K21045 Scope E - Aerosol Fire Protection Systems
7 januari 2026

Guidance document Aeresol Fire Protection Systems

kiwa

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1. Introduction

This guidance & interpretation document for Fire Protection Systems has been accepted by the Board of Experts Fire Safety (BoE FS), in which all relevant parties in the field of Fire Safety are represented. The Board of Experts also supervises the activities and where necessary requires this scope to be revised and additional interpretation is needed.

Technological developments do not wait for laws, regulations and standards. These laws, regulations and standards are following the developments. This "Interpretation document" embodies the technological and market developments. The purpose of this document is to clarify the context by drawing up new definitions on certain themes and subjects. This clarifies to persons and market parties what the preconditions are when determining compliance with the applicable requirements. It also explains developments that play at the level of standards and how they fit the developments in the market and are in line with legislation and regulations.

A interpretation document is typically a formal written explanation or clarification of the meaning, intent, or application of a specific policy, regulation, law, standard, or contractual clause. It helps ensure consistent understanding and implementation across stakeholders.

Key characteristics of an interpretation document:

- Clarifies ambiguous language in a source document.
- Provides context or background to support the interpretation.
- May include examples or scenarios to illustrate how the interpretation applies.
- Is not legally binding unless issued by an authoritative body (e.g., a government agency or standards organization).
- Supports compliance by guiding users on how to apply rules or standards correctly.

Common uses:

- In legal or regulatory contexts: to explain how a law should be applied.
- In technical standards: to clarify how specifications should be interpreted.
- In contracts: to resolve disputes or misunderstandings about terms.

To make an interpretation document legally binding under Dutch law, you need to integrate it into the contractual framework in a way that courts will recognize and uphold. See certification scheme K21045/02: Clause 11.9.

This interpretation document has been drafted to set two goals:

- To give Guidance in the context for the design, installation and operation of Fire Protection Systems and is marked with the letter “G”;
- In matters whereby the requirements in the standard are not clear on the implementation of the requirement itself, this document is giving an interpretation, explanation or clarification of the requirements of the standard. These Requirements are marked with the letter “R”.

1.1. The purpose of this document

The certification schemes K23001 “Fixed Dry Aerosol Fire Extinguishing Components” and K23003 “ fixed fire-extinguishing systems based on non-pressurized condensed aerosol generators” are included in the TIC scheme K21045 Fire Protection Systems in scope E for Aerosol Systems.

This TIC scheme (Testing, Inspection & Certification) K21045 has several scopes of fire protection systems including scope E for aeresol systems.
By merging these certification schemes, the market will have better insight into what the various quality marks mean for the several Fire Protection Systems.
K23003 is a specific scheme for process certification for fixed fire extinguishing systems based on non-pressurized condensed aerosol generators. The scheme contains knowledge based on experience on the processes of designing, installation and maintenance of these type of Fire Protection Systems.

Because the applicable standards for these systems do not contain all information, this document is be used for additional information.

2. Fire Protection Systems scope E “G”

2.1. Scope definitions

The processes with regard to supplying of the basic- and detailed design, installation and the maintenance of fixed fire-extinguishing systems based on condensed dry aerosol for structures and compartments.

The requirements with regard to the architectural and technical conditions and therefor an effective extinguishment are part of the design and installation process. Furthermore the process also comprises the service and maintenance for the fire-extinguishing systems based on dry aerosol.

For onshore application in buildings are the standards EN15276-1, EN15276-2, ISO15779 and NFPA 2010 applicable.

For offshore or maritime applications is MSC.1/Circ.1270 based on IMO-regulations the minimal requirement.

This document has additional requirements on top of the mentioned standards based on the experience with this type of fire extinguishing systems in relation to better understanding of quality assurance.

The fire extinguishing system operates on the following principles:
Volume protection
Systems designed to be installed in a volume protection shall be tested for the application selected and for the main fire protection objective/objectives.
Systems designed to be installed in a multiple hazard application shall be approved for all present hazards in the volume.
System generator distribution shall provide total volume protection, specified by the manufacturer's design and installation manual and shall consider relevant factors such as leakage through openings, ventilation rates, obstructions such as been tested during type- and system testing according to the mentioned standards.

Source protection
Systems designed to be installed in source protection shall be tested for the application selected and for the main fire protection objective/objectives.
This is also a volume protection principle. Within source protection a number of smaller volumes with a specific hazard inside are protected. The classification of the materials used for the source protection has to be such that this complies with the protection of the hazards inside.
In this application the fire alarm and controlling system have to monitor a number of volumes.

Special application
Systems designed to be installed in an special applications shall be tested for the associated application selected and for the main protection objective / objectives of the applications concerned.
Systems designed to be installed in multiple hazard object protection areas, where protection for individual objects is foreseen, shall be approved for all associated hazards present in the area.
The generator(s) distribution shall provide sufficient object coverage as specified by the manufacturers design and installation manual such as been tested during type and system testing according to the mentioned standards and additional according Specific Certification Program defining an additional specific scope of application.

Note 1. Object protection can be designed for compartmented or non-compartmented situations. For non-compartmented situations, the function of the system is controlling of the fire and not extinguishing. The level of controlling has to be determined during type and system testing including al environmental and scenario features.

Note 2. For special applications a manual activation can be a requirement. For these situations the function of the system is controlling of the fire and not extinguishing.
The level of controlling is depends on the responsible people in the organisation for activating the system. In these situations is the level of controlling not determined by the fire extinguishing system.

Fire Protection Principle	Objective	Requirements according ISO 15779	Notes
Fire extinguishing	• Fire extinguishing • preventing the spread of the fire • Limiting and reducing the intensity of the fire at its seat and in relation to the surroundings • Protecting people • Protecting buildings • Protecting technological • Equipment	Fast response of fire detection system and a short actuation time in relation to: • Class A fires • Class B fires	Maximum activation time(s) of the Aerosol Fire Extinguishing System shall follow from the pre- and free burning times from certification performance tests or against other technical standards. Note: the discharge time of the applicable generator type shall also be involved.
Fire control	Limiting and reducing the intensity of the fire at its seat and in relation to the surroundings Preventing the spread of the fire Controlled burn-out of the section in which the fire is located.	Minimum density according Basic Design Note: Minimum density shall be not lower than the lowest recorded Certification Test density	Aerosol generators shall be activated intermittent to insure the minimum density to control the fire pending the arrival and deployment of the fire brigade

Table 1 — Protection objectives in fire protection

3. Terminology “G”

3.1. Requirements

Functional requirements: essential requirements made upon the product, so that the product can be used safely by the user and is functional for its intended purpose.

Performance requirements: in measurements or figures detailed requirements that are specified to certain (functional) properties of the part of the building component (fire-extinguishing component) and that contain an obtainable limit value which can be calculated or measured unambiguously.

Product requirements: in measurements or figures detailed requirements that are specified to certain (identifiable) properties of products applied in the building component (fire-extinguishing component) and that contain an obtainable limit value which can be calculated or measured unambiguously.

Process requirements: concrete requirements which the process shall meet, if necessary including the relevant conditions and boundary conditions under which the process shall take place.

3.2. Terms and abbreviations

The following definitions are used:

- Aerosol: colloid mixture of solid or liquid particles in a gaseous medium
- Activation mechanism: automatic or manual activation which leads to a physical outflow of the aerosol extinguishing agent.
- Audit: systematic and independent test for determining whether an activity in the field of quality and associated results corresponding with the planned measures and whether these measures are implemented effectively and are suited for realisation of its purposes. The test should be focused on the output of the process. Practically the audit is aimed at organisational and management activities (software) that lead to securing the output of the process.
- Automatic: not manually controlled.
- Manual: controlled or operated by a person.
- Automatic /manual switch: Means to change the system from automatic to manual activation. Explanation: this can be done by means of a manual switch on the control panel or another unit or a blocking personnel entrance.
- Basic design: Basic design containing boundary conditions for the fire-extinguishing system (input specification basic design criteria for the fire extinguishing system based on and determined in the risk evaluation).
- Colloidal: the condition of substances that are finely dispersed in a liquid or gas, in which the particles are larger than a molecule and smaller than particles in suspension.
- Control device: device capable of tracking the sequence of events leading to activation.
- Authority having jurisdiction:
    - the authorities or principal; primarily the municipal board or its representative which demands and/or approves the application of the fire extinguishing system. Furthermore each other legal body can act as authority having jurisdiction such as fire insurance companies. These demanding parties have to determine the starting-points for the fire extinguishing system or
    - the authorisation granting authority; in most occasions the municipality or regional authorities, who will present it to a (regional) fire brigade for advice.
- Emergency plan: plan for how to act in case of calamities.
- EN: European standard.
- Fire compartment: part of one or more buildings intended as maximum expansion area.
- Fail Safe: a mechanism capable of returning to a safe state in case there is a failure or malfunction.

- Condensed aerosol generator: construction and parts like the activator and the packaging filled with dry solid extinguishing agent which ejects a dry aerosol (extinguishing medium) after activation with the purpose to extinguish the fire.
- Fire-extinguishing control and indicating equipment: central unit for control of the fire-extinguishing system according EN 12094-1 or combinations according EN 54-2 and EN 54-4 (control and indication equipment of an automatic fire detection and fire alarm system) and EN12094-1 as laid down in paragraph 4.1 (electrical automatic control and delay device).
- Fire extinguishing panel: central panel and/or supply unit. See also fire-extinguishing control and indicating equipment for standards and relation.
- Fire extinguishing system: system consisting of various components for extinguishing a fire, such as fire-extinguishing components, control cables and control centre and the functional boundary conditions as stated in the scope and which shall realise an integral safety concept. For a system in the high risk segment clear requirements shall be met for granting the installation certificate based on the test and/or inspection report by the certification body.
- Fire extinguishing system certificate: declaration by the installer, that the design, the fire-extinguishing system or the service meets the requirements in this certification guideline.
- Fire extinguishing mechanism (chemical): after ignition of the dry extinguishing agent it is ejected as dry aerosol consisting of finely dispersed particles (e.g. 40% of the mass) specifically based on alkaline metal salts and gases (e.g. 60% of the mass) mainly consisting of nitrogen, carbon dioxide and water vapour. The dry aerosol extinguishes on a chemical basis by interfering in the chain reaction of the combustion process by binding of free radicals. The binding of free radicals prevents the free electrons in the outer shell of the substance from reacting with other substances, thus stopping the combustion process. Both actions mainly occur at the surface of the microscopically small particles in the dry aerosol. These particles are suspended in an inert gas. The smaller the particles, the more effective the mechanism functions.
- Fire load: fire load as mentioned in NEN 6090.
- High risk segment: based on the hazard to humans and/or hardware (capital goods variable or structural) the supplier, authorities or user can decide to a high risk segment. In this case is a minimal yearly inspection frequency by the certification body mandatory.
- Hold time: period of time during which an extinguishant is required to maintain at least the extinguishing application density to maintain even distribution throughout protected volume; the structural capability of a room to keep the density at the desired level during a certain time.
- Housing: construction in which the dry solid extinguishing agent is stored and from which the extinguishing agent is transported through the outflow openings.
- Inspection: activities like measuring, investigating, testing or estimating of 1 or more product characteristics and comparing those results with specified requirements in order to determine if characteristic compliance has been achieved. It specifically concerns the inspection of the fire-extinguishing system and associated boundary conditions. In practice the inspection is aimed at technical physical output of the process (hardware).
- Insurance company: person or organisation who is prepared to undertake the risk stated in the insurance policy for a certain fee (premium)
- ISO: International Standard Organisation.
- Light industry function: Industry function concerning activities in which presence of human beings is of minor importance.
- NEN: Dutch Standard and Dutch Standardization Organisation
- NFPA: National Fire Protection Association.
- Normally unoccupied area: A building service equipment support area in which people are not expected to be present on a regular basis. Examples of such areas include interstitial spaces, crawl spaces, tunnels, attics and service vaults.
- Normally occupied area: An area that is normally occupied by personnel.

- Other usage functions: not further specified usage function concerning activities in which presence of human beings is of minor importance.
- Principal: owner of the installation
- Projecting: detailed design of a fire-extinguishing system, in which the installation is engineered based on the Basic design (Basic design).
- Reduced vision: when the dry aerosol generators are activated, vision is reduced during and after the outflow period; it could cause dangerous situations for people in the protected area as well as the area where it flow to in second instance. In all proposed applications of dry aerosol, sufficient protection shall be present for people near or about to enter the protected room. Examples: training for personnel present, warning signals, an alert before outflow and a system unlocking device. Ventilation provisions for after the fire should be present. See table 1.
- RIE: Risk Inventory & Evaluation or Risk Assessment (RA)
- Solid fire-extinguishing agent (SFEA): the solid form which by raise in temperature is transformed into an aerosol
- Supplier / installer: party responsible for the processes to be continuously meeting the requirements on which the certification is based, in this case the designing and installing party and the party supplying service / maintenance.
- Supply unit: unit suitable to activate the aerosol components.
- Suspension: liquid or gas containing another substance of floating microscopically small particles.
- Technical room: room for placement of equipment, necessary for a building's operation, at least including a meter room, an elevator room and a heating room. Can be expanded with various other rooms.
- Lock-off device: manual switching-off device which prevents an automatic electrical activation of the aerosol generator (see EN 12094-1).
  Note: The active position of the device shall result in an fault message on the fire panel.
- Fire resistance: Resistance against fire drift and fire spread as stated in EN13501-2.

4. Process “G”

4.1. General

These clauses describe the processes of the installer / system integrator.
The process is detailed in the following process steps in accordance with EN 16763.
1) In process step shall the minimal boundary conditions be covered.
2) If a authority having jurisdiction (insurance company, local authority and/or client) demands a inspection, this inspection shall be executed by the certification body.

4.2. Planning and design

In the planning stage the design requirements shall be recorded in the basic design.
These are specifications of protection objectives and scope of the system(s) based on identifying risk and known boundary conditions.

- The Basic Design shall contain clear functional performance requirements for the fire-extinguishing system regarding effectivity and functionality, boundary conditions and any other project related criteria for fire protection by means of an aerosol fire-extinguishing system.
- The Basic Design needs to be offered for verification to the authority having jurisdiction, insurance company and/or the client or owner of the system. During verification these parties can demand that an audit/inspection is necessary in case of a high risk situation. The authority having jurisdiction can demand local or public requirements to be applied to this type of systems or the system involved.
- The Basic Design shall be verified by the parties involved and, if a licence is obligated, at least by the authority having jurisdiction. Kiwa is performing an assessment of the Basic Design when the system is up for inspection.

In the design stage is the Detailed Design drafted.
These are selections and locations of components such that the resulting system meets the specified system objectives of the planning.

- When the parties involved have authorised the system basis design, the next step is the Detailed Design of the fire-extinguishing system. The installer has to control and verify the Basic Design. Kiwa is performing an assessment of the Detailed Design when the system is up for inspection.
- The certified installer shall validate the total design process.
- The total design process shall be realised in compliance with EN 16763 and the certification scheme.

Note: A Basic Design, not verified and validated by all parties involved, cannot be accepted.

4.3. Installation

Installation of a fire-extinguishing system based on dry aerosol shall be carried out by trained personnel according to this certification scheme and applicable standards. It shall be done based on the manufacturer’s instructions and on the detailed design. This is the implementation of the design, specifically the assembly, mounting and connecting of the relevant system components.

4.4. Commissioning - Putting into operation

The fire-extinguishing system based on dry aerosol shall be put into operation under responsibility of the certified supplier and by trained personnel and consists of all activities to make the system functional and operational in compliance with the basic and detailed design and the installation plan. This means the activating and testing of the system according to the design.

4.5. Verification - Acceptance

The certified supplier shall set up an Acceptance Installation Report in which he declares that the fire-extinguishing system is operational and functions according to the basic- and detailed design.
Through documentation it shall be proved that all system’s components and parts applied meet the requirements of quality and compatibility. This means that the process of confirming that the commissioned system meets the planning, design, installation and commissioning requirements.

4.6. Handover

After the verification - acceptance of the system shall the certified installer/supplier hand over the following documents to the client /owner and user:
The Acceptance Installation Report which shall contain at least the following (revised) documents:
• Basic design
• Installation plan (function or cause & effect matrix, block diagram or process instrumentation diagram)
• Type test report for specific applications
• Revision drawing of the installation and the system (as built)
• Equipment applied including certificates
• Service & maintenance contract (based on the installation plan)
• Checklist with al checks carried out, consisting of at least:
- Capacity calculation of secondary power supply
- Functionality of controls (according standard/guideline and/or basic design)
- Resistance measurement of activator(s)

An installation log (book) containing at least:
• General data
• Equipment applied
• Requirements to management, use, maintenance and service
• Precautions during activation of the system
• Precautions after activation of the system
• General rules and regulations for the user
• Periodical inspections of the system by the trained user
• Periodical inspections of the system by the responsible maintenance quality expert
• Material Safety Data Sheet (toxicity, sight reduction, thermal risks)
• Technical data of aerosol extinguishing components
• Fire-extinguishing system certificate and product certificates of the various components
• Installation plan including supporting documents (installation drawing, block diagram and function matrix)
• User manual fire-extinguishing system
• Maintenance reports

The certified supplier shall instruct the user regarding the operation and periodical maintenance of the fire-extinguishing system based on dry aerosol.
The name of the trained user(s) of the system shall be recorded into the installation log (book) and in the certified supplier / installer's registry.

This means that the process of transferring the responsibility of the system to the organization specified in the delivery contract.

4.7. Service & maintenance

Periodical service & maintenance of the fire-extinguishing system should be carried out to ensure its good condition and its integrity in relation to the use of the room and its actual application. Performing the service & maintenance work shall be in accordance with the manufacturer's guidelines and minimal annually. The objective of the combination of preventive and corrective activities during the life cycle of the system, which are intended to retain it in, or restore it to, a state in which it can perform the required function.

4.7.1. Activities after extinguishing

The installer shall provide instructions in the user manual about, at least, the following aspects:
• How to act during extinguishing. It shall describe how the extinguishing function of the fire-extinguishing system can be maximised.
• How the room and any other provisions or equipment present shall be cleaned after the extinguishing.
• How the fire-extinguishing system can be restored into its certified or normal condition.

5. Conditions for function & performance "R"

5.1. General

The architectural and technical conditions are important for the function and performance of the fire protection system. In the clauses below are they detailed and explained.

5.2. Room integrity in relation to volume protection

"Open" areas are generally allowed as, for example, small gaps/notches between wall and ceiling (spread evenly across the room) but not as, for example, fixed 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 defect regarding the architectural and/or technical design of the room.
- Small gaps/notches between wall and ceiling are to be considered as a defect regarding the architectural finishing of the room.

The maximum "open" or "leakage" area during extinguishing is 0.1% of the volume of the room.

For example:

Room volume in M^3	Maximum "open"- or "leakage" area in M^2
1000	1
500	0.5
100	0.1

Table 2 – volume ratio.

When a visual inspection does not provide in a sufficient insight about the room integrity, a door fan test shall be carried out to insure the room integrity.

Also regarding the room integrity, see ISO15779;

- D7 Test of the determination of the maximum leakage area/volume ratio and specifically
- D.7.1.4 Determination of hold time.

In case the minimum hold time of 10 minutes is achieved with a leakage area less than 0.1% of the room volume, the maximum "open" area or leakage area during extinguishing shall be according the test result(s).

5.3. Detection system performance requirements

The detection system shall be based on EN 54-14 or equivalent standard.

Note: In case a national standard requires a higher level or criteria's these shall be implemented in the basic design. NEN 2535 is the standard in The Netherlands.

Detection method shall be based on the following principals:

Type of application	Type of protection	Number of criteria	Detection of	Activation criteria
Room	Total flooding	3	CO, heat and smoke	2 detectors or 2 groups
Object / cabinet	Total flooding	2	CO and heat	
Specific	See protocol	See protocol	See protocol	
Note: Specific applications shall be based on a test protocol and according 6.6.				

Table 4 – detection principles.

See annex A for more details on this item.

5.4. Architectural and technical conditions requirements

All relevant architectural and technical conditions for the fire-extinguishing system to be able to function, shall be defined by the certified supplier and implemented in the Basic Design.
For this, at least the following aspects should be taken into account:

- Architectural provisions for compartment integrity regarding fire-resistance, taking into account the influence of a fire from the inside and the outside and possible sudden pressure build-up by the flammable substances present in the compartment;
- Connection with provisions for fire detection with functional integrity, fire alarm equipment (optical and acoustic signalling devices) and manual alarm devices for blocking or activation of extinguishing. Before and during extinguishing a warning shall be signalled (acoustic and optical);
- Connection with technical installations such as ventilation and air handling systems, smoke control systems, doors, emergency power supply provisions, etc.
- These technical installations shall provide in, or shall be equipped with, a “fail save” function or supply;
- Usage of the room to be protected, regarding the storage configuration in the protected room. The relation between the flammable substances present and the design of the fire-extinguishing system shall be clear; this should be expressed in the risk analysis belonging to the integral safety concept of the room to be protected;
- Usage of the room to be protected, regarding the presence of people and any risks involved in this. This should be expressed in the risk analysis belonging to the integral safety concept of the room to be protected;
- The mutual influence of the protection of adjacent rooms and buildings;
- Before and during extinguishing a warning shall be signalled (acoustic and optical);
- The internal organisation of the protected object should have knowledge of the operation of the fire-extinguishing system and associated consequences.

The fire detection system itself and the entrance controls function of the fire detection system in relation to the controls of the fire-extinguishing system do fall within the scope of this process.

5.5. Architectural and technical conditions requirements related to pressure built up by the fire-extinguishing system

Architectural and/or technical provisions for compartment integrity regarding a possible pressure build-up by the system shall always be taken into account in the following situations and implemented in the basic design;

- Pressure build-up by the fire-extinguishing system related to a (high) density;
- Pressure build-up by the fire-extinguishing system related to the architectural finishing of the room.

In case of an architectural air tight finishing of the room, resulting in a 0% “open” or “leakage” area, pressure relief valves or provisions shall always be calculated and applied.

In case of an architectural non-air tight finishing of the room, resulting in a “open” or “leakage” area of maximum 0.1% of the volume of the room, the manufacturer shall provide in an verifiable and adequate calculation method or documentation regarding pressure build-up by the fire-extinguishing system and the use of pressure relief valves or provisions, related to the applicable aerosol density and declared or applicable, pressure related, room strength.

In case the pressure calculation indicates that the pressure built up by the fire-extinguishing system will exceed the maximum allowable pressure which the enclosure will or can withstand, pressure relief valves or provisions shall be calculated and applied.

Note: Fire-extinguishing system engineers are not qualified to give guidance on compartment integrity or pressure related room strengths. Therefor it is up to the client to provide this information. In most cases the client will ask the building contractor to provide this information. In the event that the client does not make clear what the allowable pressure is which the enclosure will or can withstand, it is necessary to obtain his awareness and acceptance of the basics used.

5.6. Type tests for specific applications of the system

The determination of performance requirements of the aerosol’s extinguishing performance for specific products or product groups and specific materials or material groups in the applicable fire class.
The aerosol generators shall extinguish the products or materials in question effectively.
It could be necessary to test the extinguishing performance for specific products, materials or applications.
To do so an test protocol shall be drafted. After successfully passing an application type test, the test results shall be recorded in the attest of the product certificate.

The Technical Approval describes for which products, materials and/or applications and scale a test has been performed in which an effective extinguishing has been effectuated.
Kiwa has several Specific Certification Programs addressing specific applications.

Note 6. Current understanding of the performance of these systems does not warrant the design of systems from first principles. The basic design and installation parameters of all systems should therefore be obtained from performance tests.
Where possible, an application specific test procedure should be preferred to a generic procedure.
The design of a test procedure should be in accordance with the established scientific and engineering principles of fire protection that incorporate widely accepted methods, empirical data, calculations, correlations and computer models, as exemplified by the standard ISO/TR 13387-1 to ISO/TR 13387-8, "Fire safety engineering", and as contained in engineering textbooks and technical literature.
The intent of these guidelines is to encourage the development of fire test procedures that

- *are based on a fire protection engineering evaluation of the fire hazard, the compartment conditions, and the performance objectives for the system*
- *are developed, carried out, and interpreted by qualified fire testing laboratories.*

Evaluation of the fire hazard
The evaluation of the fire hazards should result in a list of possible design fires. The design fires should be defined at least in terms of:

- fuel (e.g. wood, plastics, cable, flammable liquid, gas);
- arrangement (e.g. crib, pile, shelved storage, pool, flowing fire, spray);
- size (dimension of the fuel array, area of the pool, or flow rate of a flowing or a spray fire);
- obstructions;
- ignition source/procedure.

The case of ventilation controlled fire applies to fires inside enclosure that may be fully closed or that may have small ventilation openings. It has been shown that in such cases, these systems have properties that are somewhat similar to gas fire extinguishing systems; the properties are pronounced for fires that are large with respect to the enclosure volume (of the order of 1 kW/m3 to 2 kW/m3 or larger). The key enclosure parameters are the following:

- enclosure volume;
- air exchange rate for forced ventilation;
- vent dimensions and orientation for natural ventilation.

For both fuel and ventilation controlled fires, the ambient conditions (temperature, moisture, air flow) surrounding the hazard, and the fire resistance and tightness of structures close to the hazard need to be evaluated.

Depending on the objectives, other parameters might be included to evaluate system performance in addition to the above-mentioned performance objectives. These include:

- structural integrity;
- damage to sensitive equipment or systems;
- smoke damage;
- visibility;
- tenability;
- flash-over prevention.

When these systems are tested for the purpose of fire extinguishment, special attention should be given to maximise the probability of fire extinguishment in real applications. One way of doing this is to test against a number of fire and ignition scenarios, and to use a range of system parameters to find out the optimum range for installations.

<u>Execution</u>
A type test for a certificate can only be carried out on the aerosol that the supplier has submitted under certificate of the K23001 / K21045 scope E. The test is carried out in compliance with scheme K23001 / K21045 scope E, with different test room dimensions.

6. Product and system requirements “R”

6.1. General

These clauses describe the requirements that the products, applied in the processes stated, shall meet. These requirements are part of the technical specification of the process, which is recorded in the process certificate. Based on the established design the certified installer / system integrator uses components and materials as per the following specifications:

Standard / scheme	Regarding
EN 54-1	Fire detection and fire alarm systems Introduction
EN 54-2/A1	Fire detection and fire alarm systems: Control and indicating equipment
EN 54-3/A1	Fire detection and fire alarm systems: Fire alarm devices – Sounders
EN 54-4/A1	Fire detection and fire alarm systems: Power supply equipment
EN 12094-1	Fixed fire-fighting systems - Components for gas extinguishing systems - part 1: requirements and test methods for electrical automatic control and delay devices
K23001/K21045 scope E product	Requirements for the product certificate for non-pressurized condensed aerosol generators and components used in fixed fire extinguishing systems

Table 5 – standard for products.

The certified supplier (installer / system integrator) has all the afore-mentioned certificates of these products available in a components file with an up-to-date overview.
This file shall be checked yearly by the certified supplier to verify if all certificates are still valid. The afore-mentioned components shall be checked visually for a valid product certificate and proper specification and marking on the packaging.

Normalized products without product control mark
These materials shall be checked yearly by the certified supplier for the declared specifications, based on a declaration by the supplier or manufacturer of the normalized products without product control mark, as well as the visual check of material and/or packaging specifications.

Non-normalized products
All non-normalized products shall be inspected for its function by the certified supplier.
All materials shall be inspected visually for damage before assembly.

6.2. Control unit of the aerosol generators

The control unit shall be, after the activation signal generated by the second fire alarm, able to activate the aerosol generators(s) in the protected area after the determined delay time (EN12094 and EN15276-2).
The Fire extinguishing panel performance shall be demonstrated to Kiwa by type tests. Voltage loss and power calculations (first and second law of Kirchhoff) and installation drawings in the installation plan shall be bases for this demonstration. Clause 5 of EN 54-13 “Fire detection and fire alarm systems - Compatibility assessment of system components” shall be taken into account during this inspection and tests.
Kiwa shall witness this tests and record the results. The specific configuration shall be tested on its performance to active all the generators.

The output of the type test shall be declared in the technical approval part of the product certificate of the certified manufacturer and / or certified supplier (installer / system integrator). When the configuration is changed, a new test shall be performed.
The type test shall be repeated every 5 years for verification.

This test in described in detail in Specific Certification Program SCP04 - Control & Indicating Equipment and Control for automatic fire protection equipment and Fire Protection Systems based on Solid Bound Compound (SBC) - generators.

7. Requirements in respect of the quality system “R”

These clauses contain the information which have to be met by the supplier’s quality system.

7.1. Competences personnel

Within the scheme and standards competences are applicable. The following function roles are recognized.

Personnel responsible for quality within the certified company

Qualification by:	Management
Level	High
Experience	1 year within field of application (demonstrable)
Education	- All manufacturer’s application trainings, for which the company is certified to install - Qualification based on end terms as stated in this document
Knowledge of:	Applicable standards and schemes

Design engineer for projecting fire-extinguishing system

Qualification by:	Personnel responsible for quality within company
Level	Mid – High
Experience	1 year within field of application (demonstrable)
Education	- All manufacturers’ application trainings, for which the company is certified to install. - Technical / electrical / chemical engineering. - Qualified design engineer fire detection and alarm systems - Qualified design engineer for fire extinguishing based on end terms as stated in this document
Knowledge of:	- Applicable standards and schemes - National and European legislation and regulations in the field of fire protection, including Building Regulations - Fires and fire-extinguishing - Fire detection, alarm and fire-extinguishing system control - Specifics of this type of extinguishing systems
The specific fields of expertise may be divided among several personnel within the certified company.	

Technician responsible for installation

Qualification by:	Management
Level	Mid – Low
Experience	1 year within field of application (demonstrable)
Education	- All manufacturer’s application trainings, for which the company is certified to install - Qualified installation technician fire detection and alarm systems - Qualified installation technician for fire extinguishing based on end terms as stated in this document
Knowledge of:	- Applicable scheme - Specifics of this type of extinguishing systems - Fire detection, alarm and fire-extinguishing system control

	- Building regulations (where relevant)
The specific fields of expertise may be divided among several personnel within the certified company.	

Technician responsible for maintenance

Qualification by:	Management
Level	Mid – Low
Experience	1 year within field of application (demonstrable)
Education	- All manufacturer's application trainings, for which the company is certified to install - Qualified maintenance technician fire detection and alarm systems - Qualification based on end terms as stated in this document
Knowledge of:	- Applicable scheme - Specifics of this type of extinguishing systems - Fire detection, alarm and fire-extinguishing system control - Building Regulations (where relevant)
The specific fields of expertise may be divided among several personnel within the certified company.	

Table 6 – competence & qualification.

7.2. Training

The qualification terms of the certified suppliers application training shall be in accordance with the mentioned competences.
A specific Kiwa training for design engineers exists and is applicable for qualification.
These terms are laid down in a separate document under the supervision of the board of experts.

7.3. The terms and objectives of the training and exams

A. General
on the basis of proven theoretical and practical knowledge of fire, fire protection, technical implementation and regulations relating to automatic extinguishing gas installations, to be considered capable of independently designing an automatic extinguishing gas installation in accordance with the regulations.

B. Fire Safety
to have extensive knowledge of the phenomenon of fire, causes of fire, fire behaviour of solids, liquids and gases, fire spread and smoke spread. Furthermore, the fire risk assessment and the measures to be taken in relation to this.

C. Technique
have extensive knowledge of contemporary technology in the field of aerosol fire extinguishing systems and equipment and their application, also have knowledge of the properties of aerosol extinguishing agents and determining the fire risk in relation to the aerosol extinguishing agent density.

D. Basic engineering to detail engineering
have extensive knowledge of the design of fire alarm systems in different types of buildings, in accordance with applicable national and European standards and regulations.

E. Architectural
to have knowledge of architecture in relation to fire safety and the relationship between structure, form and architectural design of a building and the passive and active fire safety facilities to be installed in a building.

F. Fire protection installations
to have knowledge of the various passive and active fire safety facilities and the control of these types of facilities.

G. Standards and Regulations
to have knowledge of the standards in the field of fire safety, both nationally (NEN) and internationally (CEN). Furthermore, the rules set by the government and insurers in the field of fire safety.

H. Execution
to have knowledge of commissioning procedures.

I. Maintenance
to have knowledge of the necessary maintenance and to be able to record in a maintenance schedule which maintenance must be carried out.

7.4. Checking equipment and materials

The certified supplier shall have equipment to inspect the installation.
The minimal set of equipment is:

- Voltmeter (V), current meter (A) and resistance meter (Ω) (calibrated on the specifications and applicable range, maximum tolerance is 5%);
- Test device to check the activator of the aerosol extinguishing component (calibration not possible). This can be a resistance meter (Ω);
- Distance (M) measuring equipment to determine the volume of the room (calibrated on the specifications and applicable range, maximum tolerance is 2%)

7.5. Storage of equipment and materials

All equipment and materials used by the certified supplier should be identifiable and stored dry at the company's premises as well as at the installation site. The aerosol generator(s) and all other components of the fire-extinguishing system should also be stored dry and free of weather influences, with a storage temperature between -50 °C and + 100 °C or according to the manufacturers guidelines. Storage and treatment shall be done in such a way that damaging of the product is prevented. The manufacturer shall indicate the maximum storage life.
Waste material, material to be repaired and material to be cleaned shall be identified and separated clearly from other materials.

8. Inspections “R”

These clauses contain a summary of the inspections to be carried out in the event of certification.

8.1. Inspection of the system “R”

The inspection of the system is carried out based on the following inspection plan.
This inspection plan has a list with inspection points of for the system.

Initial inspection of the aerosol extinguishing system			
Part	**Method[1]**		**Inspection items**
	With certificate	**Without certificate**	
Basic design and detail design	A	A	Presence and completeness (all information relevant for inspection)
	A	A	Basic design approved by plaintiff(s)
	A	A	Basic design mentions the derived objectives and no deviating requirements in relation to the objectives
	A	A	Detailed design is based on the basic design
Aerosol-generators	A	F, M, P	With valid product certificate

Initial inspection of aerosol extinguishing system and/or fire alarm system			
Part	**Method[2]**		**Inspection items**
	With certificate	**Without certificate**	
Basic design and detail design	A	A	Presence and completeness (all information relevant for inspection)
Installation	V	V, P, M	Installation is fully operational
General requirements		A	Equipment standards
		A	Compatibility statement and commissioning statement
		V/A	Environmental conditions central equipment
		V/A	Components suitable for the application
Performance requirements		V/A	Performance requirement fire size.
		P	Test(s) according K23001 / K21045 scope E and SCPs
Monitoring Size	V	V	Monitoring required spaces/rooms.
Network		F	Failure in network central equipment or in part of the network
		F/V	General alerts on main fire alarm control panel
		F	Maximum time of alerts
		V/F	Other participants/components in the network
		F	Interface module management system
Aerosol-and/or fire alarm control panel	V /A	V/F	Mandatory options/features
		V	Text
		V	Hand- and vision range
		V/F	Alerts and controls
		F	Access Levels
		V/F	Integration clearance early warning equipment
	V	V/F	Position in relation to the internal organization
	V	F	Interfaces C1, E, G, J, M
		F	Maximum time alerts/notifications

[1] The column "> Method with certificate" applies only to under accreditation established aerosol systems

[2] The column "> Method with certificate" applies only to under accreditation established aerosol systems

Initial inspection of aerosol extinguishing system and/or fire alarm system			
Part	**Method[2]**		**Inspection items**
	With certificate	**Without certificate**	
	F	F	Delay time in accordance with basic design
Energy Supply	V	V	Primary energy supply
		V	Electrical safety device in accordance with EU and national regulations
	M	M	Autonomy secondary energy supply
		V/A	Capacity charging installation
		F	Switching from primary to secondary
		V/F	Alerts/fault alarm
Fire Panel	A	A	Approval fire brigade (only in case of mandatory reporting to alarm receiving centre).
	V	V	Place
	V	V	Orientation (geographic fire Panel/drawing).
	V	V	Detection zones
	V	V	Hand- and vision range
	V/F	V/F	Alerts and controls
Side Panel	V	V	Position
	V	V	Hand and vision range
	V/F	V/F	Alerts and controls
Side indicator		F	Signalling
		V	Place
		V	Implementation
Detector / signal transducer[3] [4]	V	V	Presence and type of detector/signal transducer.
	F*	F/V	Functionality controls from interfaces C1, E, G, J, M. * activation of 1 detector per group
Automatic smoke detector		V	Scope/field of application
		V	Number per space and place
		V	Distance smoke sensitive element to ceiling
		V	Measures prevent unwanted/spurious notifications
	F*	F	Signalling on detector, fire alarm control panel and panels * Activation of 10% of the detectors per group
	F	F	Control functions
Manual call point		V	Design
		V	Place and position
	F*	F	Signalling on detector, fire alarm control panel and panels *minimum activation of 1 detector per group
	F	F	Control functions
External detector	F*	F*	Signalling on detector, fire alarm control panel and panels *100% of the detectors per group
	F	F	Control functions
Duct Detector	V	V	Place and position
	F*	F	Signalling on fire alarm control panel and panels. *25% of the detectors per group
	F	F	Control functions

[3] Fire alarm system: detector, extinguishing installation: sensor

[4] This point only applies in case of an Product Certificate. If an Product Certificate is not present the following ten (10) in spection points shall be followed

Initial inspection of aerosol extinguishing system and/or fire alarm system			
Part	**Method[2]**		**Inspection items**
	With certificate	**Without certificate**	
Smoke switch		V	Performance requirement fire size
		V	Distance Dv
	V	V	Place and position
	F*	F	Signalling on fire alarm control panel. *minimum activation of 1 detector per group
	F	F	Control functions
Insulators	A / V	A/F	Presence
Transmission Path		V	Electrical safety provisions
		V	Assembly and construction of cables
		V/A	Function Maintenance/retention
	F	F	Monitoring
		F	Integrity/reaction to faults
		A/V	Detector loop in relation to area
		F	Loss alert detectors at failure
		A/F	Reliability wireless transmission
		V	Mutual influence
	V	V	Electrical connections
Detection zone		V/F	Origin message clear
		V/A	Dimensions and/or format
Detector Group		A/F	Detector group in relation to detection zone
		A/F	Differentiation of detectors in Group
Other	V/F	V/F	Integration with other systems (also not supplied by the contractor)
	A/F	A/F	Adverse impact of not demanded elements (in terms of functionality or performance requirements)
	F	F	Supply, performance or functionality mentioned In basic design[5]

Follow-up inspection of fire protection based aerosol systems			
Part	**Method[6]**		**Inspection items**
	With certificate	**Without certificate**	
Basic design and detail design	A	A	Presence and completeness (all information relevant for inspection)
	A	A	Basic design approved by plaintiff (s)
	A	A	Basic design mentions the derived objectives and no deviating requirements relative to the standard
	A	A	Detailed design is based on the basic design
Maintenance	A		Based on an accepted certification guideline
	A		Final inspection by maintainer
	A		Maintainer certified for delivery product
	A		CI accredited
	A		Scope certificate
	V		Certificate is applicable for the installation

[5] Outside the designated accepted standard

[6] The column "> Method with certificate" applies only to aerosol systems established under accreditation

Follow-up inspection of fire protection based aerosol systems			
Part	**Method[6]**		**Inspection items**
	With certificate	**Without certificate**	
	A		Certificate is applicable for the basic and detailed design
	V/A		No changes since issuing of certificate
	V	V	Installation is fully operational
Log	A	A	Presence, content, completeness, data of maintenance carried out
Generators	V	V	Projection relative to obstructions
		V / F	Testing aerosol generators on factory specifications (frequency according to applicable standards stated)

Follow-up inspection of Aerosol fire extinguishing system and/or fire alarm system			
Part	**Method**		**Inspection items**
	With certificate	**Without certificate**	
Basic design and detail design	A	A	Presence and completeness (all information relevant for inspection)
Maintenance Certificate	A		Based on an accepted certification guideline
	A		Final inspection by maintainer
	A		Maintainer certified for delivery product
	A		Certification Body with accreditation
	A		Scope certificate
	V		Certificate is applicable for the installation
	A		Certificate is applicable for the basic and detailed design
	V/A		No changes since issuing certificate
	V		Installation is fully operational
	A		Based on a well-known certification guideline
Performance requirements		A	Performance requirement unwanted/spurious notifications
		A	Performance requirement system availability
Monitoring Size		V	Monitoring required spaces/rooms.
Network		F	Failure in network central equipment or in part of the network
	F	F	General alerts on main fire alarm control panel
		F	Maximum time alerts
	V/F	V/F	Other components in the network
		V/F	Interface module management system
Aerosol-and/or fire alarm control panel	V/A	V	Maintenance status
		V/F	Mandatory options/features
		V	Texts
		F	Alerts and controls
		V/F	Integration evacuation alarm equipment
		F	Interfaces C1, E, G, J, M.
		F	Maximum time alerts/notifications
		F	Delay time in accordance with basic design
Energy Supply		V	Primary energy supply
		V	Maintenance status
	M*	M*	Autonomy secondary energy supply * If battery is older than 3 years

Follow-up inspection of Aerosol fire extinguishing system and/or fire alarm system			
Part	**Method**		**Inspection items**
	With certificate	**Without certificate**	
		F	Switching from primary to secondary
		F	Alerts/fault alarm
Fire Panel		V	Maintenance status
		F	Alerts and controls
Side Panel		V	Maintenance status
		F	Alerts and controls
Detector/signal transducer[7] [8]	V	V	Presence and type of detector
	F*	F	Functionality controls from interfaces C1, E, G, J, M. *1 detector per group
Automatic smoke detector		V	Maintenance status
		V	Measurements to prevent unwanted/spurious notifications
	F*	F	Signalling on detector, side indicator, fire alarm control panel and Fire Panel. *10% or a minimum of 1 detector of the detectors per group
		F	Control functions
Manual call point		V	Maintenance status.
	F*	F	Signalling on detector, fire alarm control panel and Fire Panel. *20% of the detectors per group
	F	F	Control functions
External detector		V	Maintenance status
	F*	F*	Signalling on fire alarm control panel and fire Panel *100% of the detectors per group
	F	F	Control functions
Duct detector		V	Maintenance status
	F*	F	Signalling on fire alarm control panel and fire Panel *25% of minimum of 1 detector per group
	F	F	Control functions
Smoke Switch		V	Maintenance status
	F*	F	Signalling on fire alarm control panel. *minimum of 1 detector per group
	F	F	Control functions
Transmission Path		V/A	Function Maintenance/retention
	F	F	Monitoring
		A/V	Integrity/reaction to faults
		F	Loss alert detectors at failure
		A/F	Reliability wireless transmission
Detection zone		V/F	Origin message clear
		V/A	Dimensions and/or format
Other	A/F	A/F	Integration with other systems (also not supplied by the contractor)
	A/F	A/F	Adverse impact of not demanded elements (in terms of functionality or performance requirements)

[7] Fire alarm system: detector, extinguishing installation: sensor

[8] This point only applies in case of a Product Certificate. If a Product certificate is not present the following eight (8) inspection points shall be followed

Follow-up inspection of Aerosol fire extinguishing system and/or fire alarm system			
Part	**Method**		**Inspection items**
	With certificate	**Without certificate**	
	F	F	Supply, performance or functionality mentioned In basic design[9]

Abbreviations legend
A. Administrative
V. Visually
F. Functional
M. Measurements
P. performance requirements according K23001 / K21045 scope E & SCPs

[9] Outside the designated accepted standard

8.2. Acceptance and rejection criteria aerosol extinguishing systems

Engineering of the system:

1. The basic design or the detailed design do not contain the necessary information to be able to carry out the inspection.
2. The basic design is disapproved by the applicant (s) or does not mention the derived objective (s).
3. The detailed design is not worked out in accordance with the basic design.
4. The applied components do not have the necessary quality.
5. The installation is not fully operational.
6. The aerosol generators are not correctly placed, not properly installed, damaged or exhibiting corrosion.
7. The density is not enough based on the required amount from the details design in relation to the number of generators and the efficiency.
8. The placement or projection of the generators does not conform to the detail design.
9. A performance requirement is not met or there is no data/information showing that it can be met.
10. The activation is not functioning or the generators are not or incorrectly controlled.
11. The space/room is not sufficiently airtight whereby the necessary hold time from the basic design is not guaranteed.
12. The minimum prescribed safety features or distances from the manufacturer or as stated on the certificate are not present or functional whereby the personal safety cannot be guaranteed.
13. Warning signs are not present, the delay or alarm do not function.
14. Controls that affect the air tightness of the space/room do not function.
15. Management, control or maintenance is not properly implemented.
16. The detection installation for activating the generators is not functional, does not meet the standard or the provisions laid down in basic design or certificate.

Engineering building:

1. Architectural separations do not meet the requirements indicated in the basic design, so that the density, filling time and hold time can be met.
2. Architectural separations do not meet the requirements or level of finish, such that there is a greater leakage loss is than 0.1% of the volume of the protected space.

Organization:

1. Its property, composition of the packaging and manner of storage does not match the density present in the space/room.
2. Free space under or from the aerosol generators is insufficient.
3. There are goods stored in the secure area of which has not (or cannot) be demonstrated that the fire can be put out with the applied concentration.

4. The detection installation for activating the generators is not functional, does not meet the standard or the provisions laid down in basic design or certificate.

9. List of reference documents

9.1. Standards

ISO/IEC 17020: Conformity assessment - General criteria for the operation of various types of bodies performing inspection.

ISO/IEC 17021: Conformity assessment - Requirements for bodies providing audit and certification of management systems.

ISO/IEC 17024: Conformity assessment - General requirements for bodies operating certification of persons.

ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories.

ISO/IEC 17065: Conformity assessment - Requirements for bodies certifying products, processes and services.

ISO 15779: Condensed aerosol fire extinguishing systems — Requirements and test methods for components and system design, installation and maintenance — General requirements.

EN 15276-1: Fixed firefighting systems - Condensed aerosol extinguishing systems - Part 1: Requirements and test methods for components.

EN 15276-2: Fixed firefighting systems - Condensed aerosol extinguishing systems - Part 2: Design, installation and maintenance.

NFPA 2010: Standard on Aerosol Fire-Extinguishing Systems.

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.

EN 54-1: Fire detection and fire alarm systems Introduction.

EN 54-2/A1: Fire detection and fire alarm systems: Control and indicating equipment.

EN 54-3/A1: Fire detection and fire alarm systems: Fire alarm devices – Sounders.

EN 54-4/A1: Fire detection and fire alarm systems: Power supply equipment.

EN 54-13: Fire detection and fire alarm systems - Part 13: Compatibility and connectability assessment of system components.

CEN/TS 54-14: Fire detection and fire alarm systems - Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance.

NEN 2535: Fire safety of buildings - Fire detection installations - System and quality requirements and guidelines for detector siting.

EN 12094-1: Fixed firefighting systems - Components for gas extinguishing
systems - Part 1: Requirements and test methods for electrical automatic control and delay devices.

EN 16763: Services for fire safety systems and security systems.

EN 13501-2: Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services.

NEN 6090: Determination of fire load.

ISO/TR 13387-1: Fire safety engineering - Part 1: Application of fire performance concepts to design objectives.

ISO/TR 13387-8: Fire safety engineering - Part 8: Life safety - Occupant behaviour, location and condition.

10. Annex A – Pre/free burn & detection times "G"

This annex provides information for a correct design sequence for the activation of the aerosol extinguishing system within the time frame of the initial type tests as performed for certification of the generators. Implementation of the discharge time and the pre- and free burning times from the initial type tests, assures the functionality and objective of the aerosol fire extinguishing system. Therefore the last aerosol generator shall be activated and discharged within the pre- and free burning time from the pre-certification tests according the Kiwa certification scheme K23001 / K21045 scope E, as follows:

Example 1: As an example a generator with a discharge time of 50 seconds is chosen. This means that, in case of a class A fire with plastics and after a determined delay time of 30 seconds, the last generator shall be activated within 130 seconds after the first generator. See table below on the next page in which this is graphically explained:

<table>
<tr><td rowspan="2">Stage</td><td>>>></td><td>>>></td><td>>>></td><td>>>></td><td>>>></td><td>>>></td></tr>
<tr><td>No fire / smoke development</td><td>Start of Fire</td><td>Fire</td><td>Fire</td><td>Fire</td><td>Suppression</td></tr>
<tr><td></td><td></td><td>Variable</td><td>Depending on Fire Class and certification Test</td><td>Variable (Make and type)</td><td></td></tr>
<tr><td>Occurrence</td><td>Time Fire start and development</td><td>Time Fire detection</td><td>Time Delay time</td><td>Time Activation of last generator</td><td>Discharge Time (last generator)</td><td>Suppression due to design density</td></tr>
<tr><td>Condition</td><td colspan="2">1th + 2nd detection According EN54</td><td></td><td></td><td>100% of the design density in the room at this point in time →</td><td></td></tr>
<tr><td>Time in seconds</td><td>--- / ---</td><td>--- / 0</td><td>30</td><td>160</td><td>50</td><td>210 / --- See Annex B</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">130 sec. (Time for activation of all generators after expiry of Delay Time)</td><td></td><td></td></tr>
<tr><td rowspan="4">Effect and remark</td><td rowspan="4"></td><td>Start of Delay Time ↑</td><td rowspan="2">Activation of first generator</td><td rowspan="2">Activation of last generator</td><td rowspan="2">minimum design density throughout the area</td><td rowspan="2">Fire extinguishing</td></tr>
<tr><td>Start of Fire ↓</td></tr>
<tr><td colspan="3">Pre- and free burning time initial type tests. See table 9 below.</td><td>Time of manual activation initial type test.</td></tr>
<tr><td colspan="4">Initial type test according scheme K23001 / K21045 scope E</td></tr>
<tr><td colspan="5">Minimal time in which de compartment needs to keep its integrity in case of fire</td></tr>
</table>

Table 7 - Fire extinguishing panel performance requirements graphically displayed

Example 2: As an example a generator with a discharge time of 85 seconds is chosen. This means that, in case of a class B fire and after a determined delay time of 30 seconds, the last generator shall be activated within -25 seconds after the first generator. See table below in which this is graphically explained:

<table>
<tr><td rowspan="3">Stage</td><td>>>></td><td>>>></td><td>>>></td><td>>>></td><td>>>></td><td>>>></td></tr>
<tr><td>No fire / smoke development</td><td>Start of Fire</td><td>Fire</td><td>Fire</td><td>Fire</td><td>Suppression</td></tr>
<tr><td></td><td></td><td>Variable</td><td>Depending on Fire Class and certification Test</td><td>Variable (Make and type)</td><td></td></tr>
<tr><td>Occurrence</td><td>Time
Fire start and development</td><td>Time
Fire detection</td><td>Time
Delay time</td><td>Time
Activation of last generator</td><td>Discharge Time
(last generator)</td><td>Suppression due to design density</td></tr>
<tr><td>Condition</td><td colspan="2">1th + 2nd detection
According EN54</td><td></td><td></td><td>100% of the design density in the room at this point in time
→</td><td></td></tr>
<tr><td>Time in seconds</td><td>--- / ---</td><td>--- / 0</td><td>30</td><td>5</td><td>85</td><td>90 / ---
See Annex B</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">-25 sec. (Time for activation of all generators after expiry of Delay Time, see note 8)</td><td></td><td></td></tr>
<tr><td rowspan="4">Effect and remark</td><td rowspan="3"></td><td>Start of Delay Time
↑
Start of Fire
↓</td><td>Activation of first generator</td><td>Activation of last generator</td><td>minimum design density throughout the area</td><td>Fire extinguishing</td></tr>
<tr><td colspan="3">Pre- and free burning time initial type tests. See table 9 below.</td><td>Time of manual activation initial type test.</td></tr>
<tr><td colspan="4">Initial type test according scheme K23001 / K21045 scope E</td></tr>
<tr><td colspan="5">Minimal time in which de compartment needs to keep its integrity in case of fire</td></tr>
</table>

Table 8 - Fire extinguishing panel performance requirements graphically displayed.

Note 7: The delay time according EN12094 is limited up to 60 seconds in steps of 5 seconds. In national regulations delay time is set on 30 seconds.

Note 8: Choose another type of generator with a shorter discharge time and/or determine whether the delay time is correct in this case.

11. Annex B – Pre-/free burn time standards “G”

This annex provides in the pre- and free burning times of the initial type tests as performed for certification according the applicable standards.

Initial type tests for product-certification K23001 / K21045 scope E	**According**	**Class A Fire pre- and free burning time (in sec)**	**Class B Fire pre- and free burning time (in sec)**
Polymeric Sheet Test	EN 15276-1 A ISO 15779 D	210	---
Class A Compatible Wood Crib Test	ISO 15779 D	120	---
Wood Crib Test	EN 15276-1 A ISO 15779 D	360 (180 + 180)	---
N-Heptane Pan Test	EN 15276-1 A ISO 15779 D	---	90 (60 + 30)

Table 9.

Note 10. This table is not complete and contains only the most common classes and tests. See the product certificate of the manufacturer according Kiwa K23001 / K21045 scope E and SCPs for more details and information.