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BRL-K21014/04
June 15, 2009

Evaluation Guideline

for the Kiwa product certificate for aerosol fire-extinguishing systems for fire protection in enclosed compartments containing electrical components.

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Validation
This evaluation guideline has been validated by Kiwa on 2009-06-15

Kiwa N.V.
Sir W. Churchill-laan 273
Postbus 70
2280 AB RIJSWIJK
The Netherlands

Tel. +31 70 414 44 00
Fax +31 70 414 44 20

Summary

The requirements mentioned in this Evaluation Guideline (BRL) are operated by Kiwa when handling a request or upkeep for the Kiwa product certificate (EN 45011) for aerosol fire-extinguishing systems for fire protection in enclosed compartments containing electrical components (aerosol fire-extinguishing system). The system consists of the following components.

1. Fire-extinguishing component (FEC) containing:

a) Aerosol fire-extinguishing component for extinguishing;

b) Fire alarm extinguishing station for driving the aerosol fire-extinguishing component and other drivers;

c) Detection component for monitoring and guarding the object.

2. Signal repeater (HUB)

3. Alarm management system (AMS) with radio interface (AMS-HUB)

Component 1 can be used autonomously (standalone) as well, without using the components 2 and 3. Alarm follow-up can be guaranteed by means of other communication equipment. The communication equipment must meet the requirements from the directives PrEN 54-13, EN 54-18 and EN 54-21. This communication equipment is usually provided by the alarm receiving station.

The aerosol fire-extinguishing system must monitor the environment to be protected for fire phenomena. This is done by detecting these fire phenomena and then communicates with other equipment within the system. The purpose is to alarm in an initial phase of fire, to notify a fire alarm station, to extinguish in the fire phase and to control during a set time.

The aerosol fire-extinguishing system is aimed to be applied in compartments such as those mentioned below (i.e. object protection).

- Switch cabinets;
- Computers;
- Meter boxes.

Starting-point is a standard projection (see appendix 15) for detection and extinguishing. The system's installation must be described in the supplier's manual. The supplier should train the users through a course in design, installation, acceptance, use and follow-up. For an integral safety concept the course should be applied in combination with this Evaluation Guideline.

The maximum combined number of fire-extinguishing components (FEC) and signal repeaters (HUB) within one system is 511. Within a system configuration the transmission path between a fire-extinguishing component and the alarm management system is limited to a maximum of 32 signal repeaters (HUB). The system has to communicate on a licence-free frequency band (ISM frequency) for which wireless communication for alarm purposes is permitted. The aerosol fire-extinguishing system should be constructed in such a way that the radio connection as transmission path is carried out redundantly.

The system consists of products which must meet public law regulations including:

- the Low Voltage Directive (LVD: 2006/95/EG)
- the Radio & Telecommunication Terminal Equipment Directive (R&TTE: 1999/5/EG)
- the Electromagnetic Compatibility Directive (EMC: 89/336/EEG resp. 2004/108/EG)
- the Construction Products Directive (CPD: 89/106/EG)

In the appendices is stated which parts of the directives apply and which parts are excluded. The chapters 2.3, 2.4 en 2.5 state supplementary requirements regarding the directives mentioned, in order to achieve a well functioning system. In certain fields this Evaluation Guideline exceeds the directives.

Only certified, normalized or specified materials may be applied for system components.

The certified supplier should operate a quality system conformably to ISO 9001: 2000 (system certification EN 45012). This should also contain the warrant for the application course (personal certificate ISO 17024).

During the product's pre-certification tests (PCT), type tests (TT) should be carried out, to determine whether the products meet the specific performance and product requirements. Furthermore should be verified whether the certified product supplier's quality system meets the demands.

After granting of the product certificate periodical inspections should check whether the production still meets the specific performance and product requirements. Renewed type tests could be applied.

Periodical audits should check whether the certified product supplier's quality system still complies and whether the product is still produced according to the initially tested specifications.

Preface

This Evaluation Guideline (BRL) has been set up by the College van Deskundigen Brandveiligheid (Committee of Experts in Fire Protection), in which concerned parties in the field of fire-extinguishing systems are represented.

This Evaluation Guideline is drawn up by the technical work group BRL-K21014 and during its composition consisted of the following members:

- Mr F.C. Koelewijn RVK, NOFIQ Systems B.V.
- Mr J.W.M. Geraerts, De Goudse Verzekeringen
- Mr A.H.A. Adrichem, Hannover Risks Consultants
- Mr ing. M. Gerbers, Astron
- Mr G.M. de Groot, De Groot Installatiegroep B.V.
- Mr ir. R.J. van Geer, SPIRID Creation B.V.
- Mr ir. M. Wittenberg, SPIRID Creation B.V.
- Mr drs. ir. A. van Ardenne, AstroTec
- Mr ing. E. Hommes, AstroTec
- Mr P.E. Voshol, Kiwa Certification and Inspection (secretary)
- Mr R.G.C. Reijns, FSB
- Mr B.Sc. E.E. J. Schuurmans, TNO Electronic Products and Services
- Mr P. de Beer, TNO Electronic Products and Services
- Mr M. Steffens, BAM Techniek

This Committee is also in charge of execution of certification and makes adjustments to this Evaluation Guideline if necessary.

This Evaluation Guideline will be applied by Kiwa together with the Kiwa - Regulations for Product Certification, in which all Kiwa's general certification rules are recorded.

This Evaluation Guideline aims to guarantee, based on the current technical state, an acceptable level of fire protection in order prevent or control damage to human beings and goods.

Contents

1 Introduction

1.1 General

The requirements mentioned in this Evaluation Guideline (BRL) are operated by Kiwa when handling a request or upkeep for the Kiwa product certificate (EN 45011) for aerosol fire-extinguishing systems for fire protection in enclosed compartments containing electrical components (hereafter indicated as aerosol fire-extinguishing system).

The granted declaration of quality is indicated as Kiwa product certificate. During execution of certification activities Kiwa is tied to the requirements recorded in the chapter "Requirements to certification institutions".

The fourth version of this Evaluation Guideline incorporates UL2775 and CEN/TR 15276-1. These changes have no implementation requirement. It gives the certified company's the possibility to operate world wide. This evaluation guideline replaces the BRL-K21014/03 on March 15, 2009.

1.2 Scope

The full title of this Evaluation Guideline is the Kiwa product certificate for aerosol fire-extinguishing systems with wireless communication to an alarm management system for fire protection in enclosed compartments containing electrical components (maximum 1500 Volt DC and 1000 Volt AC).

Aim of the product

The aerosol fire-extinguishing system must monitor the environment to be protected for fire phenomena. This is done by detecting these fire phenomena and then communicates with other equipment within the system. The purpose is to alarm in an initial phase of fire, to notify a fire alarm station, to extinguish in the fire phase and to control during a set time.
Its application is primarily meant for objects that cannot be entered by humans and come under the definition "non-enterable room".
More specifically its purpose is as follows:
Early detection (with wireless fire alarm system with detection based on % CO and $\Delta T/T_{max}$) for fire sizes as stated in appendix 15. The extinguishing system should prevent an expansion of the fire outside the cabinet during the standing time of the extinguishing agent.

The aerosol fire-extinguishing system is aimed to be applied in compartments such as those mentioned below (i.e. object protection).

- Switch cabinets;
- Computers;
- Meter boxes.

Starting-point is a standard projection (see appendix 15) for detection and extinguishing. It is a pre-engineered system. The system's installation must be described in the supplier's manual. The supplier should train the users through a course in design, installation, acceptance, use and follow-up. For an integral safety concept the course should be applied in combination with this Evaluation Guideline.

Explanation: If the detection system does not function, the system shall be activated by means of a thermal cord. If this thermal cord refuses, activation takes place based on the aerosols own activation temperature. The values must be declared in the product certificate of the aerosol extinguishing agent as per guideline K23001. Additionally the product certificate must give insight in dimensioning of the system.

The aerosol fire-extinguishing system should function in an indoor environment meeting the following conditional requirements:

Conditions	FEC	HUB	AMS
Operative			
Temperature	-10°C to +45°C#	-10°C to +60°C	**-10°C** to +60°C
Air humidity	<95% RH*	<95% RH*	<95% RH*
Air pressure	86 to 106kPa	86 to 106kPa	86 to 106kPa
Storage			
Temperature	-20°C to +40°C	-20°C to +50°C	-20°C to +50°C
Air humidity	25 to 75% RH	25 to 75% RH	25 to 75% RH
Air pressure	86 to 106kPa	86 to 106kPa	86 to 106kPa
Transport (during a maximum of 24 hours)			
Temperature	-35°C to +50°C	-35°C to +85°C	-35°C to +85°C
Air humidity	<95% RH*	<95% RH*	<95% RH*
Air pressure	86 to 106kPa	86 to 106kPa	86 to 106kPa

* = no condensation.
# = The hardware is supposed to operate up to +60°C.

Table 1. Conditional requirements

The parts of the system should have been developed as per IEC 60721-3-1 and IEC 60721-3-2 and tested as per IEC 60721-4-1 and IEC 60721-4-2, in order to be stored or transported without changing the properties or life time.

1.3 Terms and abbreviations

The following definitions are used in this Evaluation Guideline:

- **Alarm management system (AMS):** The part that offers information on the fire-extinguishing components connected and that initiates the necessary actions as per this Evaluation Guideline.
- **Alphanumeric display**: An optical indicator that offers information by displaying messages consisting of alphanumeric characters (digits and letters).
- **AMS-HUB:** Radio Interface, controlling communication between AMS, HUB and FEC.
- **AQL:** Accepted quality level**.**
- **BRL**: = EGL; BRL is the abbreviation for "Beoordelingsrichtlijn" (which is Dutch for Evaluation Guideline).
- **CO:** Carbon monoxide.
- **Communication equipment:** Equipment such as SMS devices, PLC, etcetera.
- **Decentralized intelligence:** within this guideline this means that

the detection /extinguishing component is able to determine by itself (free from the central processor) whether to initiate signalling and/or driving actions, like for example extinguishing**.**

- **Detection component**: Component for monitoring and guarding the object.
- **Differential alarm device**: A device initiating an alarm, when the degree of change of the measured phenomenon in relation to time exceeds a fixed value during a certain amount of time.
- **DTMF codes:** Dual Tone Multi Frequency codes. These tones are sent by the telephone to the network for remote control of answering machines, buzzers etc.
- **EGL:** Evaluation Guideline (Dutch BRL).
- **EMC:** Electromagnetic Compatibility (European directives).
- **Faraday's Cage:** the name for a cage-shaped construction of electric conductive material like copper or iron which ensures that electromagnetic radiation cannot penetrate into the cage. Reception of radio signals is not possible inside a Faraday's Cage.
- **Fire alarm equipment:** Alarm unit, not integrated in the AMS, used for indicating a fire alarm (e.g. acoustic or optical signalling devices) and not meant for evacuation alarm.
- **Fire-extinguishing component (FEC):** The provisional designation for the aerosol fire-extinguishing system including all the different components necessary.
- **Fire alarm and extinguishing centre:** component for driving the aerosol fire-extinguishing component and other drivers, see also 2.2.
- **IP-classification**: International Protection as per IEC 60529: 2001. This denotes the degree of protection against ingress of particles/dust and/or water and/or mechanical influences.
- **IQC-scheme:** Internal Quality Control scheme for production factory control.
- **ISE:** Intermediate Safety Expert
- **ISM:** The ISM (Industrial, Scientific and Medical) radio bands were originally reserved internationally for non-commercial use of RF electromagnetic fields for industrial, scientific and medical purposes. The ISM band is defined in recommendation 70-03 of the European Radio Communications Committee.
- **LVD:** Low Voltage Directive (European directives)**.**
- **Maintenance interface cable:** specific cable for this system for maintenance activities.
- **Maximum alarm device:** An alarm device that initiates an alarm when the size of the phenomenon measured during a certain amount of time exceeds a fixed value.
- **Multiple status alarm device:** An alarm device that states multiple statuses (more than two), that refer to its normal status and one or more fire alarm statuses and other specific statuses.
- **Multi sensor:** An alarm device that is sensitive to more than one fire phenomenon. These are so-called "multi criteria" alarm devices, containing one or two sensors which detect the same fire phenomenon. These devices send more than one signal to the fire alarm station through signal processing and software-determined algorithms. Signal processing can take place in the alarm devices as well as in the fire alarm station or a combination of both.
- **Non-enterable room:** A room which cannot be entered by human beings because of its dimensions or other physical limitations such

as shallow cabinets.

- **Notification equipment for fault warnings:** Interface equipment for notifying a fault warning (error message) from the AMS to a fault warning receiving station.
- **Notification equipment for fire alarms:** Interface equipment for notifying an alarm message from the AMS to a fire alarm receiving station.
- **Object protection:** Object protection is a protection volume that protects a certain object in a room (e.g. switch cabinets, machines) with automatic fire alarm devices.
- **Point detector:** An alarm device that reacts to a perceived fire phenomenon in or near a sensor that has been fixed at a certain location.
- **Power supply:** The electrical power supply for the AMS and for those parts that are supplied through the AMS (fire alarm equipment) comprises a primary and secondary power source as described in EN 54-4.
- **PLC:** Programmable Logic Controller.
- **Receiving station for fire alarm messages:** An organisation (institution) from where at any time the necessary fire-fighting and safety measures can be initiated.
- **Receiving station for fault warning messages:** An organisation (institution) from where the necessary correcting measures can be initiated.
- **R&TTE:** Radio & Telecommunication Terminal Equipment (European directives)
- **Serial connection:** A communication connection by means of a cable for data transfer between the various components of a communication system. Through the serial connection data can be exchanged between the various system parts. This exchange takes place one after another.
- **Signal repeater (HUB):** The component that receives, amplifies/repeats and identically forwards the communication signal in order to span greater distances.
- **SFE:** Standard fire-extinguishing agent
- **SMS:** Short Message Service.
- **SSE:** Senior Safety Expert
- **Standard projection:** Projection based on type tests as described in the configuration mentioned in appendices 15 and 16.
- **Stationary extinguishing components based on dry aerosol:** Extinguishing component based on a dry aerosol, implemented in the fire-extinguishing component. The fire-extinguishing component activates autonomously at a certain temperature as defined in EGL-K23001.
- **Thermal alarm device:** An alarm device that is sensitive to rise of temperature.

1.4 Requirements and determination methods

In this Evaluation Guideline requirements and determination methods have been recorded.

1.4.1 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 must meet, if necessary including the relevant conditions and boundary conditions under which the process must take place.

1.4.2 Determination methods

Pre-certifications tests: the test to determine whether all requirements from the Evaluation Guideline have been met.

Inspection tests: the test performed after granting of the certificate to determine whether the certified processes and actions taken continuously meet the requirements from the Evaluation Guideline.

In the test matrix (chapter 5) is summarized which tests will be performed by Kiwa during pre-certification and during inspection and with what frequency the inspection tests will take place.

1.5 Acceptance of research reports provided by the manufacturer

If the supplier submits reports by test institutions or laboratories as prove that the requirements from the Evaluation Guideline are met, it must be proven that these reports are drawn up by an institution that meets the applicable accredited directives, namely:

- NEN-EN-ISO/IEC 17025 for laboratories;
- NEN-EN-ISO/IEC 17020 for test institutions;
- NEN-EN 45011 for certification institutions certifying products;
- NEN-EN-ISO/IEC 17021 for certification institutions certifying systems;
- NEN-EN-ISO/IEC 17024 for certification institutions certifying persons.

The institution is supposed to meet the requirements, when an accreditation certificate can be submitted, that has been granted by the Dutch Council for Accreditation (RvA) or an accreditation institution with which the RvA has concluded a mutual acceptance agreement. This accreditation should relate to the tests required for this Evaluation Guideline. If no accreditation

certificate can be submitted, the certification institution itself will verify whether the accreditation directives have been met, or else carry out (or have carried out) the tests in question.

1.6 Declaration of quality

The declaration of quality that is granted based on this Evaluation Guideline are denoted as Kiwa product certificate [1] granted to the certified supplier. A model of this declaration of quality is provided as an appendix to this Evaluation Guideline.

[1] This is a combination of a testimonial and a product certificate, based on the following definitions:
Testimonial: a document in which Kiwa declares that the properties of a product or a building part are supposed to meet the performance requirements recorded in the Evaluation Guidelines applying for that product or building part, provided that:

- The products and materials applied in the product or building part meet the specifications stated in the testimonial;
- The working instructions stated in the testimonial are applied;
- The application conditions stated in the testimonial are heeded.

Product certificate: a document in which Kiwa declares that on delivery a product or building part is supposed to meet the product specification as recorded in the product certificate.

2 Performance requirements

2.1 General

These chapters describe the performance requirements that the components of the aerosol fire-extinguishing system must meet. Furthermore determination methods are included which can be used to determine whether the requirements are met.

2.2 Description and structure of the system

The aerosol fire-extinguishing system must be able to detect a starting fire in the environments mentioned, communicate an alarm signal to the outside world, extinguish a starting fire and control it.

The number of fire-extinguishing components (FEC) and signal repeaters (HUB) together within an aerosol fire-extinguishing system may not exceed 511.
Within an aerosol fire-extinguishing configuration the transmission path between a fire-extinguishing component and the alarm management system may consist of a maximum of Signal repeaters (HUB).
The aerosol fire-extinguishing system should communicate on a licence-free frequency band (ISM frequency) for which wireless communication for alarm purposes is permitted. The aerosol fire-extinguishing system should be constructed in such a way that the radio connection as transmission path is carried out redundantly.

The aerosol fire-extinguishing system consists of the following components.

1. Fire-extinguishing component (FEC) containing:
   a) Aerosol fire-extinguishing component for extinguishing;
   b) Fire alarm extinguishing station for driving the aerosol fire-extinguishing component and other drivers;
   c) Detection component for monitoring and guarding the object.
2. Signal repeater (HUB)
3. Alarm management system (AMS) with radio interface (AMS-HUB)

Component 1 can be used autonomously (standalone) as well, without using the components 2 and 3. Alarm follow-up can be guaranteed by means of other communication equipment. The communication equipment must meet the requirements from the directives prEN 54-13, EN 54-18 and EN 54-21. This communication equipment is usually provided by the alarm receiving station.

The figure below shows an overview of the aerosol fire-extinguishing system.

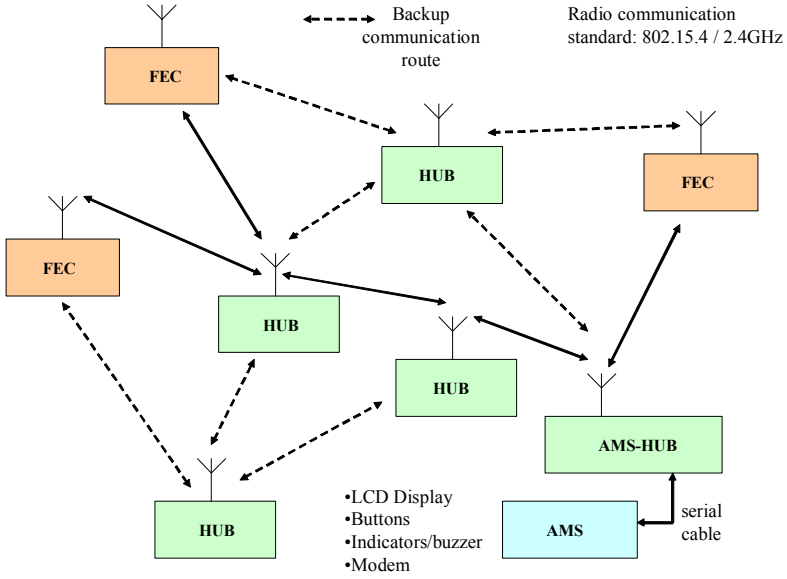

Figure 1. System overview

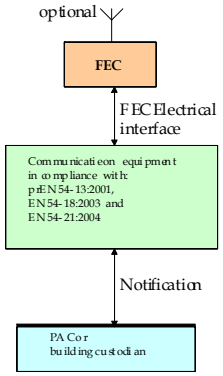

Figure 2. Overview FEC standalone use

Explanation

The system consists of products which must meet public law regulations including:

- the Low Voltage Directive (LVD: 2006/95/EG)
- the Radio & Telecommunication Terminal Equipment Directive (R&TTE: 1999/5/EG)
- the Electromagnetic Compatibility Directive (EMC: 89/336/EEG resp. 2004/108/EG)
- the Construction Products Directive (CPD: 89/106/EG)

Below an overview is given of the set-up of the directives.
In the appendices mentioned is stated which parts of the directives apply and which parts are excluded. The chapters 2.3, 2.4 en 2.5 state supplementary requirements regarding the directives mentioned in order to achieve a well

functioning system. In certain fields this Evaluation Guideline exceeds the directives.
The overview below is informative. The appendices mentioned are normative.

PERFORMANCE REQUIREMENTS	DIRECTIVE	REFERENCE
1. Fire-extinguishing component (FEC)		
a. Aerosol fire-extinguishing component	BRL K23001/03:2005 for product and quality or UL 2775: 2008 or CEN/TR 15276-1 for product.	See appendix 3A, 3B and 3C
b. Fire alarm extinguishing device	EN 54-2:1998 and EN 54-2/Design A1:2004	See appendix 4 and 13
Power supply	EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002	See appendix 5
Requirements and test methods for electrical automatic control and delay devices	EN 12094-1:2003	See appendix 6
c. Detection component		
Thermal alarm devices - Point detector	EN 54-5:2001 and correction sheet EN 54-5/Design A1:2002	See appendix 7
Carbon monoxide fire detectors using electro-chemical cells	ISO 7240-6:2004	See appendix 8
Radio connections and system requirements	The product must meet the relevant requirements as per the applying CE marking directives and EN54-25: 2008	See appendix 9
Housing	IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-27, IEC 60068-2-30, IEC 60068-2-32, IEC 60068-2-42, IEC 60068-2-56, IEC 60068-2-75, IEC 60068-2-78 and IEC 60529	See appendix 14
2. Signal repeater (HUB)		
Radio connections and system requirements	The product must meet the relevant requirements as per the applying CE marking directives and EN54-25: 2008	See appendix 9
Power supply	EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002	See appendix 5
Housing	IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-27, IEC 60068-2-30, IEC 60068-2-32, IEC 60068-2-42, IEC 60068-2-56, IEC 60068-2-75, IEC 60068-2-78 and IEC 60529	See appendix 14
3. Alarm Management System (AMS) with radio interface (AMS-HUB)		
Fire alarm extinguishing device	EN 54-2:1998 and EN 54-2/Design A1:2004	See appendix 4 and 14
Power supply	EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002	See appendix 5
System requirements and compatibility assessment	prEN 54-13:2001	See appendix 10
Requirements and test methods for input and output devices for use of transmission paths of fire alarm systems	EN 54-18:2003	See appendix 11
Alarm transmission and fault warning routing equipment	EN 54-21:2004 Explanation: This is not a compulsory element in the AMS; usually this element is provided by the alarm station.	See appendix 12
Housing	IEC 60068-2-1, IEC 60068-2-6, IEC 60068-2-27, IEC 60068-2-75, IEC 60068-2-78 and IEC 60529	See appendix 14
3a. Radio interface (AMS-HUB)		
Radio connections and system requirements	The product must meet the relevant requirements as per the applying CE marking directives and EN54-25; 2008	See appendix 9
Power supply	EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002	See appendix 5
Housing	IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-27, IEC 60068-2-30, IEC 60068-2-32, IEC 60068-2-42, IEC 60068-2-56, IEC 60068-2-75, IEC 60068-2-78 and IEC 60529	See appendix 14

Table 2. System structure in relation to national and international directives

2.3 Performance requirements of the components

Below the performance requirements for the various components of the fire-extinguishing component are stated, supplementary to and/or deviating from appendices 1 to 16.

2.3.1 General

The FEC must be able to function at a temperature from –10 °C to +45 °C and an air humidity of maximum 95% (no condensation).
Explanation: see the remarks below table 1 in this document.

2.3.2 Aerosol fire-extinguishing component (a);

The aerosol fire-extinguishing component must meet the requirements stated in the Evaluation Guideline BRL K23001/03: 2005 for product and quality or UL 2775: 2008 or CEN/TR 15276-1 for product. See further appendix 3A, 3B or 3C.

2.3.3 Fire alarm extinguishing device (b);

The Fire alarm extinguishing device must meet the requirements stated in the EN 54-2: 1998 and EN 54-2/Design A1: 2004. See further appendix 5.
Deviating and supplementary requirements are:

- The fire alarm extinguishing device must be provided with a serial port for a connection to a computer by means of a specific interface cable for executing maintenance activities.
- The fire alarm extinguishing device must be provided with at least one potential-free contact for disabling for example a ventilator (24 Volt / 1 Ampere).
  When applying the FEC as a standalone component it must be possible to delay notification of alarms in the transmission path. The delay must be at least 30 seconds.

  Explanation 1
  when applying several standalone components by means of a serial bus, combining groups of alarms is possible.

- The FEC must be able to support different operational situations and must be provided with an acoustic indicator and three different optical (red, yellow, green) indicators (see paragraph 2.3.3.1).
- The fire alarm extinguishing device must be provided with a connector to connect an antenna. When the FEC has been installed in for example a switch cabinet and no radio communication would be possible (Faraday's Cage), than it should be possible to place the antenna outside the switch cabinet and connect it by means of an extension cord, thus ensuring radio communication. The maximum length of the extension cord is 3 meters with a maximum attenuation of 1 dB.
- The power supply of the fire-extinguishing component must meet the requirements stated in EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002. Deviations from these are:
  - The secondary power supply must be composed of gas-tight batteries or storage-batteries. Under normal usage conditions (-10 to +45^{0}C, 25-75%RH, 86-106kPa) the batteries must have a minimal lifetime of two years.

- The batteries must be replaced according to the supplier's maintenance schedule or when the FEC gives a low voltage warning message.
- Optional it should be possible to connect the FEC to a primary power supply (110 V - 260 V, 50 Hz - 60 Hz). This primary power supply must be supplied by the system's supplier and must meet the system's specifications. In this case the power supply through batteries functions as emergency power supply.

  Explanation 2
  When applying the FEC as a standalone component, as a standard it must be provided with a primary and a secondary power supply. If functioning of the FEC is monitored externally, a secondary power supply is not required.

- Malfunctions in the power supply or a low (storage) battery voltage must be detected by the alarm management system and/or must be notified to for example a custodian, a receiving station for fault warnings or a receiving station for fire alarms.

§ The requirements and test methods for electrical automatic control and delay devices must meet the requirements stated in EN 12094-1: 2003.

Deviations from these are:
The aerosol fire-extinguishing component must be checked for wire breakage. It must be possible to activate at least four fire-extinguishing components simultaneously. The interjacent cabling must be provided with maintenance of functionality during fire for at least 30 minutes. Figure 3 shows a protocol of a reliable connection.

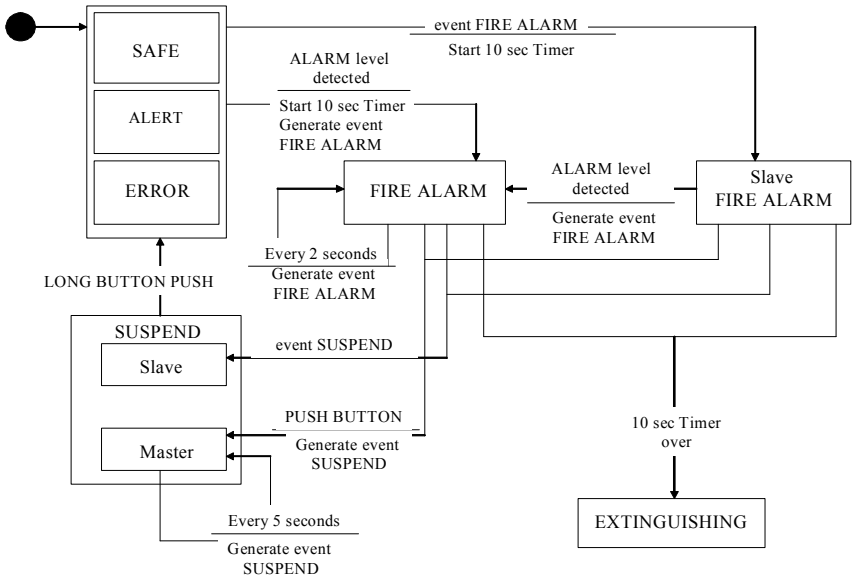

Figure 3. Example protocol

2.3.3.1 Operational statuses

Figures 4 and 5 show the behaviour of operational statuses and the optical and acoustic indicators of the FEC.

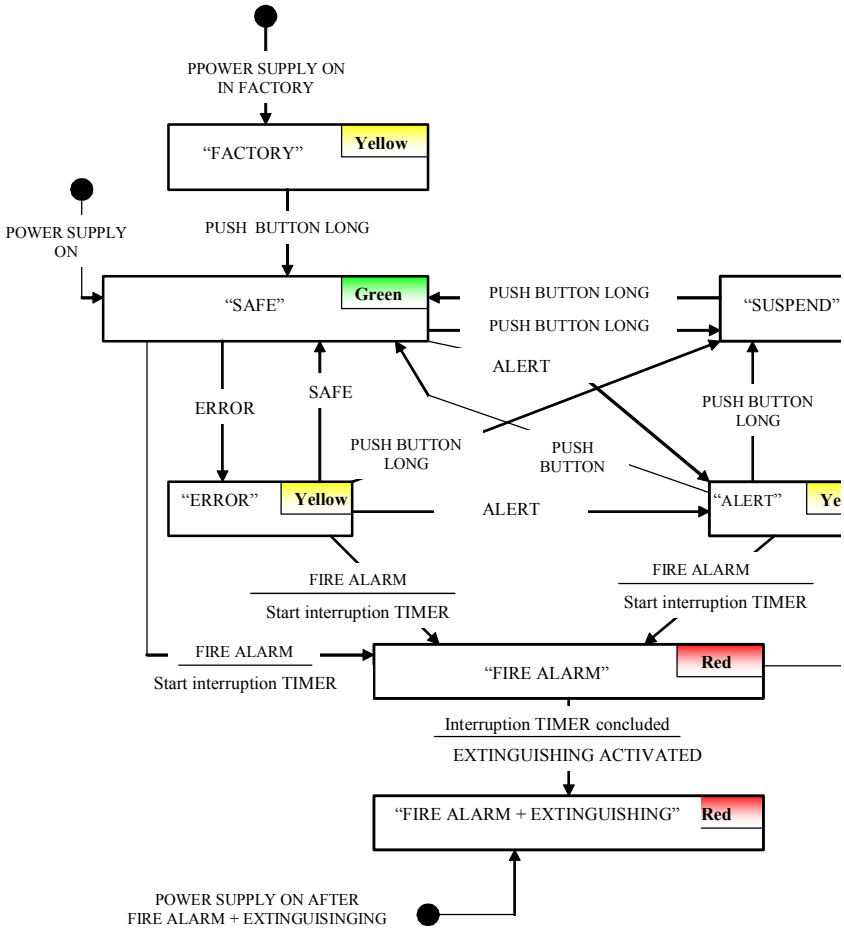

Figure 4 FEC Indicator / Buzzer-status behaviour

The optical and acoustic indicators must show a pattern as stated in figure 5.

Status		LED / Buzzer behaviour
SAFE	LED (100ms/step)	5 minutes
	Buzzer (KHz-Sweep)	Silent
SUSPEND	LED (100ms/step)	
	Buzzer (KHz-Sweep)	Silent
ERROR	LED (100ms/step)	
	Buzzer (KHz-Sweep)	5 5
ALERT	LED (100ms/step)	
	Buzzer (KHz-Sweep)	5 5 5 5
FIRE ALARM	LED (100ms/step)	See Figure 6
	Buzzer (KHz-Sweep)	See Figure 6
EXTINGUISHING	LED (100ms/step)	
	Buzzer (KHz-Sweep)	4 4
FACTORY – Delivery	LED (100ms/step)	
	Buzzer (KHz-Sweep)	Silent
FACTORY – Testing	LED (100ms/step)	Red/Green/Yellow pattern repeated
	Buzzer (KHz-Sweep)	4 Silent 5
FACTORY – Error	LED (100ms/step)	
	Buzzer (KHz-Sweep)	Silent

Figure 5 FEC Indicator behaviour

The figure below shows the behaviour of the optical and acoustic indicators at the moment that the FEC starts giving an optical and acoustic signal for the extinguishing

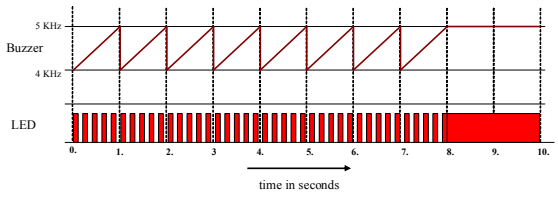

Figure 6. Optical and acoustic signal for extinguishing

2.3.4 *Detection component (c)*

The detection component must meet in principal the requirements stated in EN 54-5: 2001 and correction sheet EN 54-5/Design A1: 2002.
Deviations from these are:

- The detection component is a point detector with decentralized intelligence with a multi-sensor detecting gas (CO) and heat.
- CO detection is differentially.
- Alerts can explicitly reset by the custodian responsible.
- Temperature detection is differentially as well as absolute.
- The temperature detector complies with class A1 of EN 54-5: 2001. For this the ambient temperature is 25°C, the maximum ambient temperature 50°C and the alarm temperature ≥ 54°C.
- The detection values for an alert to the user are:
  - Increase of the CO value by 20 ppm per minute or;
  - Increase of the temperature by 2°C per minute or;
  - Reaching the temperature of ≥ 50°C.
- The detection values for an extinguishing alarm are:
  - Increase of the temperature by 5°C per minute or;
  - Reaching the temperature limit of ≥ 54°C or;
  - Increase of the temperature by 2°C per minute combined with an increase of the CO value by 20 ppm per minute.
- The aerosol fire-extinguishing component must have a delaying time of 10 seconds after detection of a fire before activation of the aerosol fire-extinguishing component. This is, among other things, for disabling and stopping ventilation provisions.

Determination method
The determination method is described in appendix 15.

Explanation
The CO determination alone is not used for extinguishing.

2.3.5 Radio connection for the FEC

The radio connections and system requirements must meet the relevant directives as per the applying CE marking guidelines and EN 54-25.
Deviations and supplementary requirements are:

- The fire-extinguishing component must communicate on a licence-free frequency band (ISM frequency) for which wireless communication for alarm purposes is permitted.
- At least every 5 minutes status reports (containing a.o. power supply conditions, CO value, temperature, operational status of the fire-extinguishing component) must be exchanged between FEC, HUB, AMS-HUB and the AMS.
- Each FEC must be provided with a radio connection.
- The FEC must be provided with an antenna accomplishing a radio connection.

Explanation 1
Even when the FEC is connected to another FEC through a serial bus connection, all FEC's must be provided with an antenna.

Explanation 2
If the FEC is used as a standalone component, it is possible that the radio connection as mentioned in chapter 2.3.5 is not used.

2.3.6 *Housing for the FEC*

The housing of the fire-extinguishing component must meet the following performance requirements.

- § The housing must remain intact during an extinguishing to enable a complete outflow of the aerosol.
- § The requirements in appendix 14 apply.
- § The housing must have at least IP class 30 as per IEC 60529: 2001.
- § The colour of the housing containing the aerosol fire-extinguishing component must be red (RAL 3000) (product requirement).

2.3.7 *Attaching*

It must be possible to attach the fire-extinguishing component appropriately to walls and ceilings of the protected room. The housing and fixing materials must be able to carry 5 x their own weight with a minimum of 5 kg.

2.4 Performance requirements signal repeater (HUB) and radio interface (AMS-HUB)

Below the performance requirements for the various components of the signal repeater are stated, supplementary to and/or deviating from appendices 1 t/m 16.

2.4.1 *General*

- § The HUB must be able to function at a temperature from –10 °C to +60 °C and an air humidity of maximum 95% (no condensation).
- § HUB and AMS-HUB must be able to indicate the statuses mentioned below.

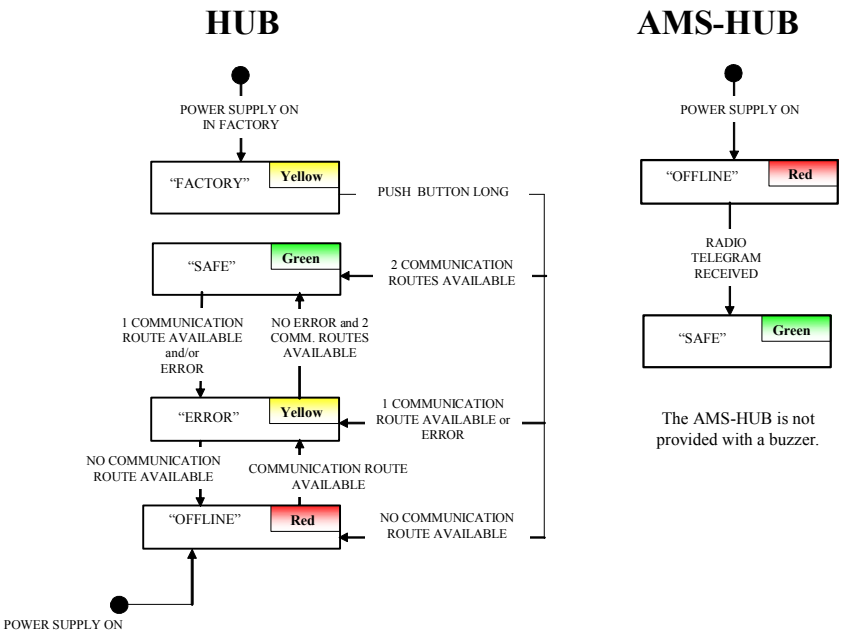

Figure 7 HUB and AMS-HUB Indicator/Buzzer Status Behaviour

The optical and acoustic indicators must show a pattern as stated in table 5.

Status		LED /Buzzer behaviour
SAFE – HUB	LED (100ms/step)	5 seconds
	Buzzer (KHz-Sweep)	Silent
SAFE – AMS-HUB	LED (100ms/step)	Green LED blinks at every radio telegram received
	Buzzer (KHz-Sweep)	AMS-HUB is not provided with a buzzer
FACTORY	LED (100ms/step)	
	Buzzer (KHz-Sweep)	Silent
ERROR	LED (100ms/step)	
	Buzzer (KHz-Sweep)	Silent
OFFLINE	LED (100ms/step)	
	Buzzer (KHz-Sweep)	4 4

Table 3 HUB and AMS-HUB indicator behaviour

2.4.2 *Power supply*

The power supply of the HUB must meet the requirements stated in EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002.

- The batteries must be replaced according to the supplier's maintenance schedule or when the HUB and/or AMS-HUB give a low voltage warning.
- The primary power supply must be obtained from an external transformer (110 V - 260 V, 50 Hz - 60 Hz).
- The secondary (emergency) power supply must be composed of gas-tight batteries or storage-batteries.
- Malfunctions in the power supply or a low (storage) battery voltage must be detected by the alarm management system.

2.4.3 *Radio connection of the HUB*

The radio connections and system requirements must meet the relevant directives as per the applying CE marking guidelines and EN 54-25. Deviations and supplementary requirements are:

- The HUB and AMS-HUB must communicate on a licence-free frequency band (ISM frequency) for which wireless communication for alarm purposes is permitted.
- At least every 5 minutes status reports (containing a.o. power supply conditions, operational status of the HUB) must be exchanged between FEC, HUB and AMS.

2.4.4 *Housing*

The housing of the HUB and AMS-HUB must meet the following performance requirements.

- The requirements in appendix 14 apply.
- The housing must have at least IP class 30 as per IEC 60529: 2001.
- It must be possible to attach the HUB appropriately to walls and ceilings of the protected room. The housing and fixing materials must be able to carry 5 x their own weight with a minimum of 5 kg.

2.5 Performance requirements alarm management system (AMS)

Below the performance requirements for the various components of the AMS are stated, supplementary to and/or deviating from appendices 1 t/m 16.

2.5.1 General

- The AMS must be able to function at a temperature from -10 °C to +60 °C and an air humidity of maximum 95% (no condensation).
- The AMS must meet the requirements stated in EN 54-2: 1998 and EN 54-2/Design A1: 2004.

The AMS must be kept connected to the AMS-HUB by means of serial cabling of maximum 3 meters that guarantees maintaining of functionality for at least 30 minutes during a fire. The AMS must in compliance be provided with at least five potential-free switch contacts (24 Volt / 1 Ampere) for communication with other systems.

  - The AMS must be provided with a serial port for connection to a computer for installation and maintenance activities.
  - The AMS must check the aerosol fire-extinguishing system at least every 15 minutes (power supply conditions, radio communication, status reports, CO value, and etcetera). The check on reports must be defined in the supplier's user manual.
  - The AMS must be provided with acoustic and optical indicators (see paragraph 2.5.1.1)

- The power supply of the AMS must meet the requirements stated in EN 54-4:1997/AC: 1999 and EN 54-4:1997/A1: 2002.
  - The AMS must be connected to a primary power supply (110 V - 260 V, 50 Hz - 60 Hz).

In case of a fault warning in the power supply the secondary (emergency) power supply must be able to feed the AMS for at least 24 hours, of which at least 30 minutes in alarm status. The primary power supply and the secondary power supply of the AMS-HUB must be obtained from the AMS.

Explanation

If faults in the power supply are automatically notified within 30 minutes to a fault warning receiving station that is manned 24 hours a day and if a maintenance agreement as per NEN 2654-1 has been concluded with the fire detection company and this company guarantees that faults are solved within 24, 12 or 6 hours, then an emergency power capacity will suffice of at least 24, 12 or 6 hours, of which at least 30 minutes in alarm status.

2.5.1.1 *Operational statuses*

Figure 8 and table 4 show the behaviour of operational statuses and the optical and acoustic indicators of the AMS.

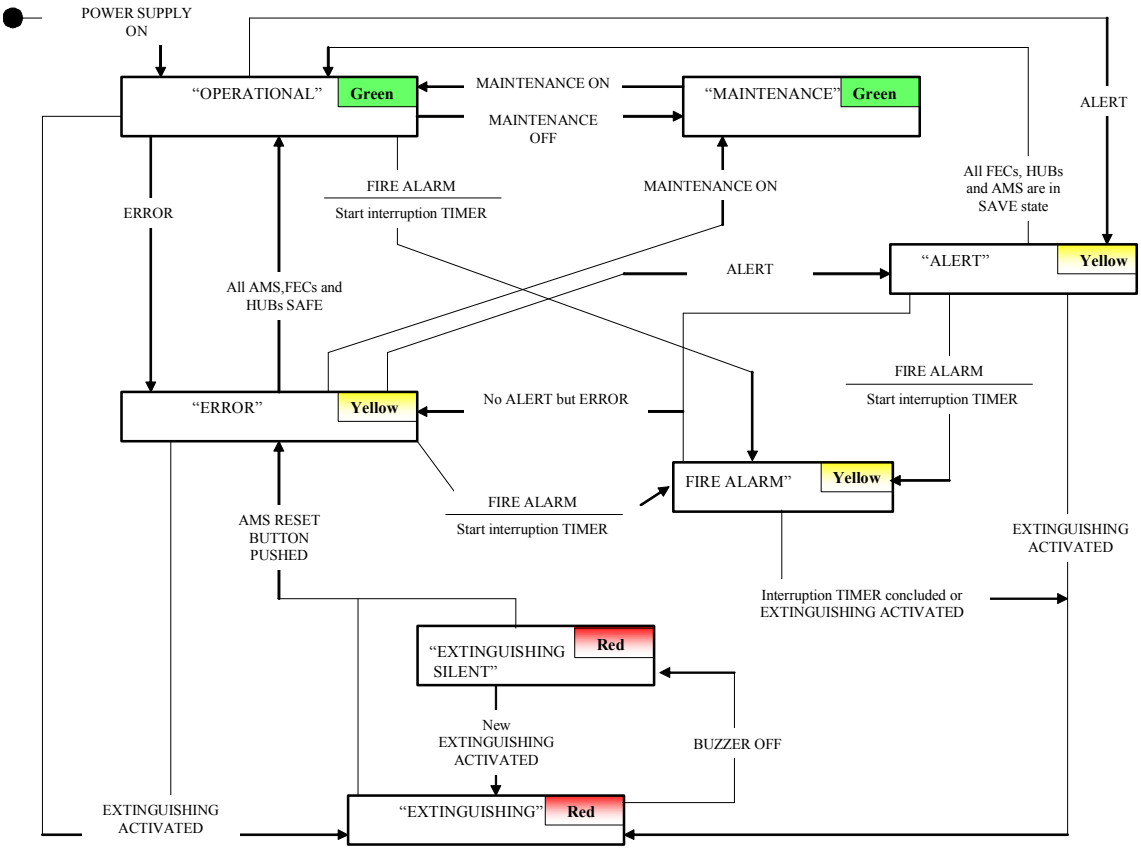

Figure 8. AMS Indicator Status Behaviour

The green LED-indicator on the front panel is always on to indicate that the power supply to the AMS is on. Table 4 shows the various LED-patterns that may be active depending on the current status.

Status		**LED /Buzzer behaviour**
ERROR	**LED (100ms/step)**	
	Buzzer (KHz-Sweep)	5 5
ALERT	**LED (100ms/step)**	
	Buzzer (KHz-Sweep)	5 5 5 5
FIRE ALARM	**LED (100ms/step)**	
	Buzzer (KHz-Sweep)	5 5 5 5 5 5
EXTINGUISHING	**LED (100ms/step)**	
	Buzzer (KHz-Sweep)	**Continuous signal sweep 4KHz..5KHz (1 sec duration sweep)**
EXTINGUISHING-SILENT	**LED (100ms/step)**	
	Buzzer (KHz-Sweep)	**disabled**

Table 4. LED/Buzzer behaviour

2.5.2 *Communication*

- § System requirements and compatibility assessment must meet the requirements as stated in prEN 54-13: 2001.
- § Requirements and test methods for input and output devices for use of transmission paths of fire alarm systems must meet the requirements as stated in EN 54-18: 2003.
- § Optional requirement: The following requirement is not compulsory, but if you do want to apply routing equipment (for notification) in the AMS, the routing equipment for alarm and fault warning must meet the requirements stated in EN 54-21: 2004.

Deviations from this are:
The AMS must be provided with a telephone dialler (in compliance with requirements from the R&TTE directive) to notify alerts, fire alarms and malfunctions to a telephone number and it must be able to forward these by DTMF-codes (dual-tone). The modem must be able to call for each status (alert , fire alarm, malfunction) five pre-programmed telephone numbers. Table 5 shows an overview of the possibilities.

Event	Priority	Telephone numbers (1 + 4 backup)	DTMF codes
ALARM	High	[0-9*#]+	[0-9*#.]+
ALERT	Medium	[0-9*#]+	[0-9*#.]+
MALFUNCTION	Low	[0-9*#]+	[0-9*#.]+

Table 5. Modem priorities

Optional requirement: When applying the FEC as a standalone component it is required that the communication equipment meets the requirements as stated in prEN 54-13:2001, EN 54-18:2003 and EN 54-21:2004. This communication equipment is usually provided by the alarm receiving station.

2.5.3 *Housing*

The housing of the AMS must meet the following performance requirements.

- § The requirements in appendix 14 apply.
- § The housing must have at least IP class 30 complying with IEC 60529: 2001.
- § It must be possible to attach the AMS appropriately to walls and ceilings of the protected room. The housing and fixing materials must be able to carry 5 x their own weight with a minimum of 5 kg.

3 Product requirements

3.1 General

These chapters describe the requirements that the products must meet. For components only certified, normalized or specified materials may be applied.

3.1.1 Certified products

The following components must be applied as certified sub product during assembly of the end product.

Directive	Subject
Evaluation Guideline K23001/03 for product and quality or UL 2775: 2008 or CEN/TR 15276-1 for product.	Aerosol extinguishing components

Table 6. Certified products

If the supplier/manufacturer submits reports by test institutions or laboratories as prove that the requirements from the directive(s) are met, it must be proven that these reports are drawn up by an institution that meets the applicable accredited directives, namely:

- § NEN-EN-ISO/IEC 17025 for laboratories;
- § NEN-EN 45011 for certification institutions certifying products;

The institution is supposed to meet the requirements, when an accreditation certificate can be submitted, that has been granted by the Dutch Council for Accreditation (RvA) or an accreditation institution with which the RvA has concluded a mutual acceptance agreement. This accreditation should relate to the tests required for this Evaluation Guideline.

If no accreditation certificate can be submitted, the certification institution itself will verify whether the accreditation directives have been met, or else carry out (or have carried out) the tests in question.

The certified supplier has all the afore-mentioned certificates of these products available in a components file with an up-to-date overview. This file must be checked yearly by the certified supplier. The afore-mentioned components must be checked visually for material and/or packaging specifications.

3.1.2 Normalized products without product control mark.

These materials must be checked for these specifications based on a declaration by the manufacturer as well as the visual check of material and/or packaging specifications.

Directive / normative reference	Concerns	AMS	HUB	FEC
NEN-EN 54-4	Power supply, primary	X		
NEN-EN 54-4	Power supply, secondary (battery)	X		
UL 609050, EN 60950, EN 55022, EN 61000	Primary power supply (internal AC/DC converter)	X		
NEN-EN 54-4	Emergency power supply regulator	X		
EN-IEC- 60950-1	Adapter power supply (external AC/DC converter)		X	X*
IEC 60086-1, IEC 60086-2, IEC 60086-3, IEC 60086-4, IEC 60086-5	Battery power supply		X	X
DIN 4102-12	Cables with functionality maintenance E30 (30 minutes as per NEN 2535)	X		X
IEC 60529	Housing IP 30	X	X	X
UL 94	Fire-delaying plastic / 94V-2 Flame Class Rating (3)		X	X
UL 2034, EN 50291, CSA22.2	CO sensor			X
EN 60950, EN 55022 (Class B), EN 55024	External communication	X		
NEN-EN 54-2	Display	X		
EN-IEC 60950	AMS Controller	X		

Table 7. Normalized products without product control mark
** optional*

3.1.3 Non-normalized products

All non-normalized products must be checked functionally for its function.
All materials must be checked visually for damage.
It concerns the following materials;

- § Small components like resistors, capacitors, indicators, switches, etc.
- § Mounting materials like fixing screws
- § Electric (flat) cable connections which are used for communication between the various components.

3.2 Environmental requirements

The solder and connection joints in the product must be lead-free as well as soldered lead-free.

3.3 Manual

The product is exclusively supplied to customers who are qualified by the supplier. In this qualification it must be settled that the customer has received and understood the installation and user manual. The manual for design, installation, acceptance, use and maintenance must meet the requirements stated in NEN 5509: 1998 and CEI-IEC 62079: 2001.
Furthermore the manual must offer compulsory information based on the R&TTE, EMC and LVD directives.

3.4 Quality structure

In a risk inventory and evaluation (as stated in chapter 4.5.1) the supplier must determine which sub products are categorized as certified products, normalized products without product control mark and non-normalized products. For all sub products documentation must be available.

3.5 Software identification

The supplier must ensure that the FEC, HUB and AMS contain the correct software configuration. To identify the software, an unique software identification must be specified in the FEC, HUB, AMS-HUB and AMS. The version control must be guaranteed by the supplier. The figure below shows the software identification.

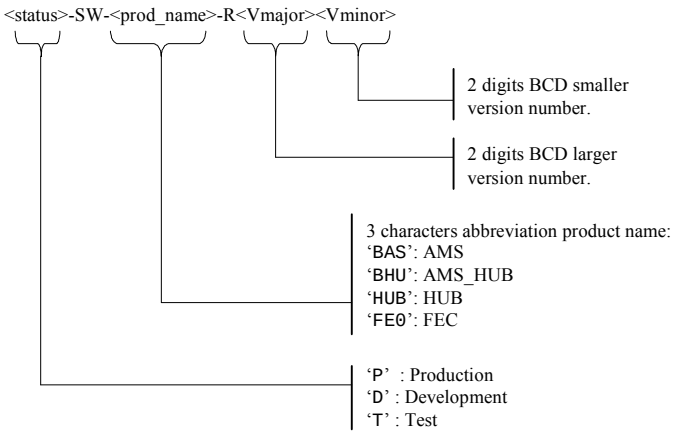

Figure 9. Software identification

The figure below shows how the traceability of the specifications is guaranteed.

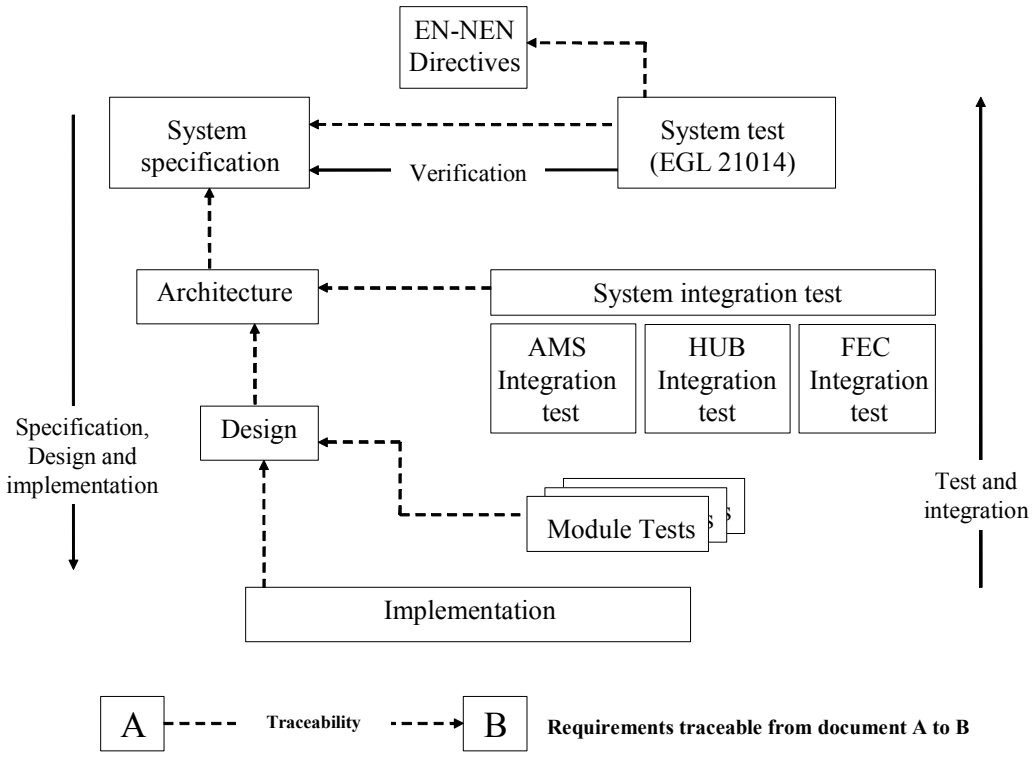

Figure 10. Traceability of the specifications

The traceability of the components in the system is assessed individually during the module tests,

3.6 Packaging, preservation, storage, identification

The packaging must be appropriate for its use, which is at least: transport with a container for road, ship and air freight.
Furthermore packaging must reckon with transport of aerosol components.
The packaging must contain stickers that offer a safety instruction for the system's use. The stickers must be attached to the outside and inside of the object to be protected and should read:
"AUTOMATIC FIRE-EXTINGUISHING SYSTEM, in case of fire or alarm, do not panic, close door(s) and alert expert assistance".
If special measures are necessary for preservation, those must be stated in the working instructions and on the identification label of the packaging.
The identification on the housing and/or packaging must clearly state the following issues:

Housing	Packaging	Indication
X		Qualification on the FEC based on EN2
X	X	Name certified supplier
	X	Address and telephone number certified supplier
X	X	Model / type number
	X	Number of pieces
X	X	Building year / date of production
X		CE + number institution in question
X	X	Land of production
	X	Compulsory information based on R&TTE, EMC and LVD directives

Table 8. Identification housing and/or packaging

3.7 Certification mark

The certified products must be provided with the following icon, stating "NL-K21014".

4 Quality system requirements

4.1 General

These chapters describe the requirements that the certified supplier's quality system must meet.

4.2 Custodian of the quality system

Within the certified supplier's organisation structure a functionary must be appointed who is charged with custody over the certified supplier's quality system.

4.3 Organisation and personnel

The certified supplier's organisation must be recorded in an organisation chart or structure diagram. The tasks, responsibilities and authorisations of all personnel plus their respective replacements must be known at Kiwa. Changes in the organisation must be passed to Kiwa by postal correspondence.

4.3.1 Requirements to other verification personnel

Personnel	Qualification by	Level	Experience	Education	Knowledge of
Custodian quality system	Management	High	1 year within field of application	Management or comparable	ISO9001 BRL-K21014 BRL-K23001
Production Manager	Management	High	1 year within field of application	Electrical engineering or comparable	ISO9001 BRL-K21014 BRL-K23001
Assembly employees	Production manager	Lower	1 year within field of application	IPC-A-610	IPC-A-600
Employee end control	Production manager	Mid	1 year within field of application	Electrical engineering or comparable	IPC-A-610 IPC-A-600 BRL-K21014
Trainers application course	Management	High	1 year within field of application	Safety expert or Electrical engineering	BRL K21014 BRL K23001
Installation mechanic	Quality manager	Mid	1 year within field of application	Electrical engineering	BRL K21014

Table 9. Overview requirements other verification personnel

Proof of education and experience of personnel in question must be recorded.

4.4 Requirements training courses

The end terms of the certified supplier's application training must satisfy the afore-mentioned competences.

4.4.1 Application training installation mechanic

The end terms below apply.

Legislation and regulations

- § Knows what an Evaluation Guideline is
- § Knows the existence of the EGL (BRL) K23001 and K21014
- § Knows the structure of legislation and regulations about the aerosol extinguishing system

General knowledge of fire

- § Knows the definition of fire
- § Knows the standard fire curve
- § Knows the fire triangle, quadrangle and pentagon
- § Knows the fire classes
- § Knows the risks that arise during a fire
- § Knows the concept flash point and the different categories
- § Knows the concept self-ignition point
- § Knows the concept explosion area and the concepts LEL and UEL
- § Knows the different extinguishing methods
- § Knows the different extinguishing agents and their extinguishing efficacy
- § Knows a dry aerosol as extinguishing system
- § Knows the different fire protection systems
- § Knows the different types of automatic alarm devices

General knowledge of radio communication

- § Knows the definition of radio communication
- § Knows the concept radio spectrum
- § Knows the different bands
- § Knows the concept polarisation of radio radiation in free space
- § Knows the general concepts of radio communication
- § Knows the concept signal strength
- § Knows the concept display and power in dB
- § Knows the concept signal quality
- § Knows the concept and properties of transmission lines
- § Knows the functioning of antennas
- § Knows the concept polarisation
- § Knows the attenuation of the different buildings
- § Knows the influence of external interferences on radio links

General knowledge of Radio Network Analyser

- § Knows the functioning of the Radio Network Analyser
- § Is able to carry out radio frequency (RF) measurements
- § Knows how to interpret the Radio Network Analyser in the correct way

General knowledge of aerosol extinguishing system

- § Knows the structure of the aerosol extinguishing system
- § Knows the fields of application of the aerosol extinguishing system
- § Knows the functioning and structure of the alarm management system with radio interface
- § Knows the functioning and structure of the signal repeater
- § Knows the functioning and structure of the fire-extinguishing component
- § Knows the levels of alarm and error messages
- § Knows the different authorisation levels

§ Knows the safety and environmental precautions to be heeded during design, installation, acceptance, use and maintenance of an aerosol extinguishing system

General knowledge of design, detailed design, installation, putting into operation, acceptance and maintenance of aerosol extinguishing systems

Design
§ Knows the concept and importance of a Program of Requirements
§ Knows the importance of frequency measurements

Detailed design
§ Knows the concept and importance of an installation plan
§ Knows the importance of calculating the amount of extinguishing agent needed for a compartment
§ Knows the right projection of fire-extinguishing components

Installation
§ Knows the concept and importance of a correct installation
§ Knows how to handle signal repeaters
§ Knows the basic principles of electrical engineering
§ Knows the concept and importance of an Acceptance Report
§ Knows the certified supplier's user manual

Putting into operation
§ Knows the concept and importance of putting into operation

Acceptance
§ Knows the concept and importance of acceptance
§ Knows the concept and importance of an Acceptance Report
§ Knows the concept and importance of a log book
§ Knows the importance of instructing the customer in use of the aerosol extinguishing system

Maintenance
§ Knows the concept and importance of maintenance as per the specifications that apply
§ Knows the importance of correct filling-out of the log book
§ Knows the concept and importance of a Maintenance Report

4.4.2 Test terms

Each end term has been translated into test terms. The scheme below shows the test terms for each end term.

Legislation and regulations
§ Can explain what an Evaluation Guideline is
§ Can name the main issues in the EGL (BRL) K23001 and K21014
§ Can state the structure of legislation and regulations about the aerosol extinguishing system

General knowledge of fire
§ Can name the definition of fire
§ Can name the standard fire curve
§ Can name the fire triangle, quadrangle and pentagon
§ Can name the fire classes
§ Can name the risks that arise during a fire

- § Can explain the concept flash point and the different categories
- § Can explain the concept self-ignition point
- § Can explain the concept explosion area and the concepts LEL and UEL
- § Can name the different extinguishing methods
- § Can name the different extinguishing agents and their extinguishing efficacy
- § Can explain a dry aerosol as extinguishing system
- § Can name the different fire protection systems
- § Can name the different types of automatic alarm devices

General knowledge of radio communication
- § Can name the definition of radio communication
- § Can explain the concept radio spectrum
- § Can name the different bands
- § Can explain the concept polarisation of radio radiation in free space
- § Can explain the general concepts of radio communication
- § Can explain the concept signal strength
- § Can explain the concept display and power in dB
- § Can explain the concept signal quality
- § Can explain the concept and properties of transmission lines
- § Can explain the functioning of antennas
- § Can explain the concept polarisation
- § Can explain the attenuation of the different buildings
- § Can explain the influence of external interferences on radio links

General knowledge of Radio Network Analyser
- § Can explain the functioning of the Radio Network Analyser
- § Is able to carry out radio frequency (RF) measurements
- § Knows how to interpret the Radio Network Analyser in the correct way

General knowledge of aerosol extinguishing system
- § Can explain the structure of the aerosol extinguishing system
- § Can name the fields of application of the aerosol extinguishing system
- § Can explain the functioning and structure of the alarm management system with radio interface
- § Can explain the functioning and structure of the signal repeater
- § Can explain the functioning and structure of the fire-extinguishing component
- § Can name the levels of alarm and error messages
- § Can name the different authorisation levels
- § Can name the safety and environmental precautions to be heeded during design, installation, acceptance, use and maintenance of an aerosol extinguishing system

General knowledge of design, detailed design, installation, putting into operation, acceptance and maintenance of aerosol extinguishing systems

Design
- § Is able to draw up a Program of Requirements
- § Is able to carry out frequency measurements

Detailed design
- § Is able to draw up a an installation plan
- § Is able to calculate the amount of extinguishing agent needed for a compartment
- § Is able to apply the right projection of fire-extinguishing components

Installation
- Is able to install an aerosol extinguishing system
- Is able to install signal repeaters
- Is able to translate the basic principles of electrical engineering into practice
- Is able to draw up an Acceptance Report
- Knows how to interpret the certified supplier's user manual

Putting into operation
- Is able to put an aerosol extinguishing system into operation

Acceptance
- Is able to carry out acceptance of an aerosol extinguishing system
- Is able to draw up an Acceptance Report
- Is able to draw up a log book
- Is able to instruct the customer in use of the aerosol extinguishing system

Maintenance
- Is able to maintain an aerosol extinguishing system in compliance with the specifications that apply
- Is able to fill out a log book
- Is able to draw up a Maintenance Report

4.4.3 Exam requirements

Evaluation of the exam is done by determining the number of correctly answered questions. The exam consists of 40 multiple-choice question and assessment of usage of the Radio Network Analyser. The examinee is entitled to a personal certificate if at least 27 multiple-choice questions have been answered correctly and the examinee has proven to master the use and data interpretation of the Radio Network Analyser.

The exam is compiled by Kiwa Certification and Inspections, based on the questions available in the item bank. During the exam a supervisor of Kiwa Certification and Inspections will be present.

The certificate has a validity of 3 years conformably to NEN-EN-ISO/IEC 17024.

4.4.4 Item bank

The item bank must contain at least four different questions for each end term.

4.4.5 Maintaining competence

To keep the certificate valid, the certificate owner must have designed, installed, accepted and maintained at least ten aerosol extinguishing systems during the certification period, with a minimum of two per year.
The certificate owner must register this in the log book supplied together with the certificate. The year period goes in effect from the moment of obtaining the personal certificate (date of issue).

Each project in which a certificate owner is or has been involved must be recorded in the log book supplied. If the certificate owner does not reach the yearly minimum number of projects, the validity of the certificate expires. In order to be considered for a renewal of the personal certificate, the applicant

must prove, by successfully passing the exam again, to be still in command of the knowledge required.

4.4.6 Keeping up knowledge

The supplier of the certified products will keep the certificate owners informed about the latest developments by means of a periodical newsletter (at least once a year). Within a month after reception of the newsletter / technical bulletin / manual adjustments the certificate owner must record in his log book, that he has received the documents in question, comprehended the information it contained and that he will act upon any instructions given. If the certificate owner omits this, the validity of the certificate expires. If validity expires, it must be recorded into the log book. In order to be considered for a renewal of the personal certificate, the applicant must prove, by successfully passing the exam again, to be still in command of the knowledge required.

4.5 Internal quality control / quality plan

The certified supplier must have an internal quality control scheme (IQC-scheme) which he applies. During the pre-certification tests this scheme must be functional for at least 3 months.

In this IQC scheme it must be proven:

- what aspects are checked by the certified supplier;
- with what methods these inspections are carried out;
- how often these inspections are carried out;
- in what way the inspection results are recorded and kept.

This IQC scheme should be at least an equivalent derivative of the blank model presented in the appendix with the following additions.

For all components drawings and part list should be available. Changes in these documents may only be made after written consent by the certification institution.

The certified supplier should have a complete overview with all component specifications, and if available, component certificate, component position and certified supplier of the component.

4.5.1 Risk inventory and risk evaluation of the product

The certified supplier must have and keep up a risk inventory and risk evaluation of critical points:

§ in the assembly process;
§ in application of the various components.

Based on this analysis quality cards should be available with critical assembly points.
The analysis and quality cards should be detailed further based on deviations recorded during the production process.
During the inventory spurious and/or false alarms by the system should be taken into account and should be at an accepted level.

4.5.2 Production provisions

Assembly should take place at a location that is protected against the negative influence of electrostatic discharge to the product.

4.5.3 Archive management quality registries / traceability

The quality registries should be kept in archive for at least 5 years. The registries should enable complete unique identification of components and systems as well as traceability of components and systems.

4.6 Procedures and working instructions

The certified supplier must be able to submit:

- § procedures for:
  - handling non-conforming products;
  - corrective actions to be taken if non-conformities are observed;
  - dealing with complaints regarding product deliveries and /or services;
- § working instructions and inspection reports in use.

4.6.1 Inward control components

Components supplied by third parties must meet the requirements stated in chapter 3.3.1, 3.3.2 and 3.3.3. This must be registered by the certified supplier. The system's composition must have been determined during type testing and should be registered by Kiwa and the certified supplier. Each delivery of semi-finished products should contain delivery certificates or specifications by the certified suppliers, proving that the composition is still according to the same specifications.

The quality of the sub products is established by means of a statistic process control based on a previously determined sampling with an accepted quality level as per ISO2859-1. This should be determined based on risk inventory and evaluation. The minimal sample size should be inspection level S2 and accepted quality level AQL 6,5.

4.6.2 Inprocess production controles

The visual controls on solder joints should take place as per IPC-A-610 version D; "Acceptability of Electronic Assemblies". IPC = Association connection electronics industries. The quality level required is class 2.
The printed circuit boards should be evaluated as per IPC-A-600, revision D, class 2.

The working instructions should give insight in the processing of the coating, finish and polarity of the components as well as cleaning of the components and the print.

The quality of the sub products is established by means of a statistic process control based on a previously determined sampling with an accepted quality level as per ISO2859-1. This should be determined based on risk inventory and evaluation. The minimal sample size should be inspection level S2 and accepted quality level AQL 6,5.

Every component from figure 1 should have a unique digital code.

4.7 End inspection production

After assembly the end product's functioning should be checked. This should take place with a software-based product inspection such as carrying out functional tests of critical functions. Before packaging of the product a last visual inspection of the exterior should take place.

4.8 Other requirements to the quality system

The certified supplier should have a functional quality system as per NEN-EN-ISO9001: 2000.

4.9 Subcontracting of activities

If the whole process is put out to subcontractors, then these subcontractors themselves must be certified in compliance with this Evaluation Guideline. If parts of the process are subcontracted, concluding procedures have to be included in the IQC scheme in which the certified supplier declares how the subcontractor's performance quality is guaranteed. It concerns the following aspects:

- § equipment/material to be used;
- § working instructions for the subcontractor;
- § inspections to be carried out by the subcontractor;
- § the entrance inspections of the certified installation mechanic;
- § quality registration of the subcontractor and the certified installation mechanic.

The supplier should settle this with his subcontractor based on contractual agreements.

The subcontractor should always be registered at Kiwa prior to commencing the activities.

4.10 Legal liability

The certified supplier should have a valid liability insurance of at least 1.25 million EURO and should be registered at the Chamber of Commerce.

4.11 Storage and treatment

The aerosol fire-extinguishing system should be transported and treated dry and free of weather influences, with a storage temperature and maximum air humidity as specified by the certified supplier.

The electronics should be packaged conformably to IEC 61340-5-2 "Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide" in a packaging preventing negative influence of electrostatic discharge.

Storage and treatment must be done in such a way that damaging of the product is prevented.

5 Summary of tests and inspections

This chapter offers a summary of the activities to be carried out during certification, namely:

- § Pre-certification tests;
- § Inspection test of performance requirements and product requirements;
- § Inspection of the quality management system;

For each activity the frequency of the inspection tests by Kiwa is stated as well.

5.1 Inspection matrix

Description of requirement	Article EGL	Inspection within scope of		
		Pre-certification audit + type test	Supervision by CI after granting of the certificate	
			Type test	Audit
Performance requirements				
Components	H2	PA + TT		2x per year
Detection and extinguishing	Appendix 15	PA + TT	1x per year	1x per year
Product requirements				
Requirements	H3	PA + TT		2x per year
Quality system				
Quality system	H4	PA		2x per year

Table 10. Inspection matrix

During the product's pre-certification audits (PA), type tests (TT) should be carried out, to determine whether the products meet the specific performance and product requirements. The matrix above shows which requirements must be met, to be eligible for certification.

Furthermore should be verified whether the certified product supplier's quality system meets the demands.

After granting of the product certificate periodical inspections should check whether the production still meets the specific performance and product requirements. Renewed type tests could be applied.

Periodical audits should check whether the certified product supplier's quality system still complies and whether the product is still produced according to the initially tested specifications.

5.2 Changes in design

Changes to the certified product's design must always be reported to Kiwa, before these are applied in production. Kiwa will evaluate whether the design changes will lead to new product type tests. The changed product can only be supplied with the Kiwa certification mark after Kiwa's written approval of the new product.

5.3 Inspection of the quality management system

The inspection of the quality management system can be proven by means of a certificate granted by an accredited certification institution under EAC Accreditation. Furthermore tests and audits should be carried out as per the inspection matrix stated in this Evaluation Guideline. The audit frequency is 2x per year.

6 Requirements to certification institutions

6.1 General

This chapter contains the agreements made by the Board of Experts on the implementation of the certification by the certification institution (CI).

6.2 Certification personnel

The personnel involved in the certification may be divided into:

- **Certification experts:** in charge of the implementation of the pre-certification tests and the assessment of the inspectors' reports;
- **Inspectors:** in charge of the implementation of external inspections at the certified supplier's;
- **Decision makers:** in charge of taking decisions in connection with the pre-certification tests carried out, of continuation of the certification in connection with inspections carried out and decisions regarding the need to take corrective actions.

6.2.1 Qualification requirements

The following qualification requirements have been set up by the Board of Experts for regarding the subject of this Evaluation Guideline:

Certification personnel	Education	Experience
Certification expert	Higher level of professional education • Electrical engineering or equivalent • Internal training certification and Kiwa policy • Audit training • Projection expert fire alarm systems • ISE or equivalent • Knowledge of EGL-K21014 and EGL-K23001	3 year
Inspectors	Intermediate level of professional education • Electrical engineering or equivalent • Internal training certification and Kiwa policy • Audit training • Knowledge of EGL-K21014 and EGL-K23001	3 year
Decision makers	Higher level of professional education • Engineering or equivalent • Internal training certification and Kiwa policy	5 year management experience

Table 11. Qualification requirements

Proof of the level of education and experience of personnel involved must be recorded.

6.3 Frequency of external inspections /audits

At the time this Evaluation Guideline takes effect, the frequency has been set at two inspection visits/audits per year per product location.

7 List of documents stated

7.1 Public law regulations

The following legal decrees apply to this product.

2006/95/EG	Low Voltage Directive	2006
99/5/EG	Radio & Telecommunication Terminal Equipment Directive	1999
89/336/EEG	Electromagnetic Compatibility Directive	1989
2004/108/EG	Electromagnetic Compatibility Directive	2004
89/106/EG	Construction Products Directive	1998

7.2 Directive / normative documents

Norm number	Title directive	Year
BRL-K23001/03	Autonomous stationary extinguishing systems based on dry aerosols	2005
UL 2775	Outline of investigation for fixed condensed aerosol extinguishing units issue no. 1.	2008
CEN/TR 15276-1	Fixed fire fighting systems - Condensed aerosol extinguishing systems - Part 1: Requirements and test methods for components	2008
ISO 2859-1	Sampling procedures for sampling attributes – part 1: sampling schemes indexed by expectance quality limit (AQL) for lot by lot inspection	1999
NEN 3011	Safety colours and safety signs	1986
NEN 5509	User manuals – Content, structure, formulation and presentation	1998
CEI/IEC 62079	Preparation of instructions structuring, content and presentation	2001
IEC 60529	Consolidated Edition Degrees of protection provided by enclosures (IP Code) Applies to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72,5 kV. Has the status of a basic safety publication in accordance with IEC Guide 104	2001
NEN - EN 54-2	Fire detection and fire alarm systems - Part 2: Control and indicating equipment (including correction document)	1999
NEN - EN 54-4	Fire detection and fire alarm systems - Part 4: Power supply equipment (including correction document)	1999
NEN - EN 54-5	Fire detection and fire alarm systems - Part 5: Thermal alarm devices - Point detectors	2001
PrNEN - EN 54-13	Fire detection and fire alarm systems - Part 13: Compatibility of system components	2001
PrNEN - EN 54-18	Fire detection and fire alarm systems - Part 18: Input/output devices	2003
PrNEN - EN 54-21	Fire detection and fire alarm systems - Part 21: Alarm transmission and fault warning routing equipment	2004
NEN - EN 54-25	Fire detection and fire alarm systems - Part 25: Components using radio links and system requirements	2008
NEN – 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	2003
IEC 60068-1-1	Basic Environmental testing procedures – 1998 Part 1: general and guidance	1998+A1:1992
IEC 60068-2-1	Environmental testing – Part 2-1: Tests – Tests A: Cold (including correction document)	1990
IEC 60068-2-2	Basic environmental testing procedures – Part 2-2: Dry Heat d (including correction document)	1974
IEC 60068-2-6	Environmental testing – Part 2-6: Tests – Tests A:Fc: Vibration (sinusoidal), (including correction document)	1996
IEC 60068-2-27	Environmental testing – Part 2-27: Tests – Tests Ea: Shock	1987
IEC 60068-2-30	Environmental testing – Part 2-30: Tests – Tests Db Damp heat cyclic	1980
IEC 60068-2-32	Environmental testing – Part 2-32: Tests – Tests Ed: Free Fall	1993

IEC 60068-2-42	Environmental testing – Part 2-42: Test methods – Tests Kc: Sulphur dioxide test for contacts and connections	2002
IEC 60068-2-75	Environmental testing – Part 2-75: Tests – Tests Eh: Hammer Test	1997
IEC 60068-2-78	Environmental testing – Part 2-78: Tests – Tests Cab: Damp Heat, steady state	2001
IEC 61340-5-2	Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide	2001
EN 2	Fire classes	1994

8 Appendix 1 - model product certificate

Number 12345 Replaces

Issue Date

Certificate

Product certificate

Aerosol fire-extinguishing systems for fire protection in enclosed compartments containing electrical components

Based on pre-certification tests as well as periodic inspections by Kiwa, the products, manufactured by

Certificate owner

specified in this certificate and marked with the KQ-mark as indicated under "Marking" may, on delivery, be relied upon to comply with the Kiwa – Evaluation Guideline K21014.

Kiwa N.V.

ing. B. Meekma
Director
Certification and Inspections

This certificate is issued in accordance with Kiwa Regulations for product certification and consists of … pages.
Publication of the certificate is permitted.

Supplier
Company

Kiwa N.V.
Certification and Inspections
Sir W. Churchill-laan 273
P.O. Box 70
2280 AB Rijswijk
The Netherlands
Telephone 070 41 44 400
Fax 070 41 44 420

Aerosol fire-extinguishing systems for fire protection in enclosed compartments containing electrical components

PRODUCT SPECIFICATION

The system consists of the following components:

1. Fire-extinguishing component (FEC) containing:
   a. Aerosol fire-extinguishing component for extinguishing;
   b. Fire alarm extinguishing station for driving the aerosol fire-extinguishing component and other drivers;
   c. Detection component for monitoring and guarding the object.
2. Signal repeater (HUB)
3. Alarm management system with radio interface

The maximum combined number of fire-extinguishing components (FEC) and signal repeaters (HUB) within one system is 511. Within a system configuration the transmission path between a fire-extinguishing component and the alarm management system is limited to a maximum of 32 signal repeaters (HUB). The system has to communicate on a licence-free frequency band (ISM frequency) for which wireless communication for alarm purposes is permitted. The aerosol fire-extinguishing system should be constructed in such a way that the radio connection as transmission path is carried out redundantly.

The system is tested and proven in the following dimensioning and projection. These dimensioning and projection fall within the scope of the product certificate. The number of fire-extinguishing components (FEC) needed for a specific object also determines the projection, i.e. the position and direction in which the FEC's must be mounted. When applying 1 FEC it will be placed in the middle of the object on the upper side, having the outflow openings pointing to the left and the right. Ensure that both outflow openings of the FEC have at least 15 cm of free outflow space in order to prevent damage to equipment. The antenna has to be connected to the FEC by means of an antenna extension cord. When applying 2 or more FEC's these are placed on the side of the object to be protected, having the outflow openings pointing upwards and downwards. Ensure that both outflow openings of the FEC have at least 15 cm of free outflow space in order to prevent damage to equipment. When applying more than 1 FEC in a cabinet these must be linked by means of a bus connection.

The FE is tested under following conditions to determine if detection is within the requirements of guideline BRL-K21014. The following conditions have been used:

- TF1, wood crib (source 7 according to BS 5852-2:1990).
- TF4, polyurethaan mats (comparable with NEN 2535:1996 and EN 54-7:2000).
- TF7, methylated spirit 85% (comparable with NEN 2535:1996).
- TF10, print with 5 resistors (comparable with NEN 2535:1996).

APPLICATION AND USE

Full title

The full title of this evaluation guideline is the Kiwa product certificate for aerosol fire-extinguishing systems with wireless communication to an alarm management system for fire protection in enclosed compartments containing electrical components (maximum 1500 Volts DC and 1000 Volts AC).

Product aim

The aerosol fire-extinguishing system should monitor the environment to be protected for fire phenomena by detecting these and then communicate with other equipment within the system with the purpose to alarm in an initial phase of fire, notify a receiving station for fire alarms, extinguish in the fire phase and control during a set period.
The application is primarily meant for objects that cannot be entered by humans and fall under the definition "un-enterable room".
More specifically the objective is as follows:
Early detection (with wireless fire alarm system with detection based on % CO and ΔT/Tmax) for fire sizes as stated in appendix 15. The extinguishing system should prevent an expansion of the fire outside the cabinet during the standing time of the extinguishing agent.

The aerosol fire-extinguishing system is aimed for application in compartments such as:

- Switch cabinets;
- Computers;
- Meter boxes.

Starting-point in this is a standard projection (see appendices 15 and 16) for detection and for extinguishing. It therefore concerns a pre-engineered system. The installation of the aerosol fire-extinguishing system should be described in the supplier's manual. The users will be instructed in design, installation, acceptance and follow-up by means of a training by the supplier. For an integral safety concept this training should be applied in combination with this BRL (EGL).

Explanation: If the detection system does not function, the system shall be activated by means of a thermal cord. If this thermal cord refuses, activation takes place based on the aerosols own activation temperature. The values must be declared in the product certificate of the aerosol extinguishing agent as per BRL-K23001. Additionally the product certificate must give insight in dimensioning of the system.

The aerosol fire-extinguishing system should be able to function in an indoor environment meeting the following conditions.

Conditions	FEC	HUB	AMS
Use			
Temperature	-10°C to +45°C#	-10°C to +60°C	-10°C to +60°C
Air humidity	<95% RH*	<95% RH*	<95% RH*
Air pressure	86 to 106kPa	86 to 106kPa	86 to 106kPa
Storage			
Temperature	-20°C to +40°C	-20°C to +50°C	-20°C to +50°C
Air humidity	25 to 75% RH	25 to 75% RH	25 to 75% RH
Air pressure	86 to 106kPa	86 to 106kPa	86 to 106kPa
Transport (during a maximum of 24 hours)			
Temperature	-35°C to +50°C	-35°C to +85°C	-35°C to +85°C
Air humidity	<95% RH*	<95% RH*	<95% RH*
Air pressure	86 to 106kPa	86 to 106kPa	86 to 106kPa

* = no condensation.
# = The hardware is supposed to operate up to +60°C.

The system parts must have been developed according to IEC 60721-3-1 and IEC 60721-3-2 and must have been tested according to IEC 60721-4-1 and IEC 60721-4-2, in order to be able to be stored and transported without changing its properties or lifetime.
The system consists of products which must meet public law regulations including:

- the Low Voltage Directive (LVD: 2006/95/EG)
- the Radio & Telecommunication Terminal Equipment Directive (R&TTE: 1999/5/EG)
- the Electromagnetic Compatibility Directive (EMC: 89/336/EEG > 2004/108/EG)
- the Construction Products Directive (CPD: 89/106/EG)

The products in the system are evaluated according to Kiwa guideline BRL-K21014. The guideline incorporates parts the following standards. The exact relation between the guideline and the standards is reflected in the annexes of the BRL. Relevant standards are;

Standard number	Standard title	Year
BRL-K23001/03	Autonomous stationary extinguishing systems based on dry aerosols	2005
ISO 2859-1	Sampling procedures for sampling attributes – part 1: sampling schemes indexed by expectance quality limit (AQL) for lot by lot inspection	1999
NEN 3011	Safety colors and safety signs	1986
NEN 5509	User manuals – Content, structure, formulation and presentation	1998
CEI/IEC 62079	Preparation of instructions structure ring, content and presentation	2001
IEC 60529	Consolidated Edition Degrees of protection provided by enclosures (IP Code) Applies to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72,5 kV. Has the status of a basic safety publication in accordance with IEC Guide 104	2001
NEN - EN 54-2	Fire detection and fire alarm systems - Part 2: Control and indicating equipment (including correction document)	1999
NEN - EN 54-4	Fire detection and fire alarm systems - Part 4: Power supply equipment (including correction document)	1999
NEN - EN 54-5	Fire detection and fire alarm systems - Part 5: Thermal alarm devices - Point detectors	2001
PrNEN - EN 54-13	Fire detection and fire alarm systems - Part 13: Compatibility of system components	2001
PrNEN - EN 54-18	Fire detection and fire alarm systems - Part 18: Input/output devices	2003
PrNEN - EN 54-21	Fire detection and fire alarm systems - Part 21: Alarm transmission and fault warning routing equipment	2004
PrNEN - EN 54-25	Fire detection and fire alarm systems - Part 25: Components using radio links and system requirements	2005
NEN – 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	2003
IEC 60068-1-1	Basic Environmental testing procedures – 1998 Part 1: general and guidance	1998 + A1: 1992
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IEC 60068-2-2	Basic environmental testing procedures – Part 2-2: Tests – Tests B: Dry Heat d (inclusive correction document)	1974
IEC 60068-2-6	Environmental testing – Part 2-6: Tests – Tests A:Fc: Vibration (sinusoidal), (inclusive correction document)	1996
IEC 60068-2-27	Environmental testing – Part 2-27: Tests – Tests Ea: Shock	1987
IEC 60068-2-30	Environmental testing – Part 2-30: Tests – Tests Db and guidance Damp heat cyclic	1980
IEC 60068-2-32	Environmental testing – Part 2-32: Tests – Tests Ed: Free Fall	1993
IEC 60068-2-42	Environmental testing – Part 2-42: Test methods – Tests Kc: Sulphur dioxide test for contacts and connections	2002
IEC 60068-2-75	Environmental testing – Part 2-75: Tests – Tests Eh: Hammer Test	1997
IEC 60068-2-78	Environmental testing – Part 2-78: Tests – Tests Cab: Damp Heat, steady state	2001
IEC 61340-5-2	Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide	2001
EN 2	Fire classes	1994

Remark 2

The prEN 54-25 refers to the following directives regarding radio communication:

- EN 300113-1 V 1.4.1: 2002, Electromagnetic compatibility and Radio spectrum Matters (ERM) — Land mobile service — Radio equipment intended for the transmission of data (and/or speech) using constant or non- constant envelope modulation and having an antenna connector — Part 1: Technical characteristics and methods of measurement.
- EN 300220-1 V 1.3.1: 2000, Electromagnetic compatibility and Radio spectrum Matters (ERM) - Short range devices — Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW — Part 1: Technical characteristics and test methods.
- 99/5/EC, Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment (R&TTE) and the mutual recognition of their conformity.

The directive EN 300220-1 is used for defining and testing of radio products in a frequency band of 25 MHz to 1 GHz. This product functions on a frequency of 2.4 GHz. The 2.4 GHz is a free band which throughout Europe can be used for alarm purposes.
The Construction Products Directive (CPD) has not taken into account higher frequencies although this is technically possible and directives for these are available.
A Notified Body has granted a general directive for a frequency band that covers this product (1 GHz – 40 GHz), thus meeting the

R&TTE directives and aligning as close as possible to the Construction Products Directive. The description of the directives is stated below.

- ETSI EN 300 440-1 V1.3.1 (2001-09) Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 1: Technical characteristics and test methods
- ETSI EN 300 440-2 V1.1.2 (2004-07) Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive

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APPLICATION AND USE

Application conditions

1. The number and/or types of the extinguishing components to be used must be installed conformably to the directives and calculation methods of the installer.
2. A delivery user manual should be supplied.
3. For product use instructions should be given by a certified product trainer who is certified by the installer.
4. Maintenance of the fire extinguishing components should be carried out as per the installer's specifications.
5. The user must manage the system conformably to his training and to the manual.

TIPS FOR THE CUSTOMER

1. Inspect on delivery:
   1.1 whether everything has been delivered as agreed;
   1.2 whether the activities carried out show no visual shortcomings.
2. If, based on the afore-mentioned, you decide to reject, please contact:
   2.1 Company.
   and if necessary:
   2.2 Kiwa N.V.
3. For the correct way of storage and transport please consult the handling guidelines by the manufacturer.
4. Check whether this certificate is still valid by consulting Kiwa – website www.kiwa.nl - and searching for certified companies under guideline BRL-K21014

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9 Appendix 2 - IQC scheme

Inspection subjects	Inspection aspects	Inspection method	Inspection frequency	Inspection registration
Raw materials or supplied materials § Product composition § Recipe sheets § Entrance inspection raw materials				
Production process § Procedures § Working instructions § Equipment § Material				
End products § a.o. statistic process inspection as per ISO2859				
Measuring and test equipment § Measuring means § Calibration				
Logistics § Internal transport § Storage § Packaging § Preservation § Identification or marking of semi-finished and end products				

Table 12. IQC scheme

The IQC scheme is drawn up by the certified supplier and set by the Certification Institution.

10 Appendix 3 - Cross reference aerosol

Appendix 3A - Cross reference BRL-K23001

Nr.	Subject	FEC	HUB	AMS
1.	**Introduction**	X	*	*
1.1	General	X	*	*
1.2	Scope	X	*	*
1.3	Definitions and abbreviations	X	*	*
1.4	Requirements and determination methods	X	*	*
1.4.1	Requirements	X	*	*
1.4.2	Determination methods	X	*	*
1.5	Acceptance of research reports provided by the supplier	X	*	*
1.6	Declaration of quality	X	*	*
1.7	Transition provision	X	*	*
2.	**Performance requirements and determination methods**	X	*	*
2.1	General	X	*	*
2.2	Requirements	X	*	*
2.2.1	Performance requirement extinguishing performance aerosol	X	*	*
2.2.1.1	Extinguishing object EN 2, class A, solid	X	*	*
2.2.1.2	Extinguishing object EN 2, class A, solid plastics	X	*	*
2.2.1.3	Extinguishing object EN2, class A, solid, multi-layer wood with/without plastics	X	*	*
2.2.1.4	Extinguishing object EN2, class B, liquid	X	*	*
2.2.1.5	Extinguishing object EN2, class C, gas	X	*	*
2.2.1.6	Extinguishing object EN 2, class F, fats and oils	X	*	*
2.2.2	Performance requirement solidity and ignition SFE	X	*	*
2.2.3	Performance requirement solidity and self-combustion SFE	X	*	*
2.2.4	Performance requirement full ignition/ outflow SFE (electric) of the fire-extinguishing component	X	*	*
2.2.5	Performance requirement suspension system fire-extinguishing component	X	*	*
2.2.6	Thermal aging of the SFE and electrical igniter	X	*	*
3.	**Product requirements and determination methods**	X	*	*
3.1	General	X	*	*
3.2	Structure and accessories of the extinguishing component	X	*	*
3.3	Product requirements and determination methods	X	*	*
3.3.1	Installation and user manual	X	*	*
3.3.2	Packaging, preservation, storage, identification	X	*	*
3.4	Certification mark	X	*	*
4.	**Quality system requirements**	X	*	*
4.1	General	X	*	*
4.2	Custodian of the quality system	X	*	*
4.2.1	Requirements to other verification personnel	X	*	*
4.3	Internal quality control / quality plan	X	*	*
4.4	Procedures and working instructions	X	*	*
4.5	Other requirements to the quality system	X	*	*
4.6	Storage and treatment	X	*	*
4.7	Entrance control SFE	X	*	*
4.8	Process control production charge	X	*	*
4.8.1	Activation and ejection mechanism	X	*	*
4.8.2	Chemical stability extinguishing agent	X	*	*
5.	**Summary of test and inspections**	X	*	*
5.1	Test matrix	X	*	*
5.1.1	Changes in design	X	*	*
5.2	Inspections of the quality system	X	*	*

Nr.	Subject	FEC	HUB	AMS
6.	**Requirements to certification institutions**	X	*	*
6.1	General	X	*	*
6.2	Certification personnel	X	*	*
6.2.1	Qualification requirements	X	*	*
6.3	Frequency of external inspections / audits	X	*	*
7.	**List of documents stated**	X	*	*
7.1	Public law regulations	X	*	*
7.2	Directives / normative documents	X	*	*
Appendix 1	**Testimonial with product certificate**	X	*	*
Appendix 2	**IQC scheme**	X	*	*

* = Not within scope, this has been settled elsewhere in the directive.

Appendix 3B - Cross reference UL 2775

Nr.	Subject	FEC	HUB	AMS
	Introduction		*	*
1	Scope	X	*	*
2	Components	X	*	*
3	Units of Measurement	X	*	*
4	Undated References	X	*	*
5	Glossary	X	*	*
	Construction		*	*
6	General	X	*	*
7	Electrically Operated Alarms	X	*	*
8	Controls and Indicators	X	*	*
9	Pneumatic Control Assembly Pressure Vessels	*	*	*
10	Pressure Relief devices for Pneumatic Control assemblies	*	*	*
11	Gaskets and 'O' Rings	*	*	*
12	Pressure Gauges for Pneumatic Control Assemblies	*	*	*
13	Puncturing Mechanisms	*	*	*
14	Electrically Operated Devices	*	*	*
15	Condensed Aerosol Extinguishing Agents	X	*	*
16	Pneumatic Control Gases	*	*	*
17	Polymeric Materials and Non-metallic parts	X	*	*
18	Anti-Recoil Devices	*	*	*
19	Pressure Switches	*	*	*
	Performance		*	*
20	General	X	*	*
21	Discharge Test	X	*	*
22	Temperature Measurement Test	X	*	*
23	Mounting Device Test	X	*	*
24	Rough Usage Test	X	*	*
25	Vibration Test	X	*	*
26	Pyrotechnic Reaction Containment Test	X	*	*
27	Fire Exposure Test	X	*	*
28	High Humidity Test	X	*	*
29	Moist Hydrogen Sulphide Air Mixture Corrosion Test	X	*	*
30	Moist carbon Dioxide-Sulphur Dioxide Air Mixture Corrosion Test	X	*	*
31	Salt Spray Corrosion Test	X	*	*
32	Thirty-day Elevated Temperature Test	X	*	*
33	Temperature Cycling Test	X	*	*
34	One-Year Time Leakage Test	*	*	*
35	Hydrostatic Pressure Test	*	*	*
35.1	Pressure Vessels	*	*	*
35.2	Other pressure retaining devices	*	*	*
35.3	Test method	*	*	*
36	Pressure Relief Test	*	*	*
37	Flexible Hose Assembly Low Temperature Test	*	*	*
38	Calibration Test – Gauges	*	*	*
39	Burst Strength Test – Gauges	*	*	*
40	Overpressure Test – Gauges	*	*	*
41	Impulse Test – Gauges	*	*	*
42	Pressure Relief Test – Gauges	*	*	*
43	Water Resistance Test – Gauges	*	*	*
44	Pneumatic Operation Test	*	*	*
45	Pneumatic Time delay Verification Test	*	*	*
46	Pressure-Operated Alarm Test	*	*	*
47	Operation Test of Manual Actuators and Manual Pull Stations	*	*	*
48	500 Cycle Operation Test	X	*	*
48.1	Electrical initiators	X	*	*

Nr.	Subject	FEC	HUB	AMS
48.2	Other Devices	X	*	*
49	Class A and B Fire Extinguishing Tests	X	*	*
49.1	General test parameters	X	*	*
49.2	Class A fire extinguishing tests	X	*	*
49.3	Class B fire extinguishing tests	X	*	*
50	Distribution Verification Extinguishing Tests with Extinguishing System Units	X	*	*
50.1	General	X	*	*
50.2	Test enclosure	X	*	*
50.3	Maximum area coverage and minimum height test arrangement procedure	X	*	*
50.4	Maximum height test arrangement procedure	X	*	*
51	Distribution Verification Extinguishing Test with Automatic Extinguisher Unit	X	*	*
51.1	General	X	*	*
51.2	Test enclosure	X	*	*
51.3	Maximum area coverage, minimum height and maximum volume test arrangement procedure	X	*	*
51.4	Maximum height and maximum volume test arrangement procedure	X	*	*
52	Automatic Extinguisher Unit Automatic Operation Extinguishing Tests	X	*	*
52.1	General	X	*	*
52.2	Test enclosures	X	*	*
52.3	Test arrangement procedure	X	*	*
53	Elastomeric Parts Test	*	*	*
54	Stress Corrosion Cracking Test for Brass Parts	*	*	*
55	Aging Test – Condensed Aerosol Generator	X	*	*
56	Aging Tests – Plastic Materials	X	*	*
56.1	Air-oven aging test	X	*	*
56.2	Light and water test	X	*	*
57	Nameplate Exposure Tests	X	*	*
58	Nameplate Adhesion Test	X	*	*
59	Nameplate Abrasion Test	X	*	*
60	Locking Device And Tamper iIndicator Test	*	*	*
	Manufacturing and Production Tests		*	*
61	General	X	*	*
61.1	General	X	*	*
61.2	Aerosol-forming compound	X	*	*
61.3	Electrical initiators	X	*	*
61.4	Hydrostatic pressure test – shells for pneumatic control assemblies	*	*	*
61.5	Gauge calibration test for pneumatic control assemblies	*	*	*
61.6	Leakage test for pneumatic control assemblies	*	*	*
	Markings	X	*	*
62	General	X	*	*
	Instructions	X	*	*
63	General	X	*	*
64	Owner's Manual	X	*	*
65	Design, Installation, Operation and Maintenance Instruction Manual	X	*	*

* = Not within scope, this has been settled elsewhere in the directive.

Appendix 3C - Cross reference CEN/TR 15276-1

Nr.	Subject	FEC	HUB	AMS
1	**Scope**	**X**	*	*
2	**Normative references**	**X**	*	*
3	**Terms and definitions**	**X**	*	*
4	**Component requirements**	**X**	*	*
4.1	Condensed aerosol generator	X	*	*
4.2	Solid aerosol-forming compound	X	*	*
4.3	Cooling mechanism	X	*	*
4.4	Ignition device	X	*	*
4.4.1	General	X	*	*
4.4.2	Electrical ignition device	X	*	*
4.4.3	Thermal ignition device	X	*	*
4.4.4	Other methods of ignition device	X	*	*
4.5	End plate and housing	X	*	*
4.6	Extinguishants	X	*	*
5	**Condensed aerosol generators requirements**	**X**	*	*
5.1	General	X	*	*
5.2	Extinguishing factor	X	*	*
5.3	Agent distribution	X	*	*
5.4	Discharge time	X	*	*
5.5	Ambient temperature and humidity operation ranges	X	*	*
5.6	Service life	X	*	*
5.7	Shelf life and storage conditions	X	*	*
5.8	Corrosion	X	*	*
5.9	Vibration	X	*	*
5.10	Mechanical shock	X	*	*
5.11	Discharge temperature	X	*	*
5.11.1	General	X	*	*
5.11.2	Casing temperature	X	*	*
5.11.3	Aerosol flow temperature	X	*	*
5.12	Ignition device	X	*	*
5.12.1	General	X	*	*
5.12.2	Electrical ignition device	X	*	*
5.12.3	Thermal ignition device	X	*	*
5.13	Function reliability	X	*	*
5.14	Open fire conditions	X	*	*
5.15	Accessories	X	*	*
5.16	Documentation	X	*	*
6	**Marking**	**X**	*	*
7	**Test methods**	**X**	*	*
7.1	Conditions	X	*	*
7.2	Samples	X	*	*
7.3	Conformity	X	*	*
7.4	Extinguishing factor determination	X	*	*
7.5	Coverage determination	X	*	*
7.6	Discharge time test	X	*	*
7.7	Temperature and humidity operation range tests	X	*	*
7.7.1	Object of the test	X	*	*
7.7.2	Test procedure	X	*	*
7.7.3	Low temperature Test	X	*	*
7.8	Accelerated ageing test	X	*	*
7.8.1	Test time	X	*	*
7.8.2	Test procedure	X	*	*
7.9	Corrosion test	X	*	*
7.10	Stress corrosion test	X	*	*
7.11	Vibration test	X	*	*
7.12	Impact test	X	*	*

Nr.	Subject	FEC	HUB	AMS
7.12.1	Test procedure	X	*	*
7.12.2	Test apparatus	X	*	*
7.13	Drop test	X	*	*
7.13.1	Impact surface	X	*	*
7.13.2	Procedure	X	*	*
7.13.3	Requirements	X	*	*
7.14	Casing and aerosol flow temperatures test	X	*	*
7.14.1	Casing temperature test	X	*	*
7.14.2	Aerosol flow temperature test	X	*	*
7.15	Ignition performance test	X	*	*
7.16	Function test	X	*	*
7.16.1	Discharge time	X	*	*
7.16.2	Aerosol flow temperatures	X	*	*
7.16.3	Test procedure	X	*	*
7.16.4	Casing temperature test	X	*	*
7.16.5	Discharged mass	X	*	*
7.16.6	Explosive atmosphere actuation test	X	*	*
7.16.7	Requirements	X	*	*
7.17	Heat exposure test	X	*	*
7.17.1	Object of the test	X	*	*
7.17.2	Test procedure	X	*	*
7.17.3	Requirements	X	*	*
7.18	Explosive atmosphere test	X	*	*
7.18.1	Object of the test	X	*	*
7.18.2	Test procedure	X	*	*
7.18.3	Requirements	X	*	*
Annex A	(normative) Extinguishing factor/coverage test procedure	X	*	*

- = Not within scope, this has been settled elsewhere in the directive.

11 Appendix 4 - Cross reference EN 54-2

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	*	*	*	*
2.	**Normative references**	X	*	X	X
3.	**Definitions and abbreviations**	X	*	X	X
4.	**General requirements**	X	*	X	X
5.	**General requirements for indications**	X	*	X	X
5.1	Display of functional conditions	X	*	X	X
5.2	Display of indications	X	*	X	X
5.3	Indications on alphanumeric displays	*	*	X	*
5.4	Indications on the supply of power	X	*	X	X
5.5	Audible indications	X	*	X	X
5.6	Additional indications	X	*	X	X
6.	**The quiescent condition**	X	*	X	X
7.	**The fire alarm condition**	X	*	X	X
7.1	Reception and processing of fire signals	X	*	X	X
7.2	Indication of the fire alarm condition	X	*	X	X
7.3	Indication of the zones in alarm	X	*	X	X
7.4	Audible indication	X	*	X	X
7.5	Other indications during the fire alarm condition	X	*	X	X
7.6	Reset from the fire alarm condition	X	*	X	X
7.7	Output of the fire alarm condition	X	*	X	X
7.8	Output to fire alarm devices	X	*	X	X
7.9	Control of fire alarm routing equipment	*	*	X	*
7.9.1	Output to fire alarm routing equipment	*	*	*	*
7.9.2	Input from fire alarm routing equipment	*	*	*	*
7.10	Output to fire protection equipment	*	*	*	*
7.10.1	Output type A	*	*	*	*
7.10.2	Output type B	*	*	*	*
7.10.3	Output type C	*	*	*	*
7.10.4	Fault monitoring of fire protection equipment	*	*	*	*
7.11	Delays to output	X	*	*	X
7.12	Dependency on more than one alarm signal	X	*	X	*
7.12.1	Type A dependency	X	*	X	*
7.12.2	Type B dependency	X	*	X	*
7.12.3	Type C dependency	X	*	X	*
7.13	Alarm counter	*	*	*	*
8.	**Fault warning condition**	X	*	X	X
8.1	Reception and processing of fault signals	X	*	X	X
8.1.1	Fault warning condition	*	*	X	X
8.1.2	Capable of simultaneously recognizing	*	*	X	X
8.1.3	Fault warning condition in 100 s	*	*	X	*
8.2	Indication of faults	X	*	X	X
8.3	Fault signals from points	X	*	X	X
8.4	Total loss of the power supply	X	*	X	*
8.5	System fault	X	*	X	X
8.6	Audible indication	X	*	X	X
8.7	Reset of fault indications	X	*	X	X
8.8	Fault output	X	*	X	X
8.9	Output to fault warning routing equipment	X	*	X	X
9.	**Disabled condition**	X	*	X	X
9.1	General requirements	X	*	X	X
9.2	Indication of the disabled condition	X	*	X	X
9.3	Indication of specific disablements	X	*	X	X
9.4	Disablements and their indication	X	*	X	X
9.5	Disablement of addressable points	*	*	*	*
10.	**Test condition**	*	*	*	*
10.1	General requirements	*	*	*	*
10.2	Indication of the test condition	X	*	X	*

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
10.3	Indication of zones in the test state	X	*	*	*
11.	**Standardized input/output interface**	*	*	*	*
12.	**Design requirements**	X	*	X	X
12.1	General requirements and manufacturer's declarations	X	*	X	X
12.2	Documentation	X	*	X	X
12.3	Mechanical design requirements	X	*	X	X
12.4	Electrical and other design requirements	X	*	X	X
12.5	Integrity of transmission paths	X	*	X	X
12.6	Accessibility of indications and controls	X	*	X	X
12.7	Indications by means of light emitting indicators	X	*	X	X
12.8	Indications on alphanumeric displays	X	*	X	*
12.9	Colours and indications	X	*	X	X
12.10	Audible indications	X	*	X	X
12.11	Testing of indicators	X	*	X	X
13.	**Additional design requirements for software controlled control and indicating equipment**	X	*	X	X
13.1	General requirements and manufacturer's declarations	X	*	X	X
13.2	Software documentation	X	*	X	X
13.3	Software design	X	*	X	X
13.4	Program monitoring	X	*	X	X
13.5	The storage of programs and data	X	*	X	X
13.6	The monitoring of memory contents	X	*	X	X
13.7	Operation of the control and indicating equipment in the event of a system fault	X	*	X	X
14.	**Marking**	X	*	X	X
15.	**Test**	X	*	X	X
15.1	General	X	*	X	X
15.2	Functional test	X	*	X	X
15.3	Environmental tests	X	*	X	X
15.4	Cold	X	*	X	X
15.5	Damp heat , steady state	X	*	X	X
15.6	Impact	X	*	X	X
15.7	Vibration, sinusoidal	X	*	X	X
15.8	Electrostatic	X	*	X	X
15.9	Radiated electromagnetic interference	X	*	X	X
15.10	Voltage transients – fast transient bursts	X	*	X	X
15.11	Voltage transients – slow high energy transients	X	*	X	X
15.12	Mains voltage dips and interruptions	X	*	X	X
15.13	Supply voltage variation	X	*	X	X
15.14	Damp heat , steady state (endurance)	X	*	X	X
15.15	Vibration, sinusoidal (endurance)	X	*	X	X
Appendix A	Explanation of access levels	X	*	X	X
Appendix B	Optional functions with requirements and alternatives	X	*	X	X
Appendix C	Processing of signals from fire detectors	X	*	X	X
Appendix D	Explanation of zones and the zone indication of fire alarms	*	*	*	*
Appendix E	Delays to output	*	*	*	*
Appendix F	Fault recognition and indication	X	*	X	X
Appendix G	Standardized input/output interface for the connection of ancillary equipment	X	*	X	X
Appendix H	Integrity of transmission paths	X	*	X	X

* = Not within scope, this has been settled elsewhere in the directive

12 Appendix 5 - Cross reference EN 54-4

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	*	*	*	*
2.	**Normative references**	X	X	X	X
3.	**Definitions and abbreviations**	X	X	X	X
3.1	Definitions	X	X	X	X
3.2	Abbreviations	X	X	X	X
4.	**General requirements**	X	X	X	X
4.1	Compliance	X	X	X	X
4.2	Power sources	*	*	X	*
5.	**General requirements for indications**	X	X	X	X
5.1	Power supply from the main power source	X	X	X	X
5.2	Power supply from the standby power source	X	X	X	X
5.2.1	Standby power	X	X	X	X
5.2.2	Battery	*	*	X	*
5.3	Charger	*	*	X	*
5.3.1	Charged automatically	*	*	X	*
5.4	Faults	*	*	X	*
6.	**Materials, design and manufacture**	X	X	X	X
6.1	Manufacturer's declaration	X	X	X	X
6.2	Mechanical design	X	X	X	X
6.3	Electrical design	X	X	X	X
6.4	Power supply interface	X	X	X	X
7.	**Documentation**	X	X	X	X
7.1	User's documentation	X	X	X	X
7.2	Design documentation	X	X	X	X
8.	**Marking**	X	X	X	X
9.	**Test**	X	X	X	X
9.1	General	X	X	X	X
9.2	Functional test	X	X	X	X
9.3	Test of the charger and the standby power source	*	*	X	*
9.3.1	Test procedure	*	*	X	*
9.3.2	Requirements	*	*	X	*
9.4	Environmental tests	X	X	X	X
9.5	Cold	X	X	X	X
9.6	Damp heat , steady state	X	X	X	X
9.7	Impact	X	X	X	X
9.8	Vibration, sinusoidal	X	X	X	X
9.9	Electrostatic	X	X	X	X
9.10	Radiated electromagnetic interference	X	X	X	X
9.11	Voltage transients – fast transient bursts	X	X	X	X
9.12	Voltage transients – slow high energy transients	X	X	X	X
9.13	Mains voltage dips and interruptions	X	X	X	X
9.14	Supply voltage variation	X	X	X	X
9.15	Damp heat , steady state	X	X	X	X
9.16	Vibration, sinusoidal	X	X	X	X
Appendix A	**Special national condition**	X	X	X	X
Appendix ZA	**Clauses of this European Standard addressing essential requirements of the Construction Products or other provisions of EU Directives**	X	X	X	X
Appendix B	**Procedure for monitoring of the battery internal resistance required**	X	X	X	X

* = Not within scope, this has been settled elsewhere in the directive.

13 Appendix 6 - Cross reference EN 12094-1

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	*	*	*	*
2.	**Normative references**	X	*	*	X
3.	**Terms, definitions and abbreviations**	X	*	*	X
3.1	Definitions	X	*	*	X
3.2	Abbreviations	X	*	*	X
4.	**Functional requirements**	X	*	*	X
4.1	General	X	*	*	X
4.2	Environmental class	X	*	*	X
4.3	Signal processing and indication	X	*	*	X
4.4	Reception and processing of input triggering signals	*	*	*	*
4.5	Transmission of extinguishing signal	X	*	*	X
4.6	Activation of alarm devices	*	*	*	*
4.7	Indication of the supply of power	X	*	*	X
4.8	Activated condition	*	*	*	*
4.9	Indication of activated condition	X	*	*	X
4.10	Released condition	X	*	*	X
4.11	Indication of the released condition	X	*	*	X
4.12	Resetting of the activated condition and the released condition	X	*	*	X
4.13	Fault warning condition	X	*	*	X
4.14	Indication of fault warning condition	X	*	*	X
4.15	Disabled condition	X	*	*	X
4.16	Indication of disabled condition	X	*	*	X
4.17	Delay of extinguishing signal	*	*	*	*
4.18	Signal representing the flow of extinguishing agent	*	*	*	*
4.19	Monitoring of the status of components	*??	*	*	*??
4.20	Emergency hold device	*	*	*	*
4.21	Control of flooding time	*	*	*	*
4.22	Initiation of secondary flooding	*	*	*	*
4.23	Manual only mode	*	*	*	*
4.24	Triggering signals to equipment within the system	X	*	*	X
4.25	Extinguishing signals to spare cylinders	*	*	*	*
4.26	Triggering of equipment outside the system	X	*	*	X
4.27	Emergency abort device	*	*	*	*
4.28	Control of extended discharge	*	*	*	*
4.29	Release of the extinguishing media for selected flooding zones	*	*	*	*
4.30	Activation of alarm devices with different signals	*	*	*	*
5.	**Design requirements**	X	*	*	X
5.1	General	X	*	*	X
5.2	Mechanical design	X	*	*	X
5.3	Manual control	X	*	*	X
5.4	Visible indicators	X	*	*	X
5.5	Audible indicators	X	*	*	X
5.6	Electrical design of components	X	*	*	X
5.7	Circuit design	X	*	*	X
6.	**Additional design requirements for software controlled e.c.d.s.**	X	*	*	X
6.1	General	X	*	*	X
6.2	Software design	X	*	*	X
6.3	Program monitoring	X	*	*	X
6.4	Storage of program and data	X	*	*	X
6.5	Monitoring of memory contents	X	*	*	X
6.6	Software documentation	X	*	*	X

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
6.7	Operation of the e.c.d. in the event of a system fault	X	*	*	X
7.	**Marking**	X	*	*	X
8.	**Documentation**	X	*	*	X
9.	**Tests**	X	*	*	X
9.1	General test requirements	X	*	*	X
9.2	Functional tests	X	*	*	X
9.3	Environmental tests	X	*	*	X
9.4	Damp heat, cyclic	X	*	*	X
9.5	SO_2-corrosion (endurance)	X	*	*	X
10.	Evaluation of conformity	X	*	*	X
10.1	General	X	*	*	X
10.2	Initial type testing	X	*	*	X
10.3	Factory production control	X	*	*	X
Appendix A	**Summary of indications**	X	*	*	X
Appendix ZA	**Clauses addressing the provisions of the EU Construction Products Directive 89/106/ECC**	X	*	*	X

* = Not within scope, this has been settled elsewhere in the directive.

14 Appendix 7 - Cross reference EN 54-5

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	*	*	*	*
2.	**Normative references**	X	*	*	X
3.	**Definitions and abbreviations**	X	*	*	X
4.	**Requirements**	X	*	*	X
4.1	Compliance	X	*	*	X
4.2	Classification	X	*	*	X
4.3	Position of heat sensitive elements	*	*	*	*
4.4	Individual alarm indication	*	*	*	*
4.5	Connection of ancillary devices	X	*	*	X
4.6	Monitoring of detachable detectors	X	*	*	X
4.7	Manufacturer's adjustments	X	*	*	X
4.8	On-site adjustments of response behaviour	X	*	*	X
4.9	Marking	X	*	*	X
4.10	Data	X	*	*	X
4.11	Additional requirements for software controlled detectors	X	*	*	X
5.	**Test**	X	*	*	X
5.1	General	X	*	*	X
5.2	Directional dependence	X	*	*	X
5.3	Static response temperature	X	*	*	X
5.4	Response times from typical application temperature	X	*	*	X
5.5	Response times from 25 °C	X	*	*	X
5.6	Response times from high ambient temperature (Dry heat operational)	X	*	*	X
5.7	Variation in supply parameters	X	*	*	X
5.8	Reproducibility	X	*	*	X
5.9	Cold (operational)	X	*	*	X
5.10	Dry heat (endurance)	X	*	*	X
5.11	Damp heat, cyclic (operational)	X	*	*	X
5.12	Damp heat, steady state (endurance)	X	*	*	X
5.13	Sulphur dioxide (SO_2) corrosion (endurance)	X	*	*	X
5.14	Shock (operational)	X	*	*	X
5.15	Impact (operational)	X	*	*	X
5.16	Vibration, sinusoidal (operational)	X	*	*	X
5.17	Vibration, sinusoidal (endurance)	X	*	*	X
5.18	Electromagnetic Compatibility (EMC), Immunity tests (operational)	X	*	*	X
6.	**Additional tests for detectors with class suffices**	*	*	*	*
6.1	Test for suffix S detectors	*	*	*	*
6.2	Test for suffix R detectors	X	*	*	X
Appendix A	**(informative) Heat tunnel for response time and response temperature measurements**	*	*	*	*
Appendix B	**(informative) Information concerning the construction of the heat tunnel**	*	*	*	*
Appendix C	**(informative) Derivation of upper and lower limits of response times**	*	*	*	*
Appendix D	**(informative) Apparatus for impact test**	X	*	*	X

* = Not within scope, this has been settled elsewhere in the directive.

15 Appendix 8 - Cross reference ISO 7240-6

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	*	*	*	*
2.	**Normative references**	X	*	*	X
3.	**Terms, definitions and abbreviations**	X	*	*	X
4.	**General requirements**	X	*	*	X
4.1	Compliance	X	*	*	X
4.2	Individual alarm indication	*	*	*	*
4.3	Connection of ancillary devices	X	*	*	X
4.4	Monitoring of detachable detectors	X	*	*	X
4.5	Manufacturer's adjustments	X	*	*	X
4.6	On-site adjustment of response behaviour	X	*	*	X
4.7	Rate sensitive response behaviour	*	*	*	*
4.8	Marking	X	*	*	X
4.9	Data	X	*	*	X
4.10	Requirements for software controlled detectors	X	*	*	X
5.	**Tests**	X	*	*	X
5.1	General	X	*	*	X
5.2	Repeatability	X	*	*	X
5.3	Directional dependence	X	*	*	X
5.4	Reproducibility	X	*	*	X
5.5	Cross sensitivity	X	*	*	X
5.6	Long-term stability	X	*	*	X
5.7	Saturation	X	*	*	X
5.8	Exposure to chemical agents associated with a fire	X	*	*	X
5.9	Variation in supply parameters	X	*	*	X
5.10	Air movement	*	*	*	*
5.11	Dry heat (operational)	X	*	*	X
5.12	Cold	X	*	*	X
5.13	Damp heat, steady state (operational)	X	*	*	X
5.14	Damp heat, steady state (endurance)	X	*	*	X
5.15	Sulphur dioxide (SO_2) corrosion (endurance)	X	*	*	X
5.16	Shock	X	*	*	X
5.17	Impact	X	*	*	X
5.18	Vibration, sinusoidal (operational)	X	*	*	X
5.19	Vibration, sinusoidal (endurance)	X	*	*	X
5.20	Electromagnetic Compatibility (EMC), Immunity tests	X	*	*	X
5.21	Fire sensitivity	X	*	*	X
6.	**Test report**	X	*	*	X
Appendix A	**Gas test chamber for response threshold value and cross sensitivity measurements**	X	*	*	X
Appendix B	**Apparatus for impact test**	X	*	*	X
Appendix C	**Fire test room**	*	*	*	*
Appendix D	**Smouldering wood fire (TF2)**	*	*	*	*
Appendix E	**Glowing smouldering cotton fire (TF3)**	*	*	*	*
Appendix F	**Deep-seated smouldering cotton fire (TF9)**	*	*	*	*
Appendix G	**Information concerning the construction of the gas test chamber**	*	*	*	*

* = Not within scope, this has been settled elsewhere in the directive.

16 Appendix 9 - Cross reference EN 54-25

Nr.	Subject	FEC	HUB	AMS
1.	**Scope**	*	*	*
X	**Normative references**	*	*	*
3.	**Terms and definitions**	X	X	X
4.	**System requirements**	X	X	X
4.1	General	X	X	X
4.2	Compatibility	X	X	X
4.3	Radio links	*	*	*
4.3.1	Immunity to attenuation	X	X	X
4.3.2	Alarm signal integrity	X	X	X
4.3.3	Identification of the transmitter	X	X	X
4.3.4	Immunity to interference	X	X	X
4.3.5	Failure in periodic communication	X	X	X
4.3.6	Antenna	X	X	X
5.	**Components requirements**	X	X	X
5.1	General	X	X	X
5.2	Power supply equipment	*	*	X
5.3	Environmental test requirements	X	X	X
6.	**Documentation**	X	X	X
7.	**Marking**	X	X	X
8.	**Test**	X	X	X
8.1	General	X	X	X
8.2	System tests	X	X	X
8.2.1	Test schedule for system tests	X	X	X
8.2.2	Test for immunity to attenuation	X	X	X
8.2.3	Test for alarm signal integrity	X	X	X
8.2.4	Test for identification	X	X	X
8.2.5	Test for the quality of the receiver	X	X	X
8.2.6	Test of compatibility within systems of the same system supplier	X	X	X
8.2.7	Test of compatibility with other band users	X	X	X
8.2.8	Test for the detection of a failure of periodic communication on a link	X	X	X
8.2.8	Test of the antenna	X	X	X
8.3	Component tests	X	X	X
8.3.1	General	X	X	X
8.3.2.	Test schedule for components tests	X	X	X
8.3.3	Verification of the service life of the non-rechargeable power source(s)	X	X	X
8.3.4	Test for the low power condition fault signal	X	X	X
8.3.5	Test for polarity reversal	X	X	X
8.3.6	Repeatability tests	X	X	X
8.3.7	Reproducibility test	X	X	X
8.3.8	Variation of supply parameters	X	X	X
8.3.9	Dry heat (operational)	X	X	X
8.3.10	Dry heat (endurance)	*	*	X
8.3.11	Cold	X	X	X
8.3.12	Damp heat, cyclic	X	X	X
8.3.13	Damp heat, steady state (operational)	X	X	X
8.3.14	Damp heat, steady state (endurance)	X	X	X
8.3.15	SO_2-corrosion (endurance)	X	X	X
8.3.16	Shock	X	X	X
8.3.17	Impact	X	X	X
8.3.18	Vibration, sinusoidal (operational)	X	X	X
8.3.19	Vibration, sinusoidal (endurance)	X	X	X
8.3.20	Electromagnetic Compatibility (EMC), Immunity tests	X	X	X
Appendix A	**Method for verification of the compatibility**	X	X	X
Appendix B	**Test configuration by using radio frequency shielded test equipment**	X	X	X

Nr.	Subject	FEC	HUB	AMS
Appendix ZA	**Clauses addressing the provisions of the EU Construction Products Directive 89/106/ECC**	X	X	X

* = Not within scope, this has been settled elsewhere in the directive.

Explanation
If the FEC is used as a standalone component, it is possible that the radio connection as mentioned in chapter 2.3.5. is not used.

17 Appendix 10 - Cross reference EN 54-13

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	X	*	X	X
2.	**Normative references**	X	*	X	X
3.	**Terms, definitions and abbreviations**	X	*	X	X
3.1	Definitions	X	*	X	X
3.2	Abbreviations	X	*	X	X
4.	**Requirements**	X	*	X	X
4.1	Compliance	X	*	X	X
4.2	Basic system design	X	*	X	X
4.3	Networked systems	X	*	X	X
4.3.1	General requirements	X	*	X	X
4.3.2	Specific requirements for hierarchical systems	*	*	*	*
4.4	Components	X	*	X	X
4.5	Transmission path(s)	X	*	X	X
4.6	Input and output devices linked to a fire protection system	X	*	X	X
4.7	Documentation	X	*	X	X
5.	**Assessment methods and tests**	X	*	X	X
5.1	General requirements	X	*	X	X
5.2	General test requirements	X	*	X	X
5.3	Functional test for compatibility	X	*	X	X
5.4	Functional test for connectability	X	*	X	X
5.5	Electromagnetic compatibility tests	X	*	X	X
Appendix A	**Functions of fire detection and alarm systems**	X	*	X	X
Appendix B	**Methods for theoretical analysis**	X	*	X	X
Appendix C	**Test report**	X	*	X	X
Appendix D	**Classification of functions of a fire detection and alarm system.**	X	*	X	X

* = Not within scope, this has been settled elsewhere in the directive.

18 Appendix 11 - Cross reference EN 54-18

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope and field of application**	*	*	*	*
2.	**References**	X	*	X	X
3.	**Definitions and abbreviations**	X	*	X	X
3.1	Definitions	X	*	X	X
3.2	Abbreviations	X	*	X	X
4.	**Requirements**	X	*	X	X
4.1	Compliance	X	*	X	X
4.2	Monitoring of detachable devices	*	*	*	*
4.3	Marking and data	X	*	X	X
4.4	Documentation	X	*	X	X
4.5	Requirements for software controlled devices	X	*	X	X
5.	**Tests**	X	*	X	X
5.1	General	X	*	X	X
5.2	Performance and variation in supply parameters	X	*	X	X
5.3	Dry heat	X	*	X	X
5.4	Cold	X	*	X	X
5.5	Damp heat, cyclic	X	*	X	X
5.6	Damp heat, steady state	X	*	X	X
5.7	Sulphur dioxide corrosion	X	*	X	X
5.8	Shock	X	*	X	X
5.9	Impact	X	*	X	X
5.10	Vibration, sinusoidal (operational)	X	*	X	X
5.11	Vibration, sinusoidal (endurance)	X	*	X	X
5.12	Electromagnetic Compatibility (EMC) Immunity tests	X	*	X	X

* = Not within scope, this has been settled elsewhere in the directive.

19 Appendix 12 - Cross reference EN 54-21

Nr.	Subject	FEC	HUB	AMS	FEC Standalone
1.	**Scope**	*	*	*	*
2.	**Normative references**	*	*	X	*
3.	**Terms and definitions**	*	*	X	*
4.	**General requirements**	*	*	X	*
4.1	General	*	*	X	*
4.2	Compliance	*	*	X	*
5.	**Functional requirements**	*	*	X	*
6.	**Alarm transmission and fault warning systems requirements**	*	*	X	*
7.	Design requirements	*	*	X	*
7.1	General requirements and manufacturer's declarations	*	*	X	*
7.2	Documentation	*	*	X	*
7.3	Mechanical design requirements	*	*	X	*
7.4	Electrical and other design requirements	*	*	X	*
7.5	Integrity of transmission paths	*	*	X	*
7.6	Accessibility of indications and controls	*	*	X	*
7.7	Indications by means of light-emitting indicators	*	*	X	*
7.8	Colours of indicators	*	*	X	*
7.9	Tests of indicators	*	*	X	*
7.10	Additional design requirements for software-controlled routing equipment	*	*	X	*
8.	**Marking**	*	*	X	*
9.	**Power supply**	*	*	X	*
10.	**Test requirements**	*	*	X	*
10.1	General test requirements	*	*	X	*
10.2	Functional test	*	*	X	*
10.3	Environmental tests	*	*	X	*
10.4	Cold	*	*	X	*
10.5	Damp heat, steady state	*	*	X	*
10.6	Impact	*	*	X	*
10.7	Vibration, sinusoidal	*	*	X	*
10.8	Electromagnetic compatibility (EMC) Immunity tests	*	*	X	*
10.9	Supply voltage variation	*	*	X	*
10.10	Damp heat, steady state	*	*	X	*
10.11	Vibration, sinusoidal	*	*	X	*
Appendix A	**Performance requirements for alarm and fault warning transmission systems**	*	*	X	*
Appendix B	**Verification of performance requirements for alarm and fault warning transmission systems**	*	*	X	*
Appendix ZA	**Clauses addressing the provisions of the EU Construction Products Directive 89/106/ECC**	*	*	X	*

* = Not within scope, this has been settled elsewhere in the directive.

20 Appendix 13 - Cross reference UL 827

N.B. This matrix is no longer applicable.

21 Appendix 14 - Environmental / Reliability test Fire Extinguisher

The network consists of FEC's, HUBs and an AMS-HUB. The FEC sends information to one or more HUBs. The HUB amplifies the signal and sends it to the next HUB. The AMS-HUB receives all information and sends the information by means of a serial cable.

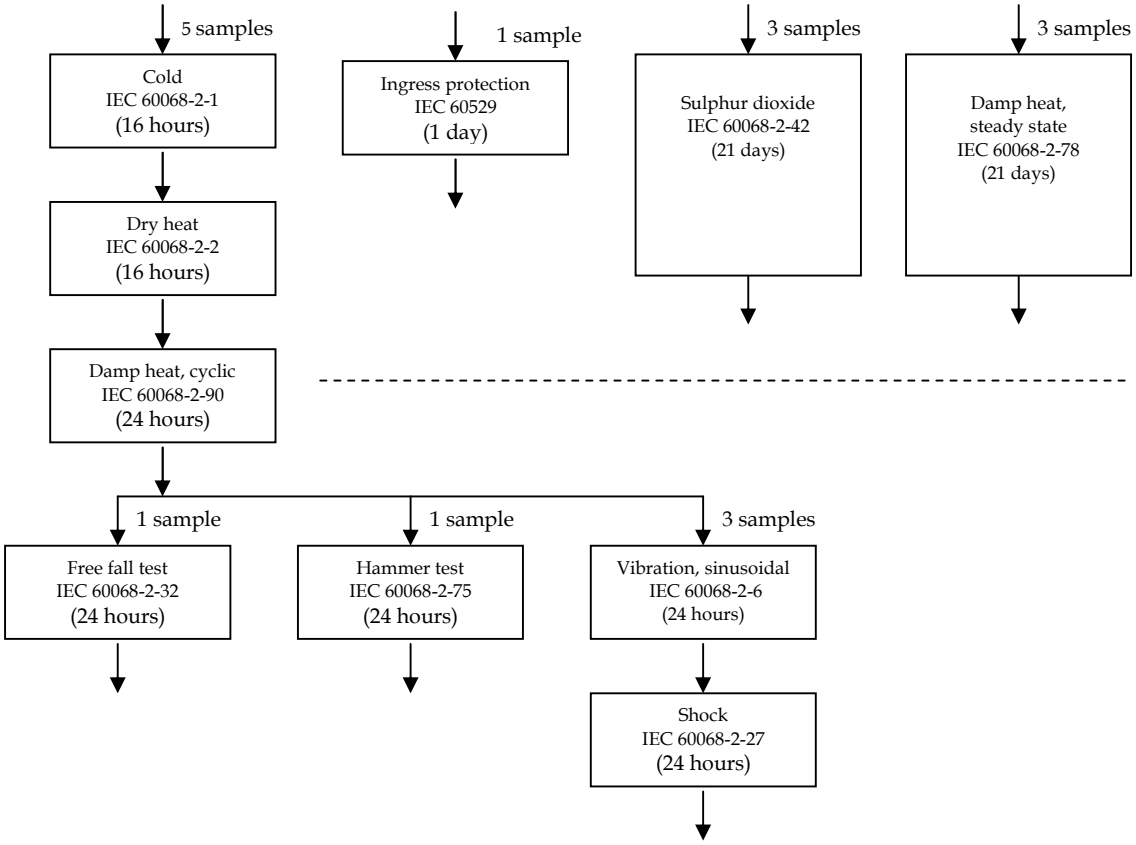
21.1 Environmental / Reliability tests FEC, HUB, AMS and FEC standalone

The fire detector and extinguisher should work reliably in different environments. The following table gives an overview of all reliability tests:

Directive	Test	Test level
IEC 60068-2-1	Tests A: Cold	-10^{0}C +/-2^{0}C / 16 hours
IEC 60068-2-2	Tests B: Dry heat	+60^{0}C +/-2^{0}C / 16 hours
IEC 60068-2-6	Test Fc: Vibration, sinusoidal (endurance)	10-150 Hz, 5 m/s^2, 3 axes, 20 sweep/axes, 1dB/octave
IEC 60068-2-27	Test Ea: Shock	Half sine, 6ms, 10x(100-20M) m/s^2, (M=mass of device)
IEC 60068-2-30	Test Db: Damp heat, cyclic	+25^{0}C +/-2^{0}C / >95%RH <-> +40^{0}C +/-2^{0}C / 93%RH +/-3%, 2 cycles
IEC 60068-2-32	Test Ed: Free fall	2m, 6 sides, 4 corners, 2x
IEC 60068-2-42	Test Kc: Sulphur dioxide test for contacts and connections	+25^{0}C +/-2^{0}C / 93%RH (+/-3%), 25 +/-5 vol ppm, 21 days
IEC 60068-2-75	Test Eh: Hammer tests	1,5 +/-0,13 m/s
IEC 60068-2-78	Test Cab: Damp heat, steady state	+40^{0}C +/-2^{0}C / 93%RH (+2%,-3%), 21 days
IEC 60529	Degrees of protection provided by enclosures (IP Code)	IP 30

Table 13. Environmental tests FEC / HUB and AMS-HUB

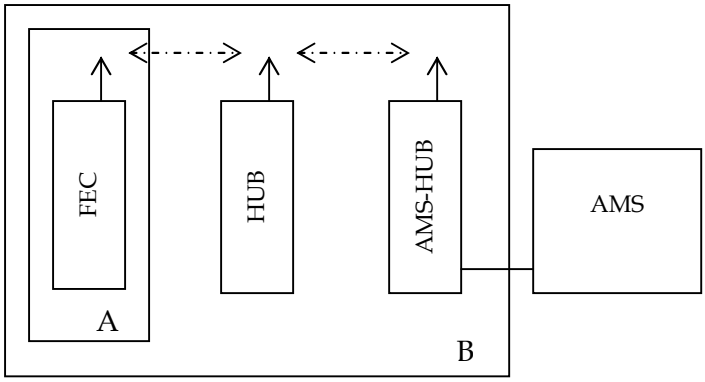
A test sequence has been made to reduce the amount of samples and



to reduce the total test time. The following test sequence has been made:

Figure 11. Test plan environmental tests FEC

The total number of samples will be 12. The total lead time is 23 days. For each test a detailed description has been made and presented in the following paragraphs. The test setup is shown in the figure below:



Situation A: only the FEC is tested
Situation B: the entire communication is tested

Figure 12. Test setup environmental tests

Test	Test situation
Test A: Cold	B
Test B: Dry heat	B
Test Fc: Vibration, sinusoidal (endurance)	A
Test Ea: Shock	A
Test Db: Damp heat, cyclic	B
Test Ed: Free fall	A
Test Kc: Sulphur dioxide test for contacts and connections	A
Test Eh: Hammer tests	A
Test Cab: Damp heat, steady state	B
Degrees of protection provided by enclosures (IP Code)	A

Table 14. Test situation environmental tests

21.2 Cold: FEC and HUB

Purpose
This test is carried out for determining the effects on electrical and mechanical characteristics at low temperatures. Visual analysis at low temperatures in combination with measurement of different functional parameters during the test shall give information about the robustness of the design. Surge current, functional parameters like CO concentration and temperature and functions like ignition, radio communication and bus communication that would show the deleterious effects due to exposure to low ambient temperatures will be measured.

Amount of samples
The test should be executed with 5 samples. One sample will be tracked during the test. The other four samples will be tested / measured before and after the test.

Procedure
The low temperature test shall be executed in accordance with "IEC 60068-2-1 Test A: Cold". The following level shall be used during the test: -10C +/-2^{0}C during 16 hours. The FEC and HUB will be connected to an external power supply due to the fact that the battery can not supply enough power at low temperatures (<0^{0}C).

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- Radio communication
- Bus communication
- Ignition
- CO measurement
- Temperature measurement

The following parameters should be tested / measured at a low temperature during 16 hours (1 sample):
- Radio communication
- CO measurement
- Temperature measurement

The following parameters should be tested / measured after 16 hours. The parameters should be tested at a low temperature (5 samples):
- Radio communication
- Bus communication
- Ignition
- CO measurement
- Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- Radio communication, still working

- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/-8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.3 Dry heat: FEC and HUB

Purpose
This test is carried out for determining the effects on electrical and mechanical characteristics at high temperatures. Visual analysis at high temperatures in combination with measurement of different functional parameters during the test shall give information about the robustness of the design. Functional parameters like: CO concentration and temperature and functions like ignition, radio communication and bus communication that would show the deleterious effects due to exposure to low ambient temperatures will be measured.

Amount of samples
The test should be executed with 5 samples. One sample will be tracked during the test. The other four samples will be tested / measured before and after the test.

Procedure
The dry heat test shall be executed in accordance with "IEC 60068-2-2 Test B: Dry heat". The following level shall be used during the test: $+60^0$C +/-2^0C during 16 hours.

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured at a high temperature during 16 hours (1 sample):
- § Radio communication
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured after 16 hours. The parameters should be tested at a high temperature (5 samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- Radio communication, still working
- Bus communication, still working
- Ignition, still working
- CO measurement, still working, measurement differences of +/-8 ppm are allowed
- Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.4 Vibration, sinusoidal: FEC and HUB

Purpose
A sinusoidal vibration simulates a single vibration. Single vibrations are applicable to continuous rotating equipment. This test method is very commonly used.

Amount of samples
The test should be executed with 3 samples, one sample for each direction. One sample will be tracked during the test. The other two samples will be tested / measured before and after the test.

Procedure
The sinusoidal vibration test shall be executed in accordance with: "IEC 60068-2-6 Test Fc: Vibration (sinusoidal)". The following level shall be used during the test: 10-150 Hz, 5 m/s^2, 3 axes, 20sweep/axes, 1dB/octave

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- Radio communication
- Bus communication
- Ignition
- CO measurement
- Temperature measurement

The following parameters should be tested / measured during the vibration (1 sample):
- Radio communication
- CO measurement
- Temperature measurement

The following parameters should be tested / measured after the test (all samples):
- Radio communication
- Bus communication
- Ignition
- CO measurement
- Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § Radio communication, still working
- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/-8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.5 Shock: FEC and HUB

Purpose
A shock test is performed to provide a degree of confidence that devices can physically and functionally withstand the relatively infrequent, non-repetitive shocks encountered in handling, transportation, and service environments.

Amount of samples
The test should be executed with 3 samples. For each direction one sample. One sample will be tracked during the test. The other two samples will be tested / measured before and after the test.

Procedure
The shock test shall be executed in accordance with: "IEC 60068-2-27 Test Ea: Shock". The following levels shall be used during the test: Half sine, 6ms, 10x(100-20M) m/s^2, (M=mass of device)

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured during the shock (1 sample):
- § Radio communication
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured after the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § Radio communication, still working
- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/-8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.6 Free fall / Drop test: FEC and HUB

Purpose
Drop tests are performed to:
A. Provide a degree of confidence that devices can physically and functionally withstand the relatively infrequent, non-repetitive drops encountered in handling, transportation, and service environments.
B. Determine the device fragility level, in order that housing and/or packaging may be designed to protect the device.

Amount of samples
The test should be executed with 3 samples.

Procedure
The drop free fall test shall be executed in accordance with: "IEC 60068-2-32 Test Ed: Free fall". The following levels shall be used during the test: 2m, 6 sides, 4 corners, 2 times for each side and corner. The device will be dropped from 2 meter height on all 6 sides and 4 corners. The total sequence of 6 drops and 4 corners will be repeated after the first 10 drops. A total amount of 20 drops will be executed.

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured after the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § Radio communication, still working
- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/- 8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.7 Damp heat, steady state: FEC and HUB

Purpose
This test is carried out to evaluate the properties of material as they are influenced by the absorption and diffusion of moisture and moisture vapour. Hygroscopic materials are sensitive to moisture, and deteriorate rapidly under high humidity conditions. Absorption of moisture by many materials results in swelling, which destroys their functional utility, and causes loss of physical strength and changes in other important mechanical properties. Insulating materials that absorb moisture may suffer degradation of their electrical properties. This method, while not necessarily intended as a simulated tropical test, is of use in determining moisture absorption of materials.

Amount of samples
The test should be executed with 3 samples. The samples will be tested / measured before and after the test.

Procedure
Exposure: The damp heat test shall be executed in accordance with "IEC 60068-2-56 Test Cb: Damp heat, steady state". The following level shall be used during the test: +40^0C +/-2^0C / 93%RH (+/-3%), 21 days.

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured at day 21 with the high humidity still in the climate chamber. The samples should be taken out of the climate chamber one by one. The following parameters should be tested within 10 minutes:
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

§ The samples will be placed back inside the chamber to finish the complete 21 days.

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
§ Radio communication, still working
§ Bus communication, still working
§ Ignition, still working
§ CO measurement, still working, measurement differences of +/-8 ppm are allowed
§ Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.8 Damp heat, cyclic: FEC and HUB

Purpose
The purpose of this method is to determine the resistance of material to the effects of a warm, humid atmosphere.

Amount of samples
The test should be executed with 3 samples. One sample will be tracked during the test. The other two samples will be tested / measured before and after the test.

Procedure
The temperature change test shall be executed in accordance: IEC 60068-2-30 Test Db and guidance: Damp heat cyclic. The following level shall be used during the test:
§ +25^{0}C +/-3^{0}C / >95%RH during 3 hours followed by:
§ +40^{0}C +/-2^{0}C / 93%RH +/-3% during 3 hours
§ 2 cycles
§ Temperature change of 3^{0}C/min (temperature change inside the 3 hours duration).

The samples should be placed in a (dry) environment after the test (20^{0}C +/- 5^{0}C)

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
§ Radio communication
§ Bus communication
§ Ignition
§ CO measurement
§ Temperature measurement

The following parameters should be tested / measured during the test:
§ Radio communication
§ CO measurement
§ Temperature measurement

The following parameters should be tested / measured between 4 and 24 hours after the test:

- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

Acceptance criteria

The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:

- § Radio communication, still working
- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/-8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.9 Sulphur dioxide test for contacts and connections: FEC and HUB

Purpose

The sulphur dioxide test will be carried out to stimulate corrosion, especially on contacts and connections. Corrosion can be caused by aggressive chemicals, such as salt (chloride), sulphur dioxide, hydrogen dioxide, nitrogen oxide, etc. This test is carried out on devices which are normally protected against water (like PCB's).

Amount of samples

The test should be executed with 3 samples. The samples will be tested / measured before and after the test.

Procedure

The corrosion (mixed gas) test shall be executed in accordance with "IEC 60068-2-42 Test Kc: Sulphur dioxide test for contacts and connections", The following levels shall be used during the test: +25^{0}C +/-2^{0}C / 93%RH (+/- 3%), 25 +/-5 vol ppm, 21 days

Inspections / measurements

The following parameters shall be tested / measured before the test (all samples):

- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured after the test (all samples):

- § Radio communication
- § Bus communication
- § Ignition

- § CO measurement
- § Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § Radio communication, still working
- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/-8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.10 Hammer test: FEC and HUB

Purpose
The hammer test will be executed to simulate high forces on the mounting construction during a fire. The hammer test can damage the housing.

Amount of samples
The test should be executed with 3 samples.

Procedure
The hammer test shall be executed in accordance with "IEC 60068-2-75 Test Eh: Hammer test", the following levels shall be used during the test:
- § Impact energy: 1,9 +/- 0,1 J
- § Hammer velocity: 1,5 +/- 0,13m/s,
- § Number of impacts: 1

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters shall be tested / measured during the impact and 2 minutes after the impact. (All samples):
- § No alarm or fault messages.

The following parameters should be tested / measured after the test (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § Radio communication, still working
- § Bus communication, still working
- § Ignition, still working
- § CO measurement, still working, measurement differences of +/-8 ppm are allowed
- § Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

21.11 Degrees of protection provided by enclosures (IP Code): FEC and HUB

Purpose
The purpose of this method is to determine the ingress of solid parts and rain water into the device.

Amount of samples
The test should be executed with 3 samples.

Procedure
The impact protection test shall be executed in accordance with "IEC 60529 Degrees of protection provided by enclosures (IP Code)", The following levels shall be used during the test:
- § IP 30

Apparatus: The protection against sold objects shall be executed with appropriated test pins. The protection against water shall be executed with an appropriated dripping box.

Inspections / measurements
The following parameters shall be tested / measured before the test(s) (all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

The following parameters should be tested / measured after the test (inside 2 hours, all samples):
- § Radio communication
- § Bus communication
- § Ignition
- § CO measurement
- § Temperature measurement

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § Radio communication, still working

- Bus communication, still working
- Ignition, still working
- CO measurement, still working, measurement differences of +/-8 ppm are allowed
- Temperature measurement, still working, temperature differences of +/- 4^0C are allowed

The AMS receives alarm and fault warning messages from the NOFIQ equipment. It also regularly receives a “still alive”-message from all devices within the network.

21.12 Environmental / Reliability tests AMS

The following table gives an overview of all reliability tests:

Directive	Test	Test level
IEC 60068-2-1	Test A: Cold	0^0C +/-2^0C / 16 hours
IEC 60068-2-6	Test Fc: Vibration, sinusoidal (endurance)	10-150 Hz, 0.981 m/s², 3 axes, 1 sweep/axes for each function, 1dB/octave
IEC 817	Impact (operational)	0.5 +/- 0.04 J; 3 impact/point
IEC 60068-2-78	Test Cab: Damp heat, steady state	+40^0C +/-2^0C / 93%RH (+2%,-3%), 4 days
IEC 60529	Degrees of protection provided by enclosures (IP Code)	IP 30

Table 16: Environmental reliability tests AMS

A test sequence has been made to reduce the amount of samples and to reduce the total test time. The following test sequence has been made:

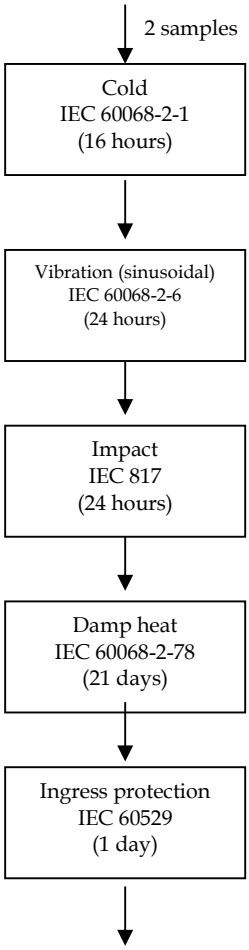
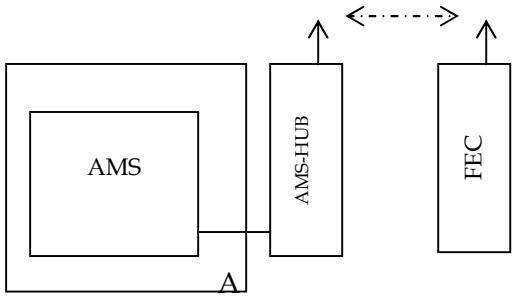


Figure 13. Test schedule environmental tests AMS

The total amount of samples will be 2. The total lead time will be 25 days. For each test a detailed description has been made, which will be presented in the following paragraphs.



Situation A: only the AMS will be tested

Figure 14. Test setup environmental tests AMS

21.13 Cold: AMS

Purpose
This test is carried out for determining the effects on electrical and mechanical characteristics at low temperatures. Visual analysis at low temperatures in combination with measurement of different functional parameters during the test shall give information about the robustness of the design. Surge current, functional parameters like: CO concentration and temperature and functions like ignition, radio communication and bus communication that would show the deleterious effects due to exposure to low ambient temperatures will be measured.

Amount of samples
The test should be executed with 2 samples. One sample will be tracked during the test. The other sample will be tested / measured before and after the test.

Procedure
The low temperature test shall be executed in accordance with "IEC 60068-2-1 Test A: Cold". The following level shall be used during the test: 0C +/-2^{0}C during 16 hours.

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § LEDs and display test
- § Button test
- § Buzzer test
- § Serial communication to AMS-HUB
- § Modem communication
- § Switching of relays

The following parameters should be tested / measured at a low temperature during 16 hours (1 sample):
- § Serial communication to AMS-HUB

The following parameters should be tested / measured after 16 hours. The parameters should be tested at a low temperature
- § LEDs and display test
- § Button test
- § Buzzer test
- § Serial communication to AMS-HUB
- § Modem communication
- § Switching of relays

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § LEDs and display test, still working
- § Button test, still working
- § Buzzer test, still working

- § Serial communication to AMS-HUB, still working
- § Modem communication, still working
- § Switching of relays, still working

21.14 Vibration, sinusoidal: AMS

Purpose
A sinusoidal vibration simulates a single vibration. Single vibrations are applicable to continuous rotating equipment. This test method is very commonly used.

Amount of samples
The test should be executed with 3 samples, one sample for each direction. One sample will be tracked during the test. The other two samples will be tested / measured before and after the test.

Procedure
The sinusoidal vibration test shall be executed in accordance with: "IEC 60068-2-6 Test Fc: Vibration (sinusoidal)". The following level shall be used during the test: 10-150 Hz, 5 m/s^2, 3 axes, 20sweep/axes, 1dB/octave

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- § LEDs and display test
- § Button test
- § Buzzer test
- § Serial communication to AMS-HUB
- § Modem communication
- § Switching of relays

The following parameters should be tested / measured during the vibration (1 sample):
- § Serial communication to AMS-HUB

The following parameters should be tested after the test.
- § LEDs and display test
- § Button test
- § Buzzer test
- § Serial communication to AMS-HUB
- § Modem communication
- § Switching of relays

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- § LEDs and display test, still working
- § Button test, still working
- § Buzzer test, still working
- § Serial communication to AMS-HUB, still working
- § Modem communication, still working
- § Switching of relays, still working

21.15 Hammer test: AMS

Purpose
The hammer test will be executed to simulate high forces on the mounting construction during a fire. The hammer test can damage the housing.

Amount of samples
The test should be executed with 1 sample.

Procedure
The hammer test shall be executed in accordance with "IEC 60068-2-75 Test Eh: Hammer test", The following levels shall be used during the test:
- Impact energy: 1,9 +/- 0,1 J
- Hammer velocity: 1,5 +/- 0,13m/s,
- Number of impacts: 1 on each visible side (front, left, right, up and bottom)

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- LEDs and display test
- Button test
- Buzzer test
- Serial communication to AMS-HUB
- Modem communication
- Switching of relays

The following parameters shall be tested / measured during the impact and 2 minutes after the impact. (All samples):
- No alarm or fault messages.

The following parameters should be tested / measured after the test:
- LEDs and display test
- Button test
- Buzzer test
- Serial communication to AMS-HUB
- Modem communication
- Switching of relays

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- LEDs and display test, still working
- Button test, still working
- Buzzer test, still working
- Serial communication to AMS-HUB, still working
- Modem communication, still working
- Switching of relays, still working

21.16 Damp heat, steady state: AMS

Purpose
This test is carried out to evaluate the properties of material as they are influenced by the absorption and diffusion of moisture and moisture vapour. Hygroscopic materials are sensitive to moisture, and deteriorate rapidly under high humidity conditions. Absorption of moisture by many materials results in swelling, which destroys their functional utility, and causes loss of physical strength and changes in other important mechanical properties. Insulating materials that absorb moisture may suffer degradation of their electrical properties. This method, while not necessarily intended as a simulated tropical test, is of use in determining moisture absorption of materials.

Amount of samples
The test should be executed with 2 samples. The samples will be tested / measured before and after the test.

Procedure
The damp heat test shall be executed in accordance with "IEC 60068-2-56 Test Cb: Damp heat, steady state". The following level shall be used during the test: +40^{0}C +/-2^{0}C / 93%RH (+/-3%), 21 days.

Inspections / measurements
The following parameters shall be tested / measured before the test (all samples):
- LEDs and display test
- Button test
- Buzzer test
- Serial communication to AMS-HUB
- Modem communication
- Switching of relays

The following parameters should be tested / measured at day 21 with the high humidity still in the climate chamber. The samples should be taken out of the climate chamber one by one. The following parameters should be tested within 10 minutes:
- LEDs and display test
- Button test
- Buzzer test
- Serial communication to AMS-HUB
- Modem communication
- Switching of relays

The samples will be placed back inside the chamber to finish the complete 21 days.

Acceptance criteria
The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
- LEDs and display test, still working
- Button test, still working
- Buzzer test, still working
- Serial communication to AMS-HUB, still working

§ Modem communication, still working
§ Switching of relays

21.17 Degrees of protection provided by enclosures (IP Code): AMS

Purpose
The purpose of this method is to determine the ingress of solid parts into the device.

Amount of samples
The test should be executed with 1 sample.

Procedure
The ingress protection test shall be executed in accordance with "IEC 60529 Degrees of protection provided by enclosures (IP Code)",The following levels shall be used during the test:
§ IP 30

Apparatus: The protection against sold objects shall be executed with appropriated test pins.

Inspections / measurements
The following parameters shall be tested / measured before the test:
§ LEDs and display test
§ Button test
§ Buzzer test
§ Serial communication to AMS-HUB
§ Modem communication
§ Switching of relays

The following parameters should be tested / measured after the test:
§ LEDs and display test
§ Button test
§ Buzzer test
§ Serial communication to AMS-HUB
§ Modem communication
§ Switching of relays

Acceptance criteria
It should be taken care of that no dangerous situations can arise during insertion of the test pin. The device is considered to have passed the test if the entire test population withstands the test according to the relevant performance levels. The following performance differences are acceptable:
§ LEDs and display test, still working
§ Button test, still working
§ Buzzer test, still working
§ Serial communication to AMS-HUB, still working
§ Modem communication, still working
§ Switching of relays, still working

22 Appendix 15 - Test fires for detection and extinguishing

22.1 General

For finding a reference for practical requirements in relation to the detection of fire, the detection components of the fire-extinguishing components are tested comparable to NEN2535: 1996 for the following fire sizes:

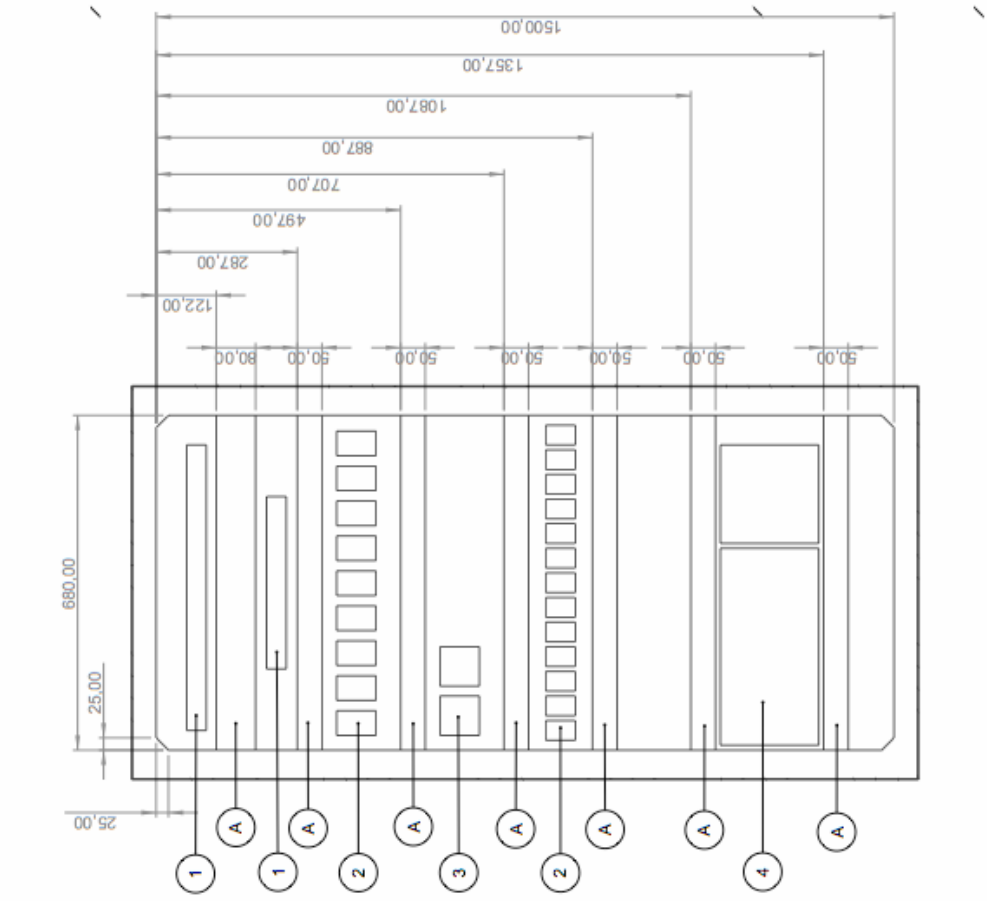
- TF 9, reference gas 30 ppm
- TF 10, print with five resistors
- TF 4, polyurethane mats
- TF 7, methylated spirit
- TF 1, beech wood crib

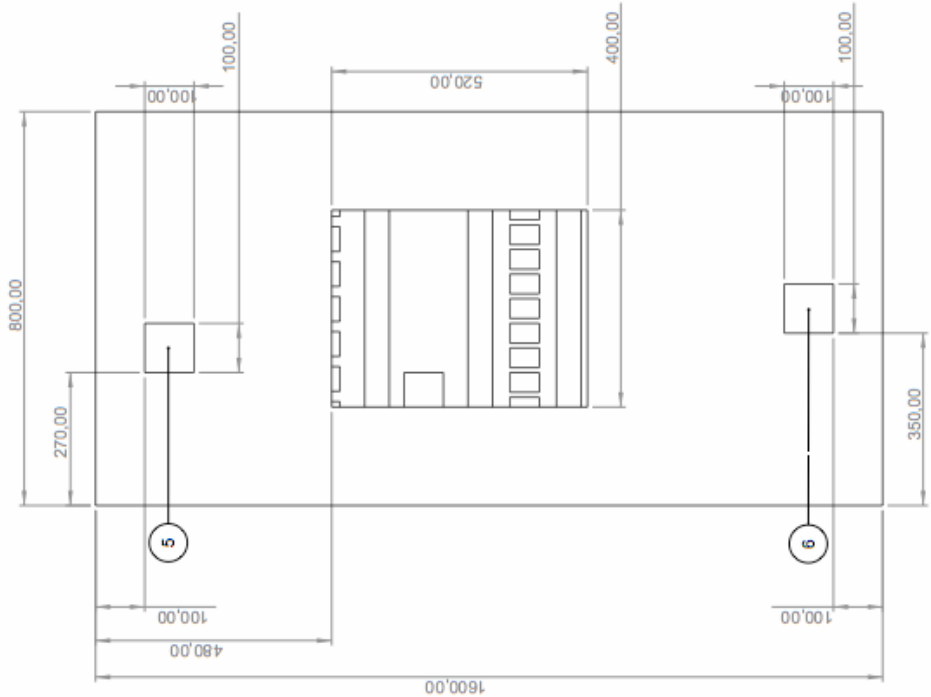
The tests are carried out minimally in a test cabinet as shown in figure 15 on the next page. The test cabinet has a transparent window in the middle of the door, so the test carried out inside the test cabinet can be observed visually. The cabinet itself contains normal electrical components, like cable conduits and relays, with sufficient room between the cabinet door and the electrical components to enable heat propulsion.

The test cabinet is provided with a ventilator with the following specifications (air speed with filter 15 m^3/h, 50 Hz and 18 m^3/h, 60 Hz, temperature range -10˚C - + 55˚C).
This ventilator (Rittal 3321.107) is placed at the bottom of the test cabinet and will blow air into the test cabinet.
At the upper side of the test cabinet an air grid is placed (Rittal 3321.800) with the same diameter as the ventilator for outflow of air and other gases.

The result of the tests determines the standard projection for fire detection and fire extinguishing. Appendix 16 shows an example of a standard projection.
The product certificate should show the standard projection proper for the system.

The tests can also be carried out for other cabinets with obviously deviating dimensions. These tests will then be conclusive for the standard projection belonging to this projection, and should be stated as such in the product certificate.





PART NUMBER	PartNo	DESCRIPTION	MATERIAL	Volume	Weight	Colour	Finish	QTY.
Verdeelcomponenten	1		diverse	41572.16	41572.16		-	1
Relais	2		diverse					22
Schakeleenheden	3		diverse					3
Zekeringenkast	4		diverse					2
Rooster + filter	5	Rittal 3321.107	diverse					1
Rooster + fan	6	Rittal 3321.207	diverse					1
Kabelgoten	A		diverse					3

22.2 TF 9. Evaluation of reference framework CO sensor (detection)

General

The purpose of this test is to determine the algorithm of the CO sensor.

Equipment

Gas container with gauge gas of 30 ppm.
Enclosed glass room of 10 litres with at the bottom a closed supply pipe and on the upper side a lockable venting.
Stopwatch.

Test setup

The fire-extinguishing component will be placed in an enclosed room of 10 litres, to which a reference gas is supplied directly.

Amount

During 1 minute the reference gas of 30 ppm is supplied.

Test procedure

Before testing the product must be conditioned and synchronized.
The reference gas should fill the housing within 1 minute.

Reaction time

Within 1 minute the alert (alarm) should be activated.

22.3 TF 10. Test fire with five resistors (detection)

General

This test fire is suited for testing the CO sensors. In this test a printed-circuit board with five resistors is electrically overloaded by a mains power supply device.

Fire material

An epoxy printed-circuit board for test purposes with the dimensions 100mm X 20mm. On this board five metal film resistors are fixed, each of 10 Ω, 0,6 W, parallel-switched. The resistors must be measured beforehand for their real impedance. Based on their real impedance sets of resistors must be selected, of which the impedance are as close together as possible.

Equipment

A stabilized mains power supply device, 230 V mains power, 8 Volt / 20 Ampere and an adjustable output voltage.
Test cabinet as per figures 15 and 22.1.
5 reference thermo-couples

Test setup

The printed-circuit board with the five resistors is laid in a box of non-inflammable material with dimensions of approx. 100mm x 100mm x 50mm. The isolating board with the printed-circuit board is placed at the bottom of the test cabinet.

The fire-extinguishing components will be placed at the top of the cabinet to the sides with due observance of the specific requirements of the aerosol fire-extinguishing components regarding outflow dimensions. Around the fire-extinguishing components reference thermo-couples will be placed, which will measure the temperature in the test cabinet.

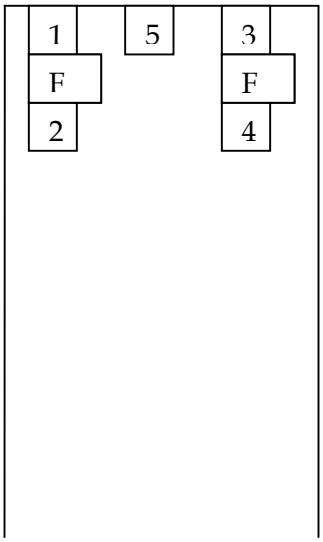


Figure 15. Drawing with thermo-couples and placement of the fire-extinguishing components (FE)

Amount
One printed-circuit board with five resistors, 10 Ω, 0,6 W, parallel-switched.

Test procedure
Before testing the product must be conditioned and synchronized.
Connect the printed-circuit board to the adjustable output of the mains power supply device and set the output voltage to 5 Volt at 2,5A. Then gradually increase the voltage in 60 seconds to 7,5 Volt as per the table below.

Time in seconds	**Voltage in Volts**
0	5
10	5,42
20	5,84
30	6,26
40	6,68
50	7,10
60	7,5

The test procedure is carried out with the ventilator present.

Reaction time
Within 120 seconds the alert (alarm) of the fire-extinguishing component should be activated.

22.4 Test fires for detection and extinguishing

General

During this test fire a reproducible blazing fire is produced by igniting the test fires TF4, TF7 and TF1. During this test fire the system compatibility, the detection and the extinguishing of the aerosol fire-extinguishing system is tested and evaluated.

Fire material TF4

Flexible polyurethane mats with uniform cell structure and a density of 17 kg/m3 to 20 kg/m3; without fire-delaying additions; dimensions 100 mm x 100 mm x 20 mm.
The mats are piled on top of each other (9 pieces in formation 3 x 3 x 3) on clean aluminium foil.

Physical and chemical properties of polyurethane mats

Shape	Open cell structure, flexible artificial foam
Colour	Variable
Thickness	Approx. 17 – 20 kg/m^3
Water solubility	Not soluble
Decomposition temperature	> 180°C
Ignition temperature	> 400°C
Stability and reactivity	The product is stable within a temperature range from –40°C to +80°C. Keep ignition sources away.

Fire material TF7

Methylated spirit 85% in a round bowl of 15 cm diameter and 5 cm deep.
Filled with 150 cl methylated spirit.

Fire material TF1 (wood crib)

In cubic shape piled beech (Fagus Silvatica) wood crib, ignited by means of 10 cl methylated spirit in a cup at the bottom centre of the piled cube.
Dimensions of the 4 x 5 piled wood crib are 80 mm x 10 mm x 10 mm on clean aluminium foil. Moisture percentage of the wood crib: ≤ 10 %.

Equipment

The complete product of the supplier with equipment for detection, alarming and communication.
Measuring equipment from the test laboratory in order to register the parameters (temperature, air humidity, CO value, etc.) during the test as stated in table 18.
A fire box of non-inflammable material, with approximate dimensions to the mats, will be placed on two rests of non-inflammable material in order to isolate the test fire from the ground floor.

Test setup

The inflammable material is placed below on the right side of test cabinet.
The fire-extinguishing components will be placed left, middle and right at the top of the test cabinet (see figure 16) with due observance of the specific requirements of the aerosol fire-extinguishing components regarding outflow dimensions.

Test procedure

Before testing the product must be conditioned and synchronized.

The FEC/AMS-HUB and the fire-extinguishing or detection components should be conditioned and synchronized before use.
The supplier's products are tested for system compatibility, detection and extinguishing. Furthermore is tested whether driving of the potential-free contact for disabling the ventilator is functioning effectively.
Based on the detection the product should notify the alarming, communication and necessary recordings to the AMS. The specifications as stated in the supplier's user manual serve as starting-point in this.
Extinguishing should take place as per EN2, class A, solids and class B, liquids. The following boundary conditions apply:

- The standard fire-extinguishing agent (SFE) should, for class A, meet the requirements as stated in EGL K23001.
- The fire cells consist of fire material TF4, TF7 and TF1.
- The fire cell should be placed on the right side on the floor of the cabinet.
- Above the fire cell the fire-extinguishing components should be placed as per the specifications by the supplier with a division as per the supplier's user manual.
  - Ignite the PUR mat sets 1, 2 and 3 in a corner with a match.
  - Ignite the methylated spirit with a gas lighter.
  - Ignite the methylated spirit for the beech wood crib with a gas lighter.
- Close the door of the test cabinet immediately after ignition; this is the test's starting moment. The cabinet's ventilator should be active when closing the door. The test procedure takes place with the ventilator present as per 22.1.
- The fire cell should burn for at least 30 seconds. CO detection and driving of the thermal alarm device should have occurred before this time expired.
- At the conclusion of the activation of the extinguishing agent the cabinet should remain closed for at least 5 minutes.
- During this period the cell should be monitored for active fire phenomena and spontaneous combustion phenomena; this will take place based on the temperature measurements near the fire cell.
- After this period the cell should be checked visually for active fire phenomena and spontaneous combustion phenomena outside the test cabinet without the presence of extinguishing agent.
- Fire phenomena should be expressed in the report. The loss of weight and the temperature after extinguishing are leading.
- Spontaneous combustion phenomena should have a form of visual fire. Just smoke is not categorised as such**.**

During the test, simultaneously another test will be carried out regarding the interbus communication. During the real life test an FEC outside the test cabinet will be connected by means of the interbus to an FEC, undergoing the real life test. The FEC that is placed outside of the test cabinet will be provided with a LED indicator in stead of an aerosol extinguishing component in order to demonstrate the driving of the interbus.

Reaction time
Within 120 seconds the fire-extinguishing component should activate a fire alarm and an extinguishing.

Explanation
The tests are carried out with stationary extinguishing components based on dry aerosol which are certified conformably to evaluation guideline K23001.

In this evaluation guideline the following performance requirements are stated.

Performance requirements aerosol fire-extinguishing component
The aerosol fire-extinguishing components must extinguish the objects to be extinguished for the fire class in question in an effective way.
As a boundary condition for this, the aerosol fire-extinguishing components must be coupled to and activated by an effective fire alarm extinguishing centre with detection component. For this a quick detection and a quick reaction are imperative.

Extinguishing effectively means that the object to be extinguished after the test does no longer burn and neither will reignite in course of time.
In order to be able to match the aerosol fire-extinguishing components, regarding the extinguishing performance, with the fire classes as stated in the fields of application. The extinguishing components are tested for every fire class stated by the supplier concerning the certification inspection.

The tests are carried out for the aerosol, which the supplier wants to have certified. During these tests the design formula, used by the supplier for projection of the aerosol extinguishing components, is verified.

The formula used by the supplier should demonstrate that the following has been taken into account:
- the dimensions of the room containing the object to be extinguished as well as the specific mutual dimension proportions (length, width and height);
- the aerosol's diffusion factor;
- the amount of extinguishing agent in terms of grams extinguishing agent per m^3 room.

The test is carried out in an all but closed room (see figure 15 and 22.1.).
Doors must be closed. The room may contain a limited amount of ventilation grids.

Any forced ventilation in the room must be disabled by a control before the extinguishing takes place.

During the test the arithmetical translation of the amount of grams per volume unit must be taken literally, for this will be leading for the value declared in the certificate. There may not be any physical obstructions inside the room.
During testing of the extinguishing performance and of the design formula for the amount of extinguishing agent necessary, no additional safety factors (1,3), which are required by European and NFPA directives for projection, may be applied.
Furthermore the design formula should take into account the amount of extinguishing amount left behind in the cooling of the fire-extinguishing component.
Determination of the extinguishing performance should be carried out on the following conditions:

Function	Performance	Unit
Fire class Determination method as per EN2	Fire class A and B	-
Thermal energy / power	See 22.1	
Fire time realised by a catalyst.	30	Seconds
Catalyst	See test procedure	-
Air humidity in the room before the fire, measured by a hygrometer	60 ± 20	%
Ambient temperature before the fire to be measured by a thermo-couple directly outside the room with a ΔT 10 sec registration through a logger.	15 ± 10	°C
Room temperature. Determination method by means of at least 5 thermo-couples as per procedure with ΔT 10 sec registration through a logger.	To be determined during test in test laboratory	°C
Dimensioning test room	See 22.1	Meters and m^3
Ventilation during the time of fire by means of a constant determination	See 22.1	
Ventilation opening and positioning during the extinguishing	See test procedure	m^2
Air current in the room	Forced	
Close test room after ignition fire	Direct	Seconds
Amount of extinguishing agent necessary as per the formula	As per design formula EGL K23001	Grams/m^3
Extinguishing time	10	Seconds
After inspection time	300	Seconds
Outflow SFE	Direction and homogeneity	Visual
Weight extinguishing component for determining the outflow percentage of the extinguishing agent	Before and after the extinguishing	Grams
Activation	According to the supplier's system	-

Table 15. Conditions real life test

Supplemental registrations during the test in seconds.

- The time of ignition.
- The time the activation of the fire-extinguishing components started.
- The end time of the activation of the aerosol.
- The time at which the flames are extinguished.

During the fire period sufficient ventilation should take place and the oxygen level inside the test room should be kept level under atmospheric conditions.

23 Appendix 16 Points of attention for use (informative)

23.1 Introduction

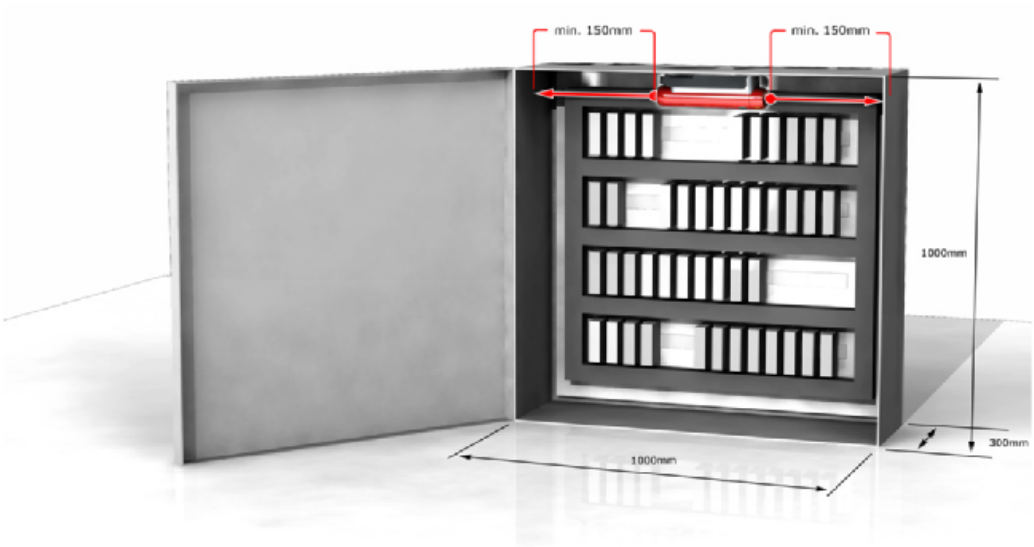
For a correct application of the product it is important to understand that the system's detection principal is designed and tested based on a certain projection.
The projection is described below. It is important to carefully follow these projection rules in order to achieve the detection performance requirements in practice as well.

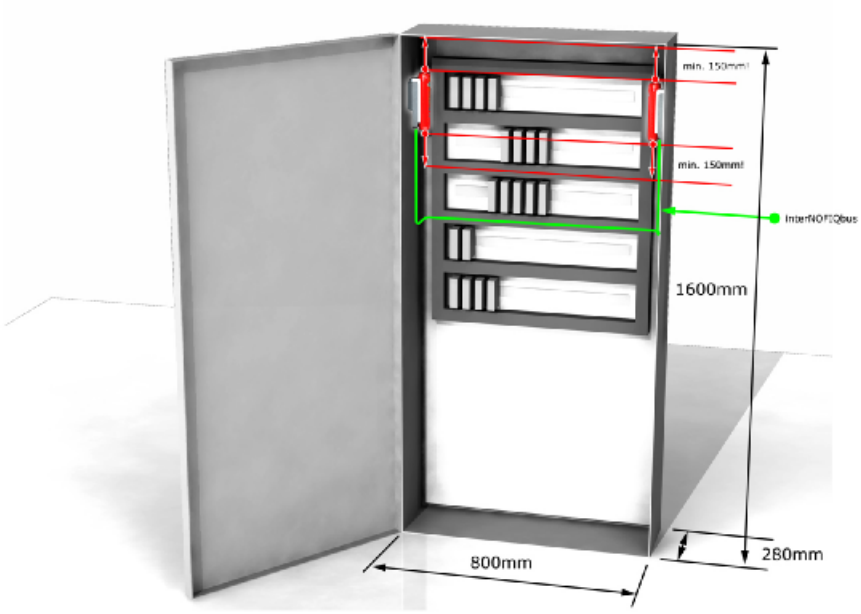
23.2 Projection – detail design

The number of fire-extinguishing components (FEC) needed for a specific object also determines the projection, i.e. the position and direction in which the FEC's must be mounted.

When applying 1 FEC it will be placed in the middle of the object on the upper side, having the outflow openings pointing to the left and the right. Ensure that both outflow openings of the FEC have at least 15 cm of free outflow space in order to prevent damage to equipment. Since the antenna always has to point upwards, the antenna has to be connected to the FEC by means of an antenna extension cord.

When applying 2 or more FEC's these are placed on the side of the object to be protected, having the outflow openings pointing upwards and downwards. Ensure that both outflow openings of the FEC have at least 15 cm of free outflow space in order to prevent damage to equipment. When applying more than 1 FEC in a cabinet these must be linked by means of a bus connection.




min. 150mm!
min. 150mm!
InterNOFIQbus
1600mm
800mm
280mm