the particular part of the application, namely i.e. the activator or condensed aerosol, that needs to meet the requirement. Furthermore, the requirement is easily **M**easured and **A**ttainable with the proper hardware. It is **R**elevant to the user, and it can be effectively **T**imed.

1.8.2 Assessment methods

Initial assessment: assessment to determine if all the requirements defined in the evaluation guideline are met.

Follow-up assessment: assessment undertaken after the issue of the certificate to verify if the certified products continue to meet the requirements of the evaluation guideline.

The assessment matrix (audit report) indicates what is assessed by Kiwa during the initial and follow-up assessments and how frequently follow-up assessments are undertaken.

1.9 Acceptance of test reports provided by the supplier or third party

When reports from conformity assessment bodies are delivered by the manufacturer in order to demonstrate that the product meets the requirements of this certification scheme, the conformity assessment bodies shall meet one of the applicable accreditation norms, namely;

- EN-ISO/IEC 17020 for inspection bodies;
- EN-ISO/IEC 17065 for certification bodies who certifies products;
- EN ISO/IEC 17021 for certification bodies who certifies management systems;
- EN-ISO/IEC 17024 for certification bodies who certifies persons.

When reports from conformity assessment ~~bodies or~~ test laboratories are delivered by the manufacturer in order to demonstrate that the product meets the requirements of this certification scheme, the conformity assessment test laboratory shall meet the applicable accreditation norm~~s~~, namely;

- EN-ISO/IEC 17025 and furthermore;
- Tests shall be performed and data collected under the supervision of qualified Kiwa personnel. Typically, Kiwa will witness all testing.
- The rules for acceptance of test reports provided by the supplier, or third parties, are laid down in the Kiwa Regulation for Certification.
- Generally this means that Test Reports issued by other accredited Institutes within the EAC-MRA or ILAC-MRA agreement framework can be accepted after a positive review by Kiwa.

The bodies are being considered to comply with this criteria when a certificate of accreditation can be shown, either issued by the National Board of Accreditation or one of the bodies with which have an European Agreement of mutual acceptance.

The accreditation shall refer to the examination as required in this certification scheme. When no certificate of accreditation can be shown, Kiwa will verify whether the accreditation norm is fulfilled or redo the assessment in question itself.

1.10 Certificate

A model of the certificate, to be issued based on this Evaluation Guideline, is included as Annex 1.

1.11 Verbal forms

In this guideline, the following verbal forms are used:

- “shall” indicates a requirement;
- “should” indicates a recommendation;
- “must” indicates a requirement;
- “may” indicates a permission;
- “can” indicates a possibility or a capability.
- “normative” indicates a requirement;
- “informative” indicates a recommendation.

2 Product requirements and test methods

2.1 General

The requirements to which products have to comply are admitted in the next chapters.

Chapter 2 explains when assessments or type tests have to be undertaken as part of the initial assessment or type test. Chapter 4 explains when assessments or tests have to be made during manufacturing operations as part of the internal quality monitoring efforts of the supplier.

This chapter 2 contains the performance requirements to be met by the fire extinguishing component and the methods to determine if the requirements are fulfilled.

All fire classes are according EN2 unless otherwise stated.

2.2 Products under test

The product under test are the samples for testing. They should be from the same batch. Products under test can be:

- Condensed Aerosol Generators, as a complete product
- Activators, as a complete product

2.2.1 Number of products under test

The number of products under test are described as follows:

- A minimum of [x] generators in each size within a family
  - Explanation: all types and all sizes shall be tested
- A minimum of [x] generators in the smallest and largest size within a family
  - Explanation: only the smallest and the largest generator size within a family shall be tested
- A minimum of [x] generators within a family shall be tested.
  - Explanation: only a specified type and number of generators within a family shall be tested

[x] specific number according standard or this guideline.
Generator family; a group of generators with same aerosol compound, same kind of cooling device, same kind of discharge outlet, same ignition device, same layout and same internal/external architecture

2.2.2 Documentation of the test

The typical chronologic order for the documentation of the assessment and testing according this guideline is as follows:

- Drafting of a test protocol
  - Assessment and testing according the test protocol
- Listing of the results of the assessment in the test report
- Listing of the results of the testing in the attachment of the product certificate.

2.3 Pre-burning time and method (changes made in comparison with standards)

Changes were made in this guideline to improve protection or will help clarify the use and limitations

Pre-burning according		
CEN/TR 15276-1, Annex A	**ISO 15779, Annex D.**	**Remark on time or method**
A.5.1	D.5.1	No remark
A.5.2	D.5.2	No remark
A.6.1	D.6.1	Objective is clarify the use and limitations. The extinguishment of a woodcrib with a pre-burning time of 6 minutes (3+3 minutes) is outside the scope of an aerosol fire extinguishing system. Therefore the following pre-burn time **shall** be used: • 2 minutes (2+0 minutes). The total pre-burn time for these tests **should** also be: • 4 minutes (3+1 minutes)
A.6.2	D.6.2	No remark
A.6.3	D.6.3	The text regarding the catalyst fuel and pre-burn time shall be supplemented by the following: The pre-burn time shall be no less than 210 seconds. Therefor the quantity of catalyst fuel can or shall deviate from the quantity stated in the standards. This will provide in a pre-burn time as desired. Note: It's a known fact that polymeric materials are difficult to ignite but will burn vigorously ones ignited.
n/a	D.6.4	No remark Note: pre-burn time is 2 minutes according standard
A.6.4	n/a	The text regarding the catalyst fuel and pre-burn time shall be supplemented by the following: The pre-burn time shall be no less than 3 minutes. Therefor the quantity of catalyst fuel can or shall deviate from the quantity stated in the standards. This will provide in a pre-burn time as desired. Note: It's a known fact that composite woods are difficult to ignite but will burn vigorously ones ignited.
n/a	D.7	No remark

Explanation of pre-burning time for tests A.6.1 and D.6.1:

- 2 minutes (2+0 minutes).
  - 2 minutes reflects the total pre-burning time
  - 2 reflects the burning time of the catalyst fluid
  - 0 reflects the free burning time
- 4 minutes (3+1 minutes)
  - 4 minutes reflects the total pre-burning time
  - 3 reflects the burning time of the catalyst fluid
  - 1 reflects the free burning time
- 6 minutes (3+3 minutes)
  - 6 minutes reflects the total pre-burning time
  - 3 reflects the burning time of the catalyst fluid
  - 3 reflects the free burning time

Explanation of pre-burning time for tests A.6.3 and D.6.3:

- 210 seconds (210+0 seconds).
  - 210 seconds reflects the total pre-burning time
  - 210 reflects the burning time of the catalyst fluid
  - 0 reflects the free burning time

Explanation of pre-burning time for tests A.6.4:

- 6 minutes (3+3 minutes)
  - 6 minutes reflects the total pre-burning time
  - 3 reflects the burning time of the catalyst fluid
  - 3 reflects the free burning time

2.3.1 Catalyst fuel specifications

The catalyst used for the pre-burning purpose in this guideline shall be a commercial grade n-Heptane (further revered to as “heptane”)

Commercial grade n-Heptane criteria		
Part	**Specific part**	**Remark / number**
Distillation	Initial boiling point	90 °C minimum
	Dry point	100 °C maximum
Density	at 15,6 °C	700 ± 50 kg/m3
MSDS	CAS #	142-82-5
	EINECS #	205-563-8

Extinguishing factor and Agent distribution, Class A and B

Objective of test
The objective of the test is the consideration regarding the intended use and limitations of the extinguishing system in an enclosure

Performance requirements	
CEN/TR 15276-1, Annex A	ISO 15779, Annex D.

The test method is described in table 1 and shall meet the requirements.

Table 1

Test objective	Enclosure size	Test fires	Test in accordance with	
			See CEN/TR	See ISO
Aerosol generator distribution verification	To suit aerosol generator's unit size	Heptanes test pans	A.5.1	D.5.1
Min. Height/max protected volume and distance **Max. Height/Max protected volume and distance**		Heptanes test pans	A.5.2	D.5.2
Extinguishing factor	≥ 100 m^3 No side less than 4m, height: not less than 3,5m	(a) Wood crib	A.6.1	D.6.1
		(b) N-heptane pan	A.6.2	D.6.2
		(c) Polymeric sheet (i) PMMA (ii) Polypropylene (iii) ABS	A.6.3	D.6.3
		(d) Class A Compatible wood crib test	n/a	D.6.4
		(e) Composite wood	A.6.4	n/a
Hold time	≥ 100 m^3 No side less than 4m, height: not less than 3,5m	n-heptane pan	n/a	D.7

The extinguishing factor found with the test for polymeric sheets (c) and composite wood (e) **should (see 2.3)** be applied for the wood crib test (a) and the Class A Compatible wood crib test (d). In case the wood crib test (a) and the Class A Compatible wood crib test (d) fails with the applied extinguishing factor for polymeric sheets (c) and composite wood (e), the extinguishing factor shall be determined for the wood crib test (a) and the Class A Compatible wood crib test (d).

In general:
If necessary, amend the extinguishing factor and repeat the test until three successive, successful extinguishments are achieved.

The manufacturer shall indicate which density shall be used according:

- Fire Class and applicable test,
- Commodity Class,
- Storage configuration.

and shall be listed in the manual.

In the tests described in

- CEN/TR 15276-1; A.5.1, A.5.2, and
- ISO 15779; D.5.1, D.5.2

the same extinguishing factor shall be used as in the tests described in

- CEN/TR 15276-1; A.6.2 and
- ISO 15779; D.6.2

Positioning of the generator
For the extinguishing tests described in • CEN/TR 15276-1; A.6.1, A.6.2, A.6.3, A.6.4, and • ISO 15779; D.6.1, D.6.2, D.6.3, D.6.4 jet energy from the discharge outlets shall not influence the development of the fire or the extinguishment of the fire. Therefore the discharge outlets shall be directed away from the fires or in the most unfavorable position

Number of product under test and remarks
• The number of aerosol generators shall be sufficient to provide the needed extinguishing density in the test enclosure. • The number of generators for agent distribution determination in table 1 will depend upon the installation limitations of each generator within a family. • A minimum of three generators in each size within a family shall be tested for the minimum height/maximum coverage test in A.5.1 and D.5.1. • A minimum of three generators in each size within a family shall be tested for the maximum height test in A.5.2 and D.5.2. • The number of generators and generator size for the extinguishing application density determination in table 1 will depend upon the area coverage limitations and generator efficiency.

The generator efficiency shall be calculated according 2.30 for each test.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate. • The attachment shall be specific about the results for the wood crib and the Class A Compatible wood crib test.

2.4 Discharge time

Objective of test
The objective of the test is the determination of the time (in sec) required by the generator to discharge the SFEA in the generator into the enclosure

Performance requirements as described in	
CEN/TR 15276-1 paragraph 7.6 (refers to 7.16)	ISO 15779 paragraph C.16.1
Remark	
The discharge time shall be tested together with the aerosol flow temperature test and casing temperature test in: • CEN/TR 15276-1; 7.16.2 and 7.16.3 • ISO 15779; C.16.2 and C.16.3.	

Positioning of the generator

No remark

Number of product under test
• A minimum of five generators in each size within a generator family shall be tested in the as-received condition.
Remark
• As-received condition: reflects the condition of the product under test; this can be a new product or a product which has been tested according environmental tests in this guideline.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.5 Temperature and humidity operation ranges

Objective of test
The objective of the test is to demonstrate the ability of the generators to function correctly at high relative humidity with condensation

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.7	ISO 15779, paragraph C.7
Remark	
The test shall include the Low Temperature test as described in CEN/TR 15276-1, paragraph 7.7.3 and ISO 15779, paragraph C.7.3 The mounting bracket shall be tested together with the generator	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.6 Accelerated ageing test (Service life period of 5 or 10 years)

Objective of test
The objective of the test is to demonstrate the ability of the generators to function correctly during the service life period

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.8	ISO 15779, paragraph C.8
Remark	
The test shall be performed on fully assembled condensed aerosol generators The mounting bracket shall be tested together with the generator	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.6.1 Accelerated ageing test (Service life period of 15 years)

Objective of test
The objective of the test is to demonstrate the ability of the condensed aerosol generators to function correctly during the service life period of 15 years. Note: The service life period includes the storage and installation life period for the product.

Performance requirements
The service life period is determined by thermal aging. The condensed aerosol generator and activator is tested in its original housing. The aerosol generator is placed in a temperature controlled room in which the temperature can be cycled (aging cabinet). The following test is then undertaken: The aging cabinet is set to -10 °C and 50 °C (± 2 °C) and alternates between these temperatures every 4 hours. Once cycle amounts to a full transition from -10 °C to 50 °C, and then back to -10 °C within 8 hours. Fifty cycles are completed, after which the fire extinguishing performance of the agent is determined in accordance with section 2.14
Remark
Service life period of 15 years if stored in a dry, non-corrosive environment. The test shall be performed on fully assembled condensed aerosol generators. The mounting bracket shall be tested together with the generator.

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
• This test is used for several materials of construction. The stability of the molecular structure of the material is tested by the temperature cycles. During each cycle the material passes the dew point which will lead to condensation on the exterior of the object. During the cold period this may lead to freezing in hairline cracks in the material which may affect the structure of the material. In use the components are not exposed to rain, i.e. they are not exposed to a full water load, but they may be affected by condensation, which is simulated by this test. This thermal aging method is adopted in several standards to obtain information about the long-term behaviour of materials in the short term. The effect of this on the fire extinguishing performance is realistic and functional. • This test replaces the test according 2.7 and 2.8

Documentation of the test

• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.7 Shelf life and storage conditions

Objective of test
The objective of the test is to demonstrate the ability of the generators to function correctly during the service life period which includes the storage and installation life period for the product.

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.7 CEN/TR 15276-1, paragraph 7.8	ISO 15779, paragraph C.7 ISO 15779, paragraph C.8
Remark	
The test shall be performed on fully assembled condensed aerosol generators The mounting bracket shall be tested together with the generator The humidity range shall be verified by the **temperature and humidity** operation range tests. The temperature range shall be verified by the **accelerated aging** test.	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate. • The shelf life and storage conditions shall be specified by the manufacturer in the manual.

2.8 Corrosion

2.8.1 Corrosion test

Objective of test
The objective of the test is to demonstrate the degree of resistance to corrosion of the materials used for the manufacturing of the generators

Corrosion test	
Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.9	ISO 15779, paragraph C.9
Remark	
The test shall be performed on fully assembled condensed aerosol generators The mounting bracket shall be tested together with the generator	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.8.2 Stress corrosion test

Objective of test
The objective of the test is to demonstrate the degree of resistance to corrosion of the materials used for the fully assembled condensed aerosol generators. • This test is to be conducted only on generators using copper alloys. The stress corrosion test is to be conducted unless it can be shown that the materials used in the construction are not susceptible to ammonia stress corrosion.

Stress corrosion test	
Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.10	ISO 15779, paragraph C.10
Remark	
The test shall be performed on fully assembled condensed aerosol generators The mounting bracket shall be tested together with the generator	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.9 Vibration

Objective of test
The objective of the test is to demonstrate the degree of resistance to vibration of the materials used for the fully assembled condensed aerosol generators.

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.11	ISO 15779, paragraph C.11
Remark	
The mounting bracket shall be tested together with the generator	

Number of product under test

• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.10 Mechanical shock

2.10.1 Impact test

Objective of test
The objective of the test is to demonstrate the degree of resistance to an impact of a foreign object on the surface of the fully assembled condensed aerosol generators.

Impact test	
Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.12	ISO 15779, paragraph C.12

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.10.2 Drop test

Objective of test
The objective of the test is to demonstrate the degree of resistance to a drop on a solid base surface of the fully assembled condensed aerosol generators.

Drop test	
Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.13	ISO 15779, paragraph C.13
Remark	
The mounting bracket shall **not** be tested together with the generator The fully assembled condensed aerosol generators shall be tested without packaging or wrapping	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark

•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.11 Discharge temperature

Objective of test
The objective of the test is to determine the minimum safe distance to a • Human or animal (75°C), • Inflammable material (200°C) or • Structure or construction (400°C) of the mounted condensed aerosol generator.

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.14	ISO 15779, paragraph C.16.1
Remark	
The discharge temperature shall be tested together with the discharge time and casing temperature tests as described in CEN/TR 15276-1, paragraph 5.11 and ISO 15779, paragraph C.16.1 and C.16.3.	

Number of product under test
• A minimum of five generators in each size within a family shall be tested in the as-received condition.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.12 Activator device

Objective of test
The objective of the test is to determine the ability of the activator device to ignite the generator at the most disadvantageous operating conditions.

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.15	ISO 15779, paragraph C.15
Remark	
All activation devices or activation solutions shall be tested unless: • Activators or specific parts of activators with reliable test data and already certified by authority for ignition reliability will be not re-tested or • The activation device is a commercially/military available component with reliability test data, this data may be used to satisfy this requirement. Both possibilities at the discretion of Kiwa.	

Number of product under test

• 25 samples of the complete ignition devices shall be tested and operate as intended according CEN/TR 15276-1 • 200 samples of the complete ignition devices shall be tested and operate as intended according ISO 15779
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.13 Function reliability

Objective of test
The objective of the test is to determine the: • discharge time, • discharge temperature or aerosol flow temperature and • outer casing temperature of the fully assembled condensed aerosol generators.

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.16	ISO 15779, paragraph C.16
Remark	
The function reliability test consists the following three tests: • discharge time test, • discharge temperature or aerosol flow temperature test and • outer casing temperature test. As described in: • CEN/TR 15276-1; 7.16.1, 7.16.2 and 7.16.3 • ISO 15779; C.16.1, C.16.2 and C.16.3.	

Number of product under test
• A minimum of five generators in each size within a family shall be tested in the as-received condition.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.14 Temperture Exposure Test (optionel with requirment)

2.14.1 Heat Exposure test

Objective of test
The objective of the test is to demonstrate the safe operation of the fully assembled condensed aerosol generator after its exposure to an external fire simulating a realistic accident.

Heat Exposure test
Performance requirements as described in

CEN/TR 15276-1, paragraph 7.17	ISO 15779, N/A
Remark	
The test as describe is related to the Fire Exposure test according ISO 15779, paragraph C.17 but not identical	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.14.2 Fire Exposure test

Objective of test
The objective of the test is to demonstrate the safe operation of the fully assembled condensed aerosol generator after its exposure to an external fire simulating a realistic accident.

Fire Exposure test	
Performance requirements as described in	
CEN/TR 15276-1, N/A	ISO 15779, paragraph C.17
Remark	
The test as describe is related to the Heat Exposure test according CEN/TR 15276-1, paragraph 7.17 but not identical	

Number of product under test
• A minimum of three generators in the smallest and largest size within a family shall be tested.
Remark
•

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.15 Explosive atmosphere test (optionel with requirment)

Objective of test
The objective of the test is to demonstrate the safe operation of the fully assembled condensed aerosol generator inside a potentially explosive atmosphere.

Performance requirements as described in	
CEN/TR 15276-1, paragraph 7.18 / A.7	ISO 15779, N/A
Number of product under test	
• A minimum of three generators within a family shall be tested.	
Remark	

- For safety reasons CEN/TR 15276-1, paragraph A.7.1.1.1 part a) is **not** applicable.
- The test enclosure shall meet the dimensions (volume) to fit the largest generator
- The test enclosure shall be equipped with a pressure relief mechanism
- The pressure relief mechanism design shall be in accordance with the expected rise of pressure testing the largest generator
- The pressure relief mechanism design shall be in accordance with the expected force generated by an explosion (if occurs)

Note:
- The pressure relief mechanism will influence the explosive atmosphere

Therefor the following statement will be applicable to the test:
-

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.16 Rigidity and activation of the Aerosol compound

Objective of test
The objective of the test is to demonstrate the ability of the aerosol compound to maintain its rigidity at temperatures from -50°C to 200°C and remain capable of being ignited by the electrical and thermal activators.
Number of product under test
• The compound shall be tested according 2.16.1, 2.16.2, 2.16.3 and 2.17 • The compound shall be from different badges • The compound shall be the standard size for the generator type • A minimum of three pieces of compound in the smallest and largest size within a family shall be tested, unless: ○ the standard size for the generator type is the same for the different types and/or families • The electrical activator shall be the standard activator for the generator type and family
Remark
• Activators shall be tested according 2.13 • Thermocouples shall be used for recording temperature

2.16.1 Test method 1

Test procedure
The aerosol compound and the activator shall be conditioned for 24 hours at -50°C. After this period the aerosol compound is removed from the stove and shall not fragment. Within 1 minute of the removal from the stove, the aerosol compound shall be ignited by the activator in a room at ambient temperature. The aerosol compound shall ignite immediately.
Remark
• The aerosol compound shall be submitted to the test outside the container with no other parts involved then the activator. • After conditioning the determination of fragmentation and ability to ignite are 2 separate tests
Pass / fail criteria
• The aerosol compound shall not fragment • The aerosol compound shall ignite immediately.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.16.2 Test method 2

Performance requirements
The aerosol compound and the activator shall be conditioned for 24 hours at -50°C. After this period the aerosol compound is removed from the stove and shall not fragment. The aerosol compound shall be conditioned at ambient temperature for 24 hours. The aerosol compound shall be ignited by the activator in a room at ambient temperature.
Remark
• The aerosol compound shall be submitted to the test outside the container with no other parts involved then the activator. • After conditioning the determination of fragmentation and ability to ignite are 2 separate tests
Pass / fail criteria
• The aerosol compound shall not fragment after being conditioned at -50°C and after being conditioned for 24 hours at ambient temperature. • The aerosol compound shall ignite immediately after being conditioned for 24 hours at ambient temperature.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.16.3 Test method 3

Performance requirements
The aerosol compound and the activator shall be conditioned for 24 hours at -50°C. After this period the aerosol compound is removed from the stove and shall not fragment. The aerosol compound shall be conditioned at ambient temperature for 1 hours. After 1 hour the temperature of the aerosol compound is increased by 10°C every 10 minutes up to a temperature of 200°C. The aerosol compound is then conditioned for 24 hours at a temperature of 200°C. Within 1 minute of the removal from the stove, the aerosol compound shall be ignited by the activator in a room at ambient temperature.
Remark
• The aerosol compound shall be submitted to the test outside the container with no other parts involved then the activator. • After conditioning the determination of fragmentation and ability to ignite are 2 separate tests
Pass / fail criteria
• The aerosol compound shall not fragment after being conditioned at -50°C • The aerosol compound shall ignite immediately after being conditioned for 24 hours at a temperature of 200°C.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.17 Auto activation of Aerosol compound

Objective of test
The objective of the test is to demonstrate the quality, rigidity and consistency of the aerosol compound

Performance requirements
The aerosol compound and the activator shall be conditioned for 24 hours at -50°C. After this period the aerosol compound shall be positioned in an oven and heated up to a temperature of 150°C. After reaching 150°C the temperature shall be increased in steps of 10°C. Once a temperature stage is reached, it shall be maintained for 10 minutes.
Remark
• The aerosol compound shall be submitted to the test outside the container • The compound shall also be tested according 2.16
Pass / fail criteria
• The aerosol compound shall not fragment after being conditioned at -50°C • The aerosol compound shall demonstrate auto activation between a temperature of 250°C and 350°C.

Number of product under test
• A minimum of three samples of aerosol compound in the smallest and largest size within a family shall be tested.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.18 Auto activation of non-electrical thermal activation device

Objective of test
The objective of the test is to demonstrate the quality, rigidity and consistency of the non-electrical thermal activation device.

Performance requirements
The non-electrical thermal activation device is stored at -50°C. After this period the non-electrical thermal activation device is removed from the store and shall not fragment. The temperature of the non-electrical thermal activation device is then increased in steps of 10°C. Once a temperature stage is reached, it shall be maintained for at least 10 minutes. Above 150°C the temperature steps shall be decreased into steps of 5°C.
Remark
• The non-electrical thermal activation device shall be submitted to the test outside the aerosol generator (or not installed) • Note: The non-electrical thermal activation device can contain a binder whose function may be impaired at low temperatures. Specifically when it is based on aerosol compound.   ○ In case this does not comply to the product, execute the test as described in 2.13
Pass / fail criteria
• The non-electrical thermal activation device shall not fragment after being conditioned at -50°C • The non-electrical thermal activation device shall demonstrate auto activation between the temperatures specified by the manufacturer.

Number of product under test

• 25 samples of the non-electrical thermal activation device shall be tested and operate as intended according and in analogy with CEN/TR 15276-1 • 200 samples of the non-electrical thermal activation device shall be tested and operate as intended according and in analogy with ISO 15779

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.19 Fixing system or mounting bracket of the aerosol generator

Objective of test
The objective of the test is to demonstrate the stability and rigidity of the fixing system or mounting bracket of the aerosol generator
Performance requirements
• It shall be possible to install the aerosol generator to the ceiling, wall or floor of the enclosure concerned. • The fixing system or mounting bracket of the aerosol generator (minimum 100 g) shall be able to withstand a load equivalent to the weight of the aerosol generator multiplied by a factor of five. The fixing system or mounting bracket shall be installed on a wall or ceiling in accordance with the supplier's instructions. A weight of at least five times the weight of the actual aerosol generator is secured to the fixing system or mounting bracket. This shall be maintained for 10 minutes.
Remark
• The fixing system or mounting bracket shall **not** be tested together with the aerosol generator • During the test the screws, plugs and the physical condition of the ceiling are not directly tested. The fire extinguishing system is intended for a rapid response and extinguishing action. Maintaining it's functionality for more than e.g. 15 minutes of the fixing system or mounting bracket is not relevant. The extinguishing action will always occur (see 2.17). A higher temperature due to the activation which results in thermal stress on the fixing system is assessed during the fire extinguishing performance tests.
Pass / fail criteria
• The fixing system or mounting bracket of the aerosol generator shall withstand a load equivalent to the weight of the aerosol generator multiplied by a factor of five without visible distortion.

Number of product under test
• A minimum of three fixing systems or mounting brackets in the smallest and largest size within a family shall be tested.

Documentation of the test
• The result of the assessment and tests shall be listed in the attachment of the product certificate.

2.20 EN2, Class B, large liquid fires (additional testing)

The performance requirement for large liquid fires of the fire extinguishing component is determined following The solid fire extinguishing system shall meet the assessments for Class B according to EN2.

Test method

The test objective is a liquid fire in a test room of 1250 m^3. The room shall have the following minimum dimensions: height 8 m, width 8 m, depth 12 m. These dimensions shall be scaled up to 1250 m3. Central in the room is a steel fire pan positioned of 1.8 x 1 m and a height of 10 cm.
The fire pan shall contain a layer of 45 l heptane on 5 cm of water with a burning time of at least 5 minutes and a power of approx. 6 MW. The pan shall be placed on the floor.

The fire extinguishing components shall be suspended in accordance with the supplier's specifications and distributed as specified by the supplier. The fire cell shall be placed at the edge of the radius of the design extinguishing area.

The heptane shall be ignited for each test and have a free burning time of 30 seconds. After the end of the activation of the fire extinguishing agent the room shall remain closed for at least 10 minutes. During this period the cell shall be monitored for signs of active fire and signs of spontaneous activation, based on the temperature measurements in the vicinity of the fire cell.

After this period the cell shall be inspected visually for signs of active fire and signs of active activation outside the test room without the presence of the fire extinguishing agent. Any signs of fire shall be described in the report. The temperature after extinguishing shall be decisive. Visible fire is considered as a sign of spontaneous activation, but solely smoke is not**.**

The result of the assessment and tests shall be declared in the attachment of the product certificate.

Note: it is possible to test other fuels. Fuel quantity shall be altered to achieve a power of approx. 6 MW.

2.21 EN2, Class C, fires gas (additional testing)

The performance requirement for gas fires of the fire extinguishing component is determined following The solid fire extinguishing system shall meet the assessments for Class C according to EN2.

Test method
A triangular sand bed burner to EN13283 filled with two layers of sand and gravel.
A controlled volume of propane gas is blown through the sand bed burner.
After activation the propane gas shall have a thermal power of 30 kW. The total burning time shall be 2 minutes.

The objects to be extinguished shall be placed in the centre of the test room at floor level. The fire extinguishing components shall be suspended in accordance with the supplier's specifications and distributed as specified by the supplier.

After the end of the activation of the fire extinguishing agent the room shall remain closed for at least 10 minutes. During this period the cell shall be monitored for signs of active fire and signs of spontaneous activation, based on the temperature measurements in the vicinity of the fire cell.

After this period the cell shall be inspected visually for signs of active fire and signs of active activation without the presence of the fire extinguishing agent. Any signs of fire shall be described in the report. The temperature after extinguishing shall be decisive. Visible fire is considered as a sign of spontaneous activation, but solely smoke is not.

The gas burner shall have a thermal cut-out which independently interrupts the flow of gas when the burner is extinguished.

The result of the assessment and tests shall be declared in the attachment of the product certificate.

2.22 EN2, Class F, Cooking oils and fats (additional testing)

The performance requirement for fat fires of the fire extinguishing component is determined following The solid fire extinguishing system shall meet the assessments for Class F according to EN2.

Test method

A steel pan with a diameter of 38 cm and a depth of 30 cm is filled with approx. 15 kg of solid deep-frying fat (Ossewit brand). The pan is placed on a metal frame with a propane burner underneath it which heats the steel pan from the bottom. The fat is heated to the auto activation temperature (approx. 320°C). After activation the fat shall have a total free burning time of 30 s.

The object to be extinguished shall be located at one side of the test room, above floor level. The top of the steel pan shall be 60 to 65 cm above the floor.
A metal extractor hood with an area of 0.8 m^2 (minimum dimensions 1 x 0.5 m) shall be suspended above the steel pan. The extractor hood shall be approx. 1.4 m above the floor.

While the pan is being heated the flue gasses and grease fumes shall be extracted by the hood.
After activation of the pan and before extinguishing, the flue gas duct shall be closed and the extractor fan motor shall be switched off.

The fire extinguishing components shall be suspended in accordance with the supplier's specifications and distributed as specified by the supplier.

After the end of the activation of the fire extinguishing agent the room shall remain closed for at least 30 minutes. During this period the cell shall be monitored for signs of active fire and signs of spontaneous activation, based on the temperature measurements in the vicinity of the fire cell.

After this period the cell shall be inspected visually for signs of active fire and signs of spontaneous activation. The temperature shall have fallen below the auto activation temperature.
Any signs of fire shall be described in the report. Visible fire is considered as a sign of spontaneous activation, but solely smoke is not.

The gas burner shall be turned off after the auto activation of the fat in the pan.

The result of the assessment and tests shall be declared in the attachment of the product certificate.

2.23 Classfication according MSC.1/Circ.1270 (additional listing)

The performance requirements for the aerosol are described in MSC.1/Circ.1270, appendix 1.

The test methods are described in MSC.1/Circ.1270, appendix 1 and shall meet the requirements.

The result of the assessment and tests shall be declared in the attachment of the product certificate. The classification in the attachment is according to MSC.1/Circ.1270, appendix A4.

2.24 Qualification according UL 2775 (Additional listing)

The performance requirements for the aerosol are described in UL2775.

The relevant test methods for dry condensed aerosols are described in UL2775 paragraphs 20 until 60 and shall meet the requirements.

The result of the assessment and tests shall be declared in the attachment of the product certificate.

2.25 Qualification according NFPA 2010, 2010 Edition (Additional listing)

The performance requirements for the aerosol are described in NFPA 2010.

The relevant test methods for dry condensed aerosols are **not** described in NFPA 2010. The extinguishing application density shall be determined by test as part of a listing program or as otherwise required by the authority having jurisdiction.

The result of the assessment and tests shall be declared in the attachment of the product certificate.

2.26 Documentation

The requirements for the documentation of the aerosol generator and system are described in CEN/TR 15276-1, paragraph 5.16 and ISO15779, chapters 4 and 5.

2.26.1 Design, installation and operation manual

At delivery the product should be accompanied by an operation manual in the English language, known and authorized by Kiwa.
Following minimum items shall be described:

- Type of aerosol generators;
- Design application density;
- Description of occupancies and hazards to be protected against;
- Specification of aerosol generators;
- Equipment schedule or list of materials for each piece of equipment or device, showing device name; supplier, model or part number and description;
- System calculation;
- Enclosure pressurization and venting calculations;
- Description of fire detection, actuation and control systems.
- Requirements for inspection, maintenance and testing of an aerosol fire-extinguishing system and for the training of inspection and maintenance personnel.

2.27 Material Safety Data Sheet

The fire extinguishing agent shall be safe to humans and the environment during processing, storage and application. The application is in relation to its intended goals. With respect to the user this shall be demonstrated by the Chemical Product Safety Data Sheet or Material Safety Data Sheet in accordance with:

- NEN-ISO11014-1;
- EU Directive 91/155/EEC (Official Journal L76/91) of March 5th, 1991;

Registration has to be in according to REACH, see EU-GHS (EG. nr 1272/2008).

2.28 Determination of the chemical stability of the fire extinguishing agent and extinguishing performance

The chemical composition shall be determined during the type tests and this formulation shall be recorded by Kiwa and the supplier. All components of the product shall be clearly identified.

2.28.1 Aerosol-generating chemical

The aerosol-generating chemical is a thermoplastic mixture consisting of an oxidiser, a combustion binder and additives. The oxidiser is solid potassium nitrate (KNO3), the binder is solid plasticised resin and other ingredients are for stabilisation.
The solid residual compound contains elementary species, potassium salts, mineral fractions, retarded resin and a binding retarder as environmentally innocuous chemically acting fire suppression additives.

2.28.2 Assessment of the aerosol-generating compound

Powered fire-extinguishing medium extracts being prepared with water hydrolysis by dissolving the chemical using ultra-sonic wave technology and acid digestion using micro-wave destruction technology. Sample extracts for performing techniques, such as ICP-MS, pH, potentiometric measurements on alkalinity and acidimetry, TOC analyzer, CFA analyzer, total organic N analyser and Ion chromatography, are prepared. The original compound is analyzed by the two analytical procedures:

1. ICP-MS after applying digestion techniques using pressed pellets and
2. the water dissolved extracts will be analyzed for anions by Ion chromatography or CFA, for pH by potentiometric measurement, hydro carbonates and carbonates by acidimetric measurements. The dissolved organic carbon is analyzed with TOC equipment. C and S are determined with a combustion C and S analyzer and N with a total organic N analyzer.

2.28.3 Assessment of the effectiveness of a gaseous fire extinguishing agent

The effectiveness of a gaseous fire extinguishing agent, consisting of solid aerosol-forming compound, is determined after activation by electrical ignition at a temperature of 300ºC with a thermo cord. The present residue after activation of the extinguishing generators is directed to analytical testing with the performing techniques

2.28.4 Equipment for activation issues on a fire suppression aerosol generator

A combustion chamber can be used for the activation of solid aerosol-forming compound. Before the activation the combustion chamber need to be inspected and cleaned before discharging the deleterious compound. Only by-products from the activation itself have to be present on the integrated glass plate, which is integrated into the combustion chamber. No unwanted by-products from the outside of the combustion chamber could be present.
Residual aerosol particulates after activation of the solid aerosol-forming compound being collected from the inert glass plate, which is integrated in the combustion chamber. The collected particulates are directly analyzed by the different analytical techniques.

2.28.5 Analytical results

All analytical experiments by 2.25.1 and 2.25.2 show the original specific composition of the aerosol-forming compound and the formed particulates after activation at a temperature of 300°C in a combustion chamber. In these experiments both samples of aerosol-forming compounds are analyzed according to several European Standard Methods. The data before – and after activation are obtained by analysing the original compound and the formed residues. The transport of particulates and gasses are calculated(1) in accordance with their model - and actual chemical reactions based on the used original fire extinguishing compound and their formed residual products.

(1) A special spread sheet for chemical calculations on all different fire extinguishing compounds before - and after activation at a temperature of 300°C can be used to fulfil requirements on the formed products in relation to safety, corrosion - and toxicological purposes.

2.29 Assessment of the efficiency of an aerosol generator

The efficiency of any type of aerosol generator shall be calculated using the following formula:

Formula
(Mb – Ma) / Mc x 100 = efficiency of an aerosol generator

The efficiency of any type of aerosol ≥ 100 will be declared at 100%.

Abbreviation		Unit
Mb	Mass of the aerosol generator before activation	gram
Ma	Mass of the aerosol generator after activation	gram
Mc	Mass of the compound in the aerosol generator according specification of the manufacturer	gram
Efficiency	actual amount of aerosol extinguishing agent in the enclosure after discharge	%

Calculating the efficiency of the generator provides in the actual amount (density) of aerosol extinguishing agent in the enclosure.

A minimum of three generators in each size within a family shall be calculated in the as-received condition.

The result of the calculation shall be declared in the attachment of the product certificate.

2.30 Packaging, preservation, storage and identification

The packaging shall be appropriate for the application. If special preservation measures are required then these shall be stated in the application instructions and on the packaging identification label. In view of the preservation requirements the storage shall be in accordance with the application instructions.
The identification on the aerosol generator and/or packaging shall clearly provide the following (minimum) information:

Generator	**Packaging**	**Marking**
X	X	Manufacturer
	X	Supplier's address and telephone number
X	X	Supplier's type designation
X		Reference to the application instructions*
X		Certification mark
X	X	Year and month of manufacturing and batch number
	X	Number of items
X		Fire Class to EN2

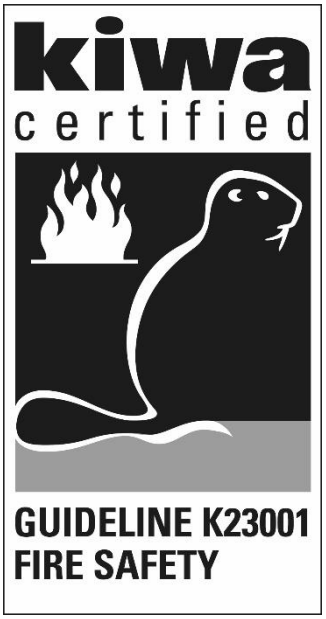
*The application instructions shall describe the scope of application, fire extinguishing capacity, discharge length and temperature decay and the surface temperature during fire extinguishing action.

2.31 Marking

The requirements for the marking of the aerosol generator and system are described in CEN/TR 15276-1, paragraph 5.17 and ISO15779, paragraph 6.4

2.32 Certification mark

The following Kiwa®-mark and indications shall be provided on each product and product packaging in a clear, legible and indelible way.
The Kiwa certification mark to be applied to certified products shall be as shown below, with the legend “Guideline K23001 Fire Safety”.



Place of the mark:
- On each generator and product packaging (see table 2.31)

Required specifications:
- Name of the product and supplier
- Supplier’s type designation
- Production date and serial number
- Mass of aerosol-forming compound
- Temperature range
- Storage humidity range
- Service life
- Reference to the application instructions
- Certification mark
- Fire Class according EN2

Method of marking:
- Non-erasable and non-detachable;
- Non-flammable;
- Permanent an legible

3 Quality system requirements

3.1 General

This chapter contains the requirements that have to be fulfilled by the manufacturer's quality system.

3.2 Manager of the quality system

Within the manufacturer's organisational structure an employee shall be appointed who is in charge of managing the quality system.

3.2.1 Requirements concerning other verification personnel

Function	Education	Experience
Production manager	Higher professional qualification in one of the following disciplines: • Technical	1 year
Laboratory manager	Higher professional qualification in one of the following disciplines: • Chemistry or comparable	1 year

The education and experience of relevant personnel shall be verifiably documented.

3.3 Internal quality control / quality plan

As part of the quality system the manufacturer shall implement an internal quality control schedule (IQC-scheme).

In this IQC-scheme the following shall be demonstrably recorded:

- Which aspects are inspected by the manufacturer;
- According to which methods these inspections are carried out;
- How often these inspections are carried out;
- How the inspection results are registered and stored.

This IQC-schedule shall be in the format as shown in the annex. The schedule shall be detailed in such a way that it provides Kiwa sufficient confidence that requirements will be continuously fulfilled.

3.4 Procedures and work instructions

The manufacturer shall be able to submit:

- Procedures for:
  - the handling of non-conforming products;
  - corrective actions in case non-conformities are found;
  - the handling of complaints regarding the products and / or services supplied;
- The work instructions and inspection sheets in use.
- Instructions for packaging and closing off of products during storage and transport.

3.5 Other Quality system requirements

The supplier (manufacturer) shall have an operative quality system according EN-ISO9001.

3.6 Storage and handling

The storage and handling of the fire extinguishing agent shall be dry and protected against the weather and the storage temperature and maximum relative humidity shall be as specified by the supplier.

3.7 Receiving inspection aerosol compound

The chemical composition shall be determined during the type tests and be recorded by Kiwa and the supplier. Every delivery of aerosol compound/ ingredients shall be accompanied by delivery certificates issued by the supplier to demonstrate that the composition meets the specifications. The delivery certificates shall be based on laboratory analysis of the composition of each production batch of the aerosol compound. The receiving inspection of the aerosol compound shall be carried out for each received delivery. The results shall be determined through laboratory analysis.

3.8 Process control of production batches

The performance of completed product shall be tested using random samples. The statistical process control shall be based on a defined sampling system with an accepted level of quality to ISO2859. The minimum sample size shall be inspection level S2 and the accepted quality level AQL 6.5.

Sampling according ISO 2859, inspection level S2, AQL6.5				
Batch Quantity	Inspection Level code S2	Sample size quantity	Max number of failure and accept batch	Max number of failure and reject batch
2-25	A	2	0	1
26-150	B	3	0	1
151-1200	C	5	1	2
1201-35000	D	8	1	2
35001- over	E	13	2	3

- Note 1: in the table above, table A (Sample Size Code Letters and table B (Single Sampling Plans for Normal Inspection) are combined.
- Note 2: “Sample size quantity” samples shall be randomly picked out of the batch

3.8.1 Activation and discharge mechanism

The reliable operation of the activation and discharge mechanism and its initiation shall be statistically demonstrated by multiple functional tests.
These tests shall clearly indicate the possibility of failure, completeness of the discharge and discharge quantity. This data shall be included in the statistical process control for the completed products. This shall be governed by a test similar to that described in section 2.13 or 2.17 and 3.8.

4 Summary of tests, audits and inspections

4.1 General

This chapter contains a summary of tests and inspections to be carried out during:
Initial evaluation: the investigation necessary in order to determine whether all requirements of the evaluation guideline are fulfilled;
Inspection visit: the surveillances are carried out after issue of the certificate in order to determine whether the certified products continuously fulfil the requirements of this evaluation guideline. The surveillance audits and inspections are carried out according to the frequency indicated;
Audit of the quality system: audit with regard to the correct implementation of the IQC-schedule and procedures. The surveillance audits and inspections are carried out according to the frequency indicated.

4.2 Assessment matrix

The initial evaluation (IE) consists out type tests (TT) of the product to determine if it meets the relevant performance and product requirements. The matrix identifies the requirements to be fulfilled to be eligible for certification. During the initial audit it is also verified if the quality system of the product's manufacturer meets the requirements.

Requirement	BRL chapter	Assessment for		
		Initial Evaluation + Type Test	Surveillance by Kiwa after issue of the certificate	
			Type Test frequency	Audit & Inspection frequency
Fire extinguishing performance of the generator	2	IE + TT	If applicable	1/year, verification of the initial design and compound
Complete activation/discharge (electrical or other method) of the generator	2	IE + TT	If applicable	1/year, batch testing
All further requirements	2	IE + TT	If applicable	1/year
Product requirements				
Installation and application manual (DIOM)	3.3.1	IE		1/year
Packaging, preservation, storage, identification	3.3.2	IE		1/year
Certification mark	3.3.3	IE		1/year
Quality system	3 and/or 4.4	IE		1/year

Once the certificate has been granted it shall be verified regularly if the manufactured products continue to meet the relevant performance and product requirements, which

can require further type tests. Typically after a new- or re-design of the compound or generator, see 4.3.
There shall be regular audits to determine if the quality system of the manufacturer of the products is still complying and if the product continues to be manufactured in accordance with the specifications used for the initial tests.

4.3 Design modifications

Design modifications to the certified product shall always be notified to Kiwa before being introduced in the production process. Kiwa shall assess to what extent the design modifications will require new type tests of the product. The modified product may only be supplied with the Kiwa mark after written approval by Kiwa of the re-designed or new product.

5 Agreements on the performance of certification

5.1 General

This chapter contains the by the Board of Experts elaborated agreements on the performance of certification by Kiwa.
Furthermore are the general agreements on the performance of certification applicable as laid down in the Kiwa-Regulations for Product Certification.

This includes in special the:

- The general procedures for execution of the pre-certification evaluation such as:
  - The process in which the suppliers are informed about the handling of the application for certification;
  - The execution of the assessment;
  - The decision based on the execution of the evaluation
- The general procedures for the execution of the audits and inspections and the aspects for the evaluation;
- The sanctions by the certification body when non-conformities are found during the audits and inspections;
- The sanctions by the certification body when improper use of the Product Certificate, the Certification Mark, Pictograms and Logo's.
- The procedures at withdrawing a Product Certificate;
- The possibility of an appeal lodged with the Board of Appeal against a decision or measure taken by Kiwa.

5.2 Certification staff

The staff involved in the certification process is sub-divided into:

- Certification engineers: in charge of carrying out the pre-certification tests and assessing the reports of the auditors / inspectors;
- Inspectors / auditor : in charge of carrying out external inspections / audits at the supplier's works;
- Decision-makers: in charge of taking decisions in connection with the pre-certification tests performed, continuing the certification in connection with the inspections performed and taking decisions with regard to corrective actions.

5.2.1 General Qualification of certification staff

The qualification certification staff shall meet the requirements of chapter 6 of EN-ISO-IEC17065=2012 (former EN45011). The quality system of Kiwa describes the procedures for general and specific qualification of certification staff.

5.2.2 Specific Qualification of certification of staff

The Board of Experts has defined the following qualification requirements for the scope of this Evaluation Guideline:

Certification personnel	Education	Experience
Certification expert	Higher professional qualification in one of the following disciplines: • Chemistry, electrical engineering, mechanical engineering or similar • Internal training in certification and Kiwa policies • Audit training • (Fire) Safety education or equivalent	3 years

Certification personnel	Education	Experience
Inspector / auditor	Senior secondary vocational education qualification in one of the following disciplines: • Chemistry, electrical engineering, mechanical engineering or similar • Internal training in certification and Kiwa policies • Audit training • (Fire) Safety education or equivalent	3 years
Decision-maker	Higher professional qualification in one of the following disciplines: • Chemistry, electrical engineering, mechanical engineering or similar • Internal training in certification and Kiwa policies • Audit training	5 years Management experience

The education and experience of relevant certification personnel shall be adequately documented.

6 List of mentioned documents

6.1 Rules by public law

There is no legislation pertinent to this product.

6.2 Standards

Following standards are used in this evaluation guideline.

Standard	Subject	Data
CEN/TR 15276-1	Fixed fire fighting systems - Condensed aerosol extinguishing systems - Part 1: Requirements and test methods for components	2009
CEN/TR 15276-2	Fixed fire fighting systems - Condensed aerosol extinguishing systems - Part 2: Design, installation and maintenance	2009
ISO 15779	Condensed aerosol fire extinguishing systems - Requirements and test methods for components and system design, installation and maintenance - General requirements	2011
EN13823	Single Burning Item test procedure	2002
ISO2859	Sampling procedures for inspection by attributes – Part 1: sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	1999
ISO2859	Technical corrigendum	2001
ISO9001	Quality management systems - Requirements	2008
MSC.1/Circ.1270	Revised Guidelines for the approval of fixed aerosol fire extinguishing systems equivalent to fixed gas fire extinguishing systems, as referred to in SOLAS 74, for machinery spaces	2008
NEN-EN2	NEN-EN2: Classification of fires	2004
NEN-ISO11014-1	Safety data sheet for chemical products. Part 1: Content and order of sections	2009
UL 2775	Outline of Investigation for fixed condensed aerosol extinguishing system units	2008
UL2127	UL2127, Standard for Inert Gas Clean Agent Extinguishing System Units, first edition, March 31, 1999	1999

Annex 1 Model certificate (normative)

CERTIFICATE

Product Certificate
Kxxxxx/xx UK

Issued
Valid until
Replaces

Page 1 of x

Brand name

Non-Pressurized Condensed Aerosol Generators and Components

STATEMENT BY KIWA
With this product certificate, issued in accordance with the Kiwa Regulation for Certification, Kiwa declares that legitimate confidence exists that the products supplied by

Manufacturer name

are complying with the technical specifications as laid down in this product certificate and marked with the Kiwa®-mark in the manner as indicated in this product certificate, on delivery, may be relied upon to comply with Kiwa evaluation guideline BRL-K23001/05 "Product Certification Scheme for non-pressurized condensed aerosol generators and components used in fixed fire extinguishing systems".

Luc Leroy
Kiwa

Publication of the certificate is allowed.
This certificate consists of x pages
Note: Publication of only this front page or parts of the certificate is considered as "not valid".
Advice: consult www.kiwa.nl in order to ensure that this certificate is still valid

Company

Kiwa Nederland B.V.
<Address>
The Netherlands

<Phone Number>
<Internet website address>

RvA logo

Certification process consists of initial and regular assessment of:
- **quality system**
- **product**

Annex 2 Model IQC-scheme (informative)

Subjects	Aspects	Method	Frequency	Registration
Raw materials or materials supplied: • Recipe sheets • Incoming inspection raw materials				
Production process, production equipment, material: • procedures • work instructions • equipment • release of product				
Finished-products				
Measuring and testing equipment • measuring equipment • calibration				
Logistics • internal transport • storage • preservation • packaging • identification or marking of semi-finished and finished products				

Annex 3 Additional information test procedure (informative)

The condensed aerosol generators shall effectively extinguish objects of the relevant fire class. A further requirement is that the condensed aerosol generators are connected to and initiated by an effective fire detection system. A fast detection and response are essential. Effective extinguishment means that the object to be extinguished is no longer burning after the test and does not reignite later. To provide a correlation between the extinguishing performance of condensed aerosol generators and the fire classes referred to in the scope, the condensed aerosol generators are tested for each fire class requested by the supplier for the certification assessment.

The tests are undertaken using the aerosol and condensed aerosol generators for which the supplier wants to receive a certificate. During the tests the supplier's design formula for the use of his condensed aerosol generators is also verified. The formula used by the supplier shall incorporate:

- the dimensions of the room containing the object to be extinguished and the length, width and height ratios;
- aerosol dispersal factor (see chapter 2);
- Aerosol efficiency factor (see 2.30);
- the amount of fire extinguishing agent, expressed as grams of agent per m^3 in the room.

The test is carried out in a sufficient air-tight room. Doors and windows shall be closed. However, a limited "open" area, for example small gaps/notches between wall and ceiling may be present. Any forced ventilation system or apparatus/system that will affect the density in the room, shall be shut down. The test shall be based on the exact arithmetical calculation of the number of grams per volume unit as this governs the value stated in the certificate. There shall be no physical obstructions in the room. The design formula shall allow for a quantity of remaining (condensed) aerosol in the cooling effect of the condensed aerosol generator. When testing Class B fires the operation of the condensed aerosol generator in relation to its dispersal shall be tested more extensively.

The test of the fire extinguishing effect shall be made under the following conditions.

With regard to	Requirement/ Function	Unit	Tolerance
Fire class Assessment method to EN2 and applicable standard	According Fire Class A, B, C, F	N/A	N/A
Thermal energy/power	See fire extinguishing test or objective	N/A	N/A
Burning time due to catalyst	See fire extinguishing test or objective	Minutes	± 15 sec
Catalyst	Heptane, see Table 2.3.1	N/A	N/A
Relative humidity in the room, before the fire, measured with a hygrometer	60	%	± 20%

With regard to	Requirement/ Function	Unit	Tolerance
Ambient temperature ~~before~~	According test procedure	°C	According test procedure
Temperature in the test room	20 or ambient Note: According test procedure. Otherwise determined using at least 2 thermocouples on the ceiling with ΔT 10 sec recording using a data logger	°C	5, N/A for ambient
Thermocouples	The use of K type thermocouples (Ni-CrNi), diameter 1 mm, is recommended.	N/A	N/A
Dimensions of the test room	According guideline or standard	m and m^3	- 0 / + XX
Ventilation during the pre-burning time and free burning time, using constant measurement	Adequate ventilation	N/A	N/A
"Open" area or leakage area and position during extinguishing	0.1% max. of the volume of the room, distributed evenly across the room *	% in m^2	-0.1 / +0
Air flow through the room	Non-forced (Natural), <1	m/s	-1 / +0
Oxygen level in the room	According test procedure	% O2	According test procedure
Closing of the test room after igniting the fire	According test procedure guideline or standard	s	N/A
Required amount of fire extinguishing agent	Supplier's design formula	g/m^3	N/A, determined by tests according this scheme
Extinguishing time	According test procedure ~~according~~ and generator type	s	According test procedure
Monitoring time	According test procedure	s	According test procedure
Agent discharge	According test procedure	s	According test procedure
Weight of agent to determine percentage of agent discharged	Before and after extinguishing, any generator type	gr	± 5
Activation	Supplier's system	N/A	N/A
Electrical activator	Measurement of resistant according generator type. Note: most between 0.5 and 5 Ω	Ω	± 1

With regard to	Requirement/ Function	Unit	Tolerance
Instrumentation			
Weighing scale	Measurement (Incremental) from approx. 0 till approx. 75	Kg	± 0.005
Oxygen meter	Measurement from approx. 0 till approx. 25	% O2	± 0.1
Multi meter	Measurement of resistance from approx. 0 till approx. 30	Ω	± 0.1

* "Open" area or leakage area during extinguishing = 0.1% (e.g.: 1000 m^3 = 1 m^2 and 100 m^3 = 0.1 m^2).

"Open" areas are generally allowed as, for example, small gaps/notches between wall and ceiling but not as, for example, open ventilation piping or a hole/opening in a wall or ceiling.

- Open ventilation piping or a hole/opening in a wall or ceiling are to be considered as a an defect regarding the architectural and/or technical design of the room.
- Small gaps/notches between wall and ceiling are to be considered as a an defect regarding the architectural finishing of the room.

(Additional) registrations during the test, in seconds:

- Time of activation of the heptane.
- Pre burning time (catalyst)
- Free burning time
- Time of initial activation of the fire extinguishing components.
- End of the discharge of the aerosol.
- Time at which the flames are extinguished (if possible)
- Soak time

There shall be adequate ventilation during the pre-burning and free burning time and the oxygen concentration in the test room shall be maintained. If this cannot be guaranteed then during the activation the oxygen percentage at the level of the source of fuel shall not deviate more than 0.5 vol% from the normal percentage under ambient conditions and the oxygen percentage shall be measured with a calibrated oxygen gauge using a sensor at the same level as the source of fuel.

Complete activation and discharge of the condensed aerosol (electrical)

Assessment method

Weigh the condensed aerosol generators to 0.1% before assembly. The electrical activator in the condensed aerosol generators is activated at ambient temperature. After activation all the condensed aerosol in the generator as stated by the supplier shall be discharged, with a maximum tolerance of -0% - +5%. The electrical activator shall be initiated electrically using the minimum specifications (Volt, Ampere) stated by the supplier, with a tolerance of 5%. This shall be measured with a Class 1.5 VA meter. After activation, the amount of condensed aerosol discharged shall be determined by weighing and it shall be verified visually if this occurred

homogeneously through the discharge port provided. This may be done by determining if the condensed aerosol generator exhibits any cracks or punctures.