AeroFOT®

Condensed Aerosol Fire Extinguishing System Installation, Operation and Maintenance Manual

EXCELLENCE IN FIRE SUPPRESSIONS

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Preamble

This installation, operation and maintenance manual is intended to provide general information about the design, installation and maintenance of AeroFOT fire extinguishing systems.

FOT fire control is not responsible for systems and applications outside the scope of this manual. The technical data and instructions given here are for general information. FOT fire control gives no warranty and assumes no liability whatsoever for applications other than the information provided herein

FOT fire control makes no guarantees of any kind, either express or implied, including but not limited to warranties of the AeroFOT products for their fitness for a particular purpose.

FOT fire control will not be liable for any indirect, special, incidental, punitive, or consequential damages of any kind.

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This manual quotes directly from NFPA standards, including NFPA 2010 (2015 Edition) and NFPA 72 (2010 Edition). These standards, along with other national and codes and requirements, must be carefully followed at all times during all phases of system design, installation, operation and maintenance.

INTRODUCTION

In the early 90s, the use of aerosol fire extinguishers began to become widespread due to the need for alternative fire extinguishing agents that could replace Halon gaseous fire extinguishers in the fire extinguishing systems and due to the prohibition of the use of portable fire extinguishers containing halon gases and fixed fire extinguishing systems after the Vienna Convention, Montreal and Kyoto Protocols, which were prepared and adopted in order to prevent climate changes around the world, to impose restrictions on greenhouse gas emissions and to reduce the effects of global warming.

The aerosol fire extinguishers belong to the class of hot aerosol extinguishers and they are one of the most preferred fire extinguishers, because they have high fire extinguishing efficiency, their structure is simple, convenient and modular, they do not need a pressurized and sealed container, they contain fire extinguisher chemicals in solid tablets with long service life, they are easy to service and maintain, their Ozone Hazard Potential (ODP) and Global Warming Potential (GWP) are zero, they are harmless to the environment and they have well economic-performance ratio.

AeroFOT is a trade name of FOT fire Control and Equipment Limited.

2.1 Aerosol Fire Extinguishers

Traditionally, there were three elements assumed as necessary for combustion: heat, fuel, and oxygen, These form the “fire triangle”.

Typical fire extinguishment involves removing the fuel from the fire, limiting oxygen to the fire (smothering), or removing the heat (quenching).

This physical process had to be modified as halons became more widely used and better understood.
The halons, as well as other agents like the AeroFOT condensed aerosol, do not extinguish fire in any of these ways, but instead break up the uninhibited chain reaction of the combustion process. There is definitely a chemical reaction that interferes with the combustion process by removing the active chemical species involved in the flame chain reaction.

Upon activation, the AeroFOT condensed aerosol generators immediately starts a chemical reaction that in few seconds produces condensed dry aerosol in the discharge density defined by the system designer (i.e. potassium compounds, K2 CO3 , H2 O, N2 , CO2 , and other gas particles in small quantities). The condensed aerosol thus generated consists of micro-sized particles of potassium compounds suspended in inert gases in an extremely high ratio between the exposed surface and their reaction mass.

The AeroFOT condensed aerosol then remains in suspension for a relatively long time into the protected volume, allowing its active inhibitor to flow into the combustion core transported by its own natural convection currents and breaking the chain reaction upon flame contact with extremely high efficiency.

Alkaline metal requires the least amount of energy for ionization because of its very low ionization potential. Therefore a certain amount of energy is removed from the combustion itself to eliminate the atom's electrons during this ionization process. This is the physical action of the extinguishing process of AeroFOT condensed aerosol.

The chemical process of the condensed aerosol fire extinguishment is characterized by certain reactions in rapid sequence taking place between atoms and fragments of unstable molecules, which is called “chain reactions of radicals”.

Since the radicals are unstable, they tend to reach a final stable condition. The stable final products, among others, are carbon dioxide (CO2) and water (H 2 O).

The potassium atoms derived by the disassociation of the potassium compounds contained in the AeroFOT condensed aerosol, react during combustion with the free radicals of unstable hydroxides forming potassium hydroxide (KOH), which is a very stable compound.

At this stage the chain reaction of the free radicals is halted and the flame is extinguished.

The reaction sequence is shown on the table below:

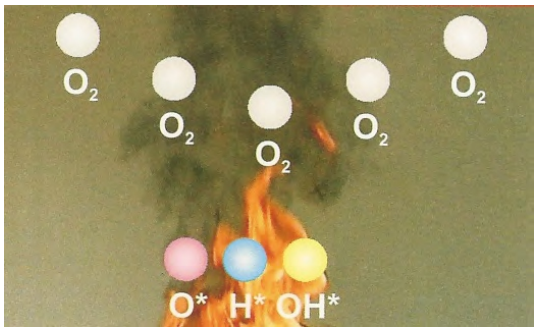
AeroFOT Condensed Aerosol Fire Extinguishing Reaction Sequence

Oxidation of hydrogen in the flames:

$H_2 + O_2 \rightarrow 2\ OH^-$
$OH^- + H_2 \rightarrow H_2O + H^+$
$H^+ + O_2 \rightarrow OH^- + H^+$
$O^{--} + H_2 \rightarrow OH^- + H^+$

Oxidation of carbon monoxide in the flame:

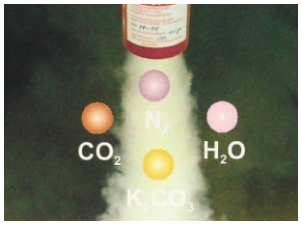
$H_2 + O_2 \rightarrow 2\ OH^-$
$OH^- + CO^{++} \rightarrow CO_2 + H^+$
$H^+ + O_2 \rightarrow OH^- + O^{--}$



Therefore, in the flame, during combustion, further to water and carbon dioxide (stable), only unstable hydroxyl radicals are formed which allow the reaction to continue (phenomenon of auto catalysis).

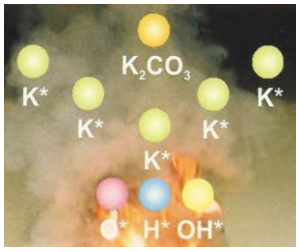
The chain reaction is interrupted by the Potassium atoms, which react with the unstable hydroxyl as follows:

$OH^- + K^+ \rightarrow KOH$ (and flames are thus extinguished)

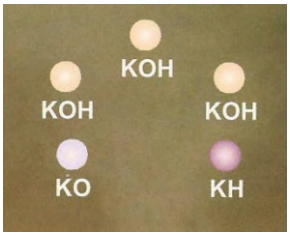


Notice that the potassium hydroxide (KOH) is formed in quantities smaller than micrograms.

The KOH reacts further in the presence of CO_2 and form K_2CO_3 .



During this process we can verify that the extinguishing action of potassium compounds is not achieved either through smothering or quenching but through a reaction in presence of flame with consequent termination of the chain reaction.



Legend:	
H_2	Hydrogen stable
O_2	Oxygen stable
OH^-	Hydroxyl radicals unstable
H_2O	Water stable
H^+	Hydrogen atoms unstable
O^-	Oxygen atoms unstable
CO^{++}	Carbon monoxide unstable
CO^2	Carbon dioxide stable

AeroFOT Condensed Aerosol Fire Use and Limitations

Use and Application

The aerosol fire extinguishers are used effectively in the following fire classes in indoor environments;

Class A Fires: Fires of solid organic materials such as wood, coal, paper, grass, textile products, plastics and similar products.

Class B Fires: Fires of liquid combustible materials such as gasoline, diesel oil, fuel oil, mineral oils, paint, varnish, thinner, alcohol, acetone, glue.

Class C Fires: Fires of combustible gases such as LPG (liquefied petroleum gas), propane, natural gas, methane, hydrogen, acetylene and fires of gaseous material liquefied under pressure.

Fires in electrical and electronic equipment, transformers, electrical distribution systems and panels, computer and data processing system cabinets, telecommunication devices

Limitations

The aerosol fire extinguishers are not suitable for use in the following types of fires;

- Chemical fires containing their own oxygen source such as cellulose nitrate
- Reactive metal fires such as sodium, potassium, magnesium, titanium, zirconium
- Fires of oxidizing agents such as sodium chlorate, sodium nitrate, nitric oxide, fluorine
- Some organic peroxide fires with capability of autothermal degradability
- Reactive hydride and metal amide fires that can react with the aerosol fire extinguishers
- Pyrophobic material fires such as white phosphorus.

Advantages of Aerosol Fire Extinguishing Systems

- Does not require the use of pressure vessels. No leakage or sealing problems.
- No need to use pipe or nozzle. When the system is activated, the extinguishing gas released fills the entire closed volume.
- Easy to install and mount.
- Can be used without maintenance for 10 years.
- Can be activated directly by an electrical signal without the need for a valve or mechanical activation device.
- Robust and compact body structure. Takes a small space.
- Toxic or corrosive effect. It does not harm the environment and living things.
- Does not leave any residue or sediment after activation.

Areas of Applications of AeroFOT Fire Extinguishing Systems

- Electricity Distribution Rooms
- Control Rooms
- Vaults
- Base Stations and Communication Plants
- Engine Rooms
- Electrical Panels and Cabinets
- Substations
- Battery and Generator Rooms
- Wind turbines
- Warehouses and Archives
- Power Plants
- Petrochemical Plants
- Factories and Production Machinery
- Sea, Road and Railway Transportation
- Mining Facilities

Model Names	Activation Type	Chemical Weight (gr)	Protection Volume (m3)	Discharge Time (s)	Equipment Weight (Kg)
AeroFOT-500	E-TH-GB	500	5	10-20	3.5
AeroFOT-1000	E-TH-GB	1000	10	20-30	6.5
AeroFOT-2000	E	2000	20	40-50	9.8
AeroFOT-3000	E	3000	30	40-50	12.5
AeroFOT-4500	E	4500	45	40-50	29.3
AeroFOT-6000	E	6000	60	40-50	33.7

E-Electrical Activation
TH - Thermal Cord Activation
GB - Glass Bulb Activation

Electrical Activation

The electrical activation of the aerosol fire extinguishers is performed by a 2-pin electric actuator on the aerosol fire extinguishing unit. The technical information of the electric actuator is as follows:

- Electrical resistance: 1.0 – 1.2Ohm
- Minimum activation current: 1.0A for 50 milliseconds
- Maximum line continuity test current: 20mA
- Application voltage: 3 – 24V DC

Fire Extinguishing Panels

It is recommended to use the aerosol fire extinguishers with fire extinguishing panels certified in accordance with the relevant national or international standards.

Extinguishing Delay

When fire is detected in the areas where the aerosol extinguishers are used, in case of existence of human or other living beings in the area, it is recommended to make the related settings in the fire extinguishing panel and to ensure a delay of 30 seconds between fire detection and start of extinguishing (aerosol discharge to the area) in order to allow time for evacuation of the those in the area. Although the gas produced by the aerosol extinguishers and having a fire-extinguishing effect and the fog composed of very fine particles of a few microns in size do not cause any vital harm to living things, unnecessary inhalation or exposure is not recommended.

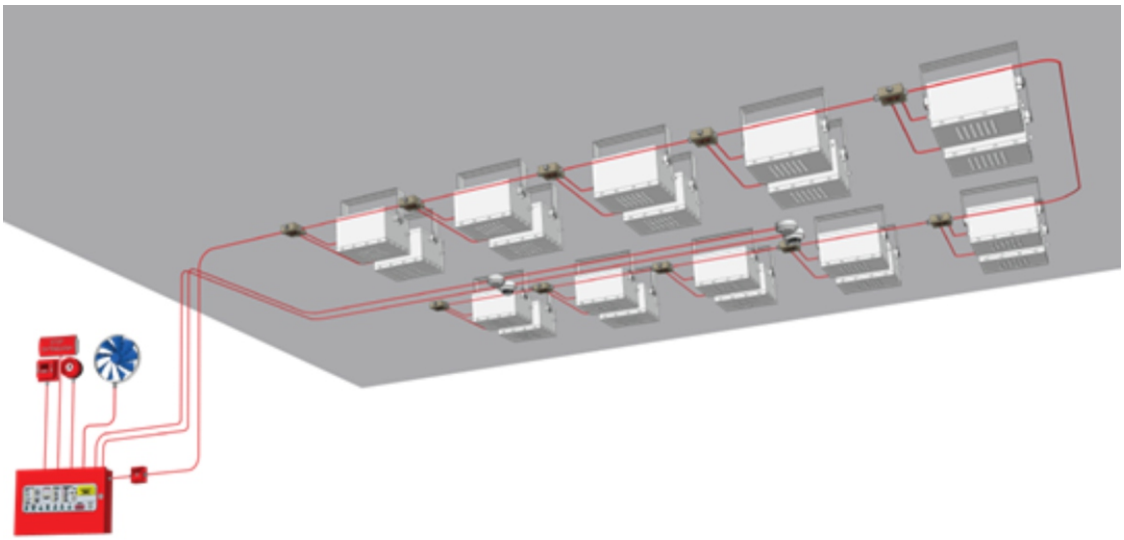
Technical Data : Type E Activation

Extinguishing Time	≤30s
Spout Temperature	≤200℃(5mm distance from the outlet)
Shall Surface Temperature	≤100
Actual Extinguishing Efficiency	≤100g/m3
Feedback Signal Style	Normally Open Dry Contact
Outlet and People's Safety Distance	1.5m
Outlet and Objects 's Safety Distance	0.3m
Use Life(Life-Span)	10 Years
Fire Suppression Type	A,B,C,E

Activation Parameters of E Type

Fire Suppression Type	DC3～24/AC3-220V
Min Activation Current	≥250mA/5mS
Max Safety Current	≤150mA/5min
Connection Method of Several Sets	Series

SCHEMATIC TEMPLATE FOR TYPE E



Thermal Cord and Glass Bulb Activation

The activation of the aerosol fire extinguishers can be performed without electricity by using the AeroFOT thermal Cord or glass bulb which has been developed to provide mechanical activation by increasing the ambient temperature.

The electrical actuator on the aerosol extinguishing unit is removed and replaced by a AeroFOT thermal Cord –glass bulb and the safety pin on the actuator is removed to make the extinguishing unit ready for activation in case of increase in heat. AeroFOT thermal cord –glass bulb are available with a trigger threshold of 57,62, 68,79,70, 93,98, 124,138,141 and 175 degrees Celsius.

3. DESIGN OF AEROSOL FIRE EXTINGUISHING SYSTEM

The design of aerosol fire extinguishing system should be done in accordance with TS ISO 15779 standard.

3.1 Design Calculations

Determining the amount of aerosol extinguishers required for effective fire extinguishing process in the protected area depends on the following factors:
1- Type of fire risk
2- Total volume of environment to be protected
3- Air conditioning and ventilation system that may be in the environment
5- The extinguisher preservation time in the room and the sealing, lost and leakage characteristics of the room
6- Other factors (atmospheric pressure, ambient temperature, etc.)

The basic calculation formula for the total amount of aerosol extinguishers required is as follows:

TM = V x TY
TM: Required amount of fire extinguishers (gr)
V: Volume of the environment (in m3)
TY: Design Application Density (gr/m3)

Design Application Density = Extinguishing Application Density x Safety Factor

Extinguishing Application Density values are given in

Table 3.1.
Safety Factor is considered 1.3 unless otherwise specified.

(Related standards: NFPA 2010, CEN/TR 15276 1/2, TS ISO 15779)

Table 3.1: Aerosol Extinguishing Application Density Table

Fire Classes	Extinguishing Application Density
Class A	77
Class B	51
Class C	35
Electric Fire	According to density of classes A and B

Calculation of Amount of Aerosol Extinguishing Unit Required for Volume to be Maintained: AS = TM/k

AS: Number of aerosol extinguishing units required for the volume to be maintained. If it is not an integer, it must be rounded up as an integer.

TM: Total amount of aerosol extinguishing agent required for the volume to be maintained.

k: The amount of extinguishing agent contained in one of the aerosol extinguishing units intended to be used in the volume to be maintained.

4. MOUNTING OF AEROSOL EXTINGUISHING UNITS

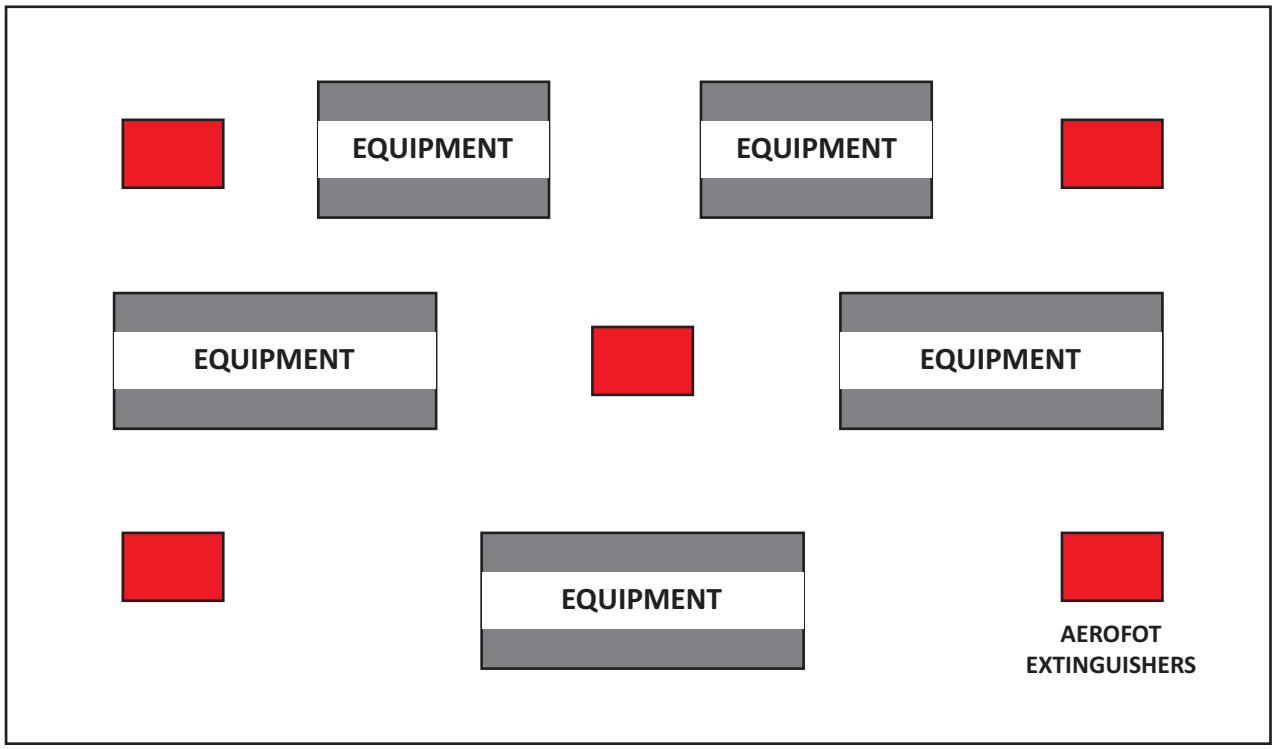
The aerosol extinguishing units are made with surface mounting apparatus in the product packaging and fixing bolts to be used for mounting the apparatus to the unit. The aerosol extinguishing units are mounted on the ceiling or ambient walls by adjusting the appropriate discharge angles by using the mounting apparatus. The electrical connection of the aerosol extinguishing units to the fire extinguishing system is also made by using the connection socket included in the product packaging.

4.1 Distribution of Extinguishing Units to Media

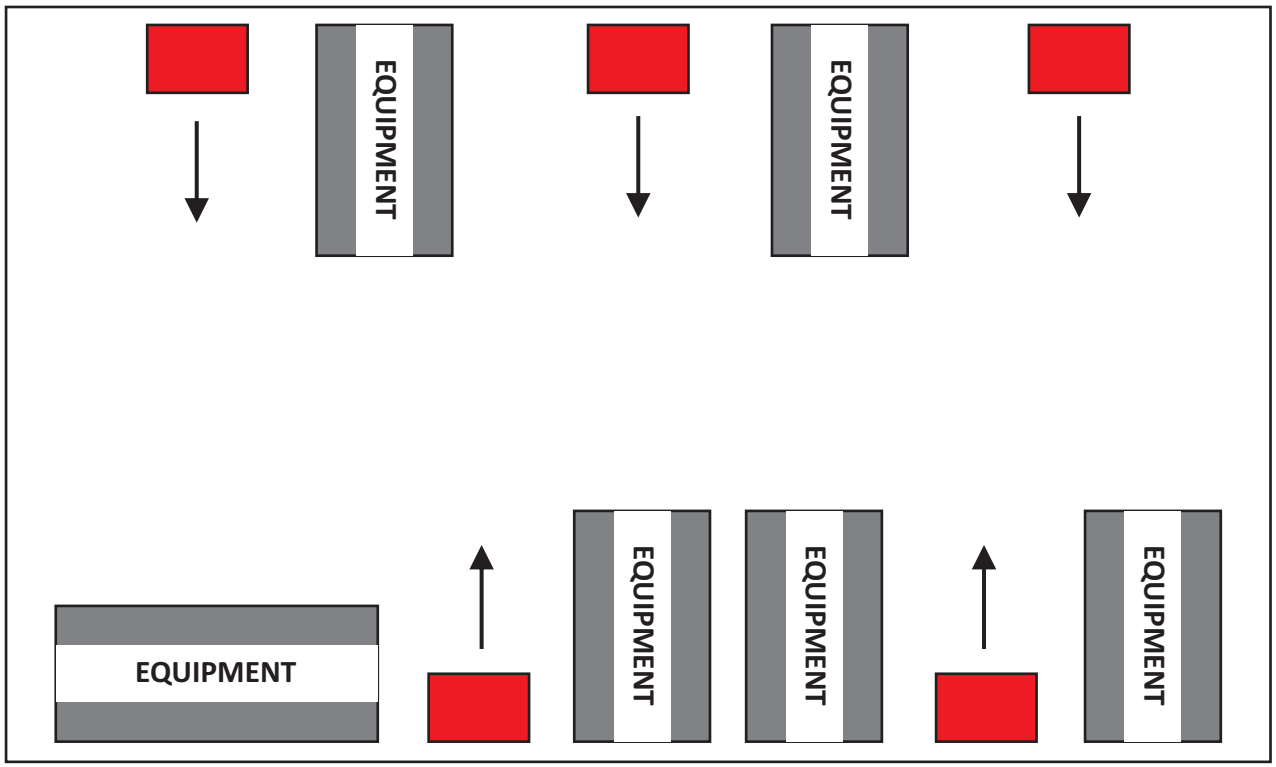
It is extremely important that the aerosol extinguishing units are placed in the enclosure to ensure proper aerosol flow and distribution. The aerosol extinguishers should be placed as evenly spaced as possible in the protected environment and positioned so as to form an equal, three- dimensional aerosol discharge throughout the environment. In order to avoid excessive aerosol particle condensation and accumulation at one point, the aerosol extinguishing units should not be placed toward each other so that they are discharged. In addition, the discharge direction of the aerosol extinguishing units should be chosen so that they cannot be directed to the walls of the protected environment or the equipment within the protected environment.

The discharge path of the aerosol extinguishing units should be mounted as open and unobstructed as possible. The minimum safe discharge temperature distances must be maintained and the discharge clearance distances up to 75°C should be taken into consideration when installing in environments where there is a possibility of living beings inside. In the environment where combustible and flammable materials exist, the properties of combustible and flammable material should be taken into consideration, it should be ensured that minimum 200°C discharge clearance distances are ensured between the aerosol extinguishing units discharge directions and flammable materials.

If the amount of equipment in the environment to be protected is excessive and the equipment is positioned to prevent the free flow and distribution of aerosol discharge, it should be preferred to ensure efficient and homogeneous aerosol distribution in the environment by using smaller but more AeroFOT extinguishing units instead of large capacity units in such environments.

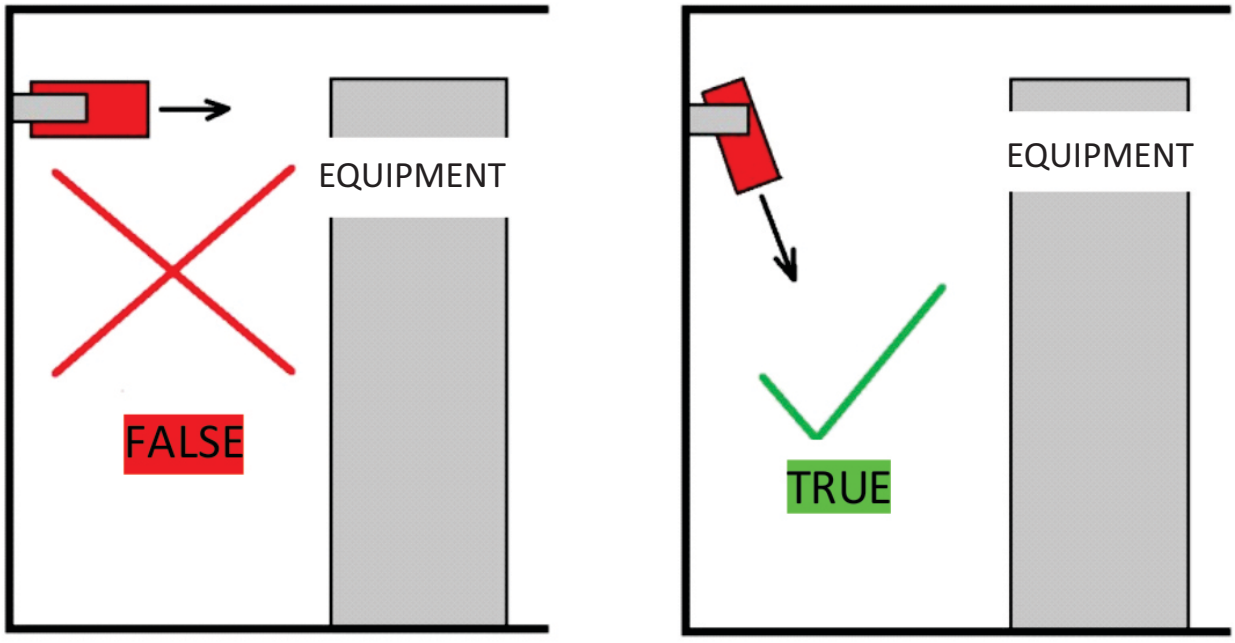


CEILING MOUNTING OF THE AEROSOL EXTINGUISHERS



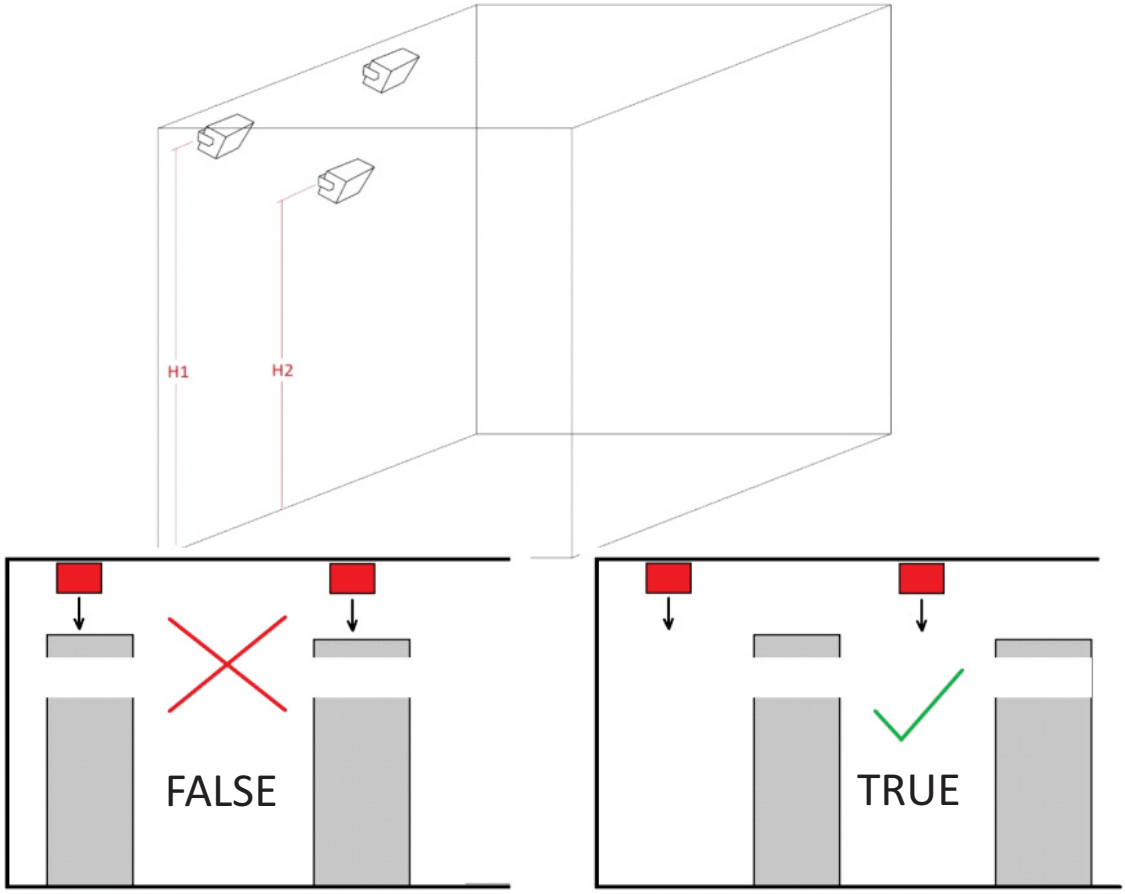
WARNING: Installation of the aerosol extinguishers should be done in a way that the discharge path will be open.

Wall Mounting Of The Aerosol Extinguishers



WARNING: Installation of the aerosol Extinguishers should be done in a way that the discharge path will be open.

Mounting Height



In general, the aerosol extinguishing units are mounted to side walls, at heights close to the ceiling so as to be directed towards the ceiling or floor with an angle of 15 to 45 degrees towards the floor to provide three-dimensional aerosol distribution in the enclosure to be protected. The maximum installation height of the aerosol extinguishing units installed in the enclosure should be within the limits specified in Table below, in order to ensure the maximum distribution of the aerosol in the enclosure to be protected.

In enclosure where the ceiling height is higher than the maximum height values specified in Table, the installation of the aerosol extinguishing units should be made in a way that it will form more than one layer with different height levels by taking into consideration the maximum coverage area values in order to ensure that the density of aerosol extinguishers is appropriate to the enclosure. In raised floor (underground) applications it is recommended to use small capacity models such as AeroFOT-500 due to the limited height and to make its installation in such a way that the discharge direction is horizontal.

Model Names	Activation Type	Minimum Height (m)	Maximum Height (m)
AeroFOT-500	E-TH-GB	0.5	3.0
AeroFOT-1000	E-TH-GB	0.5	4.0
AeroFOT-2000	E	0.5	4.5
AeroFOT-3000	E	0.5	5.0
AeroFOT-4500	E	0.5	6.0
AeroFOT-6000	E	0.5	6.0

Mounting of Aerosol Extinguishing Units in Hazardous Areas

The aerosol extinguishing units are designed to be mounted both horizontally and vertically and when installed in walls, beams, ceilings and columns by taking into account the discharge clearance and discharge distance values in the enclosure, it does not affect the personnel, equipment and flammable materials in the protected environment. When mounting the aerosol extinguishing units, there shall be a minimum space up to the values as specified in Table below, between the aerosol extinguishing unit body and the flammable and non-flammable materials and equipment.

Minimum proximity distance to flammable and non-flammable materials and equipment

Model Names	Activation Type	Maximum Proximity Height (mm)
AeroFOT-500	E-TH-GB	20
AeroFOT-1000	E-TH-GB	30
AeroFOT-2000	E	30
AeroFOT-3000	E	35
AeroFOT-4500	E	40
AeroFOT-6000	E	40

Shutdown of Ventilation System and Electricity in Protected Environment

When the event of a fire is detected, the ventilation system must be shut down in the event of a fire, if there is ventilation system in the protected environment, to ensure that the required extinguishing application intensity is provided by the discharge of the aerosol extinguishing units installed in the environment and to prevent the fire from blazing by excessive airflow. In addition, in order to eliminate the effects such as short-circuit and re-ignition due to short-circuit in case of fire, the power of electrical equipment in the protected environment should be cut off in case of fire.

Operating Temperature Range

AeroFOT extinguishing units are designed to operate in a temperature range of -40°C to + 60°C.

5. INSTALLATION OF AEROSOL EXTINGUISHING SYSTEM

The AreoFOT extinguishing units must be installed in accordance with the requirements described in this installation and operating manual and in such a way that they are physically or chemically undamaged and that all test and maintenance procedures in accordance with the instructions are operated.

WARNING

WHEN INSTALLING THE AEROSOL EXTINGUISHING UNITS, MAKE SURE THAT THE FIRE EXTINGUISHING PANEL IS DE-ENERGIZED.

IF THE ELECTRICAL ENERGY IS NOT CUT OFF, THE AEROSOL EXTINGUISHERS MAY BE DISCHARGED UNEXPECTEDLY AS A RESULT OF POSSIBLE CONNECTION OR SHORT CIRCUITS DURING THE INSTALLATION.

WHEN MOUNTING THE AEROSOL EXTINGUISHING UNITS, BE CAREFUL NOT TO STAND IN FRONT OF THE DISCHARGE NOZZLES FOR PRECAUTIONARY PURPOSES.

Installation

1. Secure the apparatus firmly to the surface with screws, dowels or bolts by choosing the locations of the mounting apparatus so that they are stable and unmoved, their direction and position does not change over time and they are fixed on the walls, ceiling, beams or columns.

2. Unpack the aerosol extinguishing unit and check the body for damage during carrying and transportation. Open the cover of the electrical activation connection port and connect the electrical connection socket to the activation port and make sure to read a resistance value between

1.0 - 1.2 Ohm by measuring with “ohmmeter" at both ends of the connection socket. Do not install that unit if you are reading high resistance or short circuit from the ohmmeter.

3. When attaching and fixing the aerosol extinguishing unit to the mounting apparatus, ensure that the discharge direction is determined to ensure as unobstructed and homogeneous aerosol discharge as possible. Therefore, make sure that the discharge direction of the aerosol extinguisher is open, that there are no objects to prevent aerosol emission during discharge, and that it is not directed towards the wall, any equipment in the environment or another aerosol extinguisher. Make sure to tighten the mounting fixing bolts of the aerosol extinguishing unit body after determining the proper discharge direction and angle.

4. The aerosol extinguishing units can be connected to the extinguishing outlet/outlets of a fire extinguishing panel via the electrical connection port, either individually or in series or parallel to each other. The polarity of the connection (the sequence of the + and - end) is insignificant. The electrical activation of each aerosol extinguishing unit requires a 3 - 24V DC triggering voltage and a nominal 1A triggering current. Depending on the maximum current capacity of the extinguishing output of the fire extinguishing panel, it is determined how many AeroFOT extinguishing units can be connected to the extinguishing output of the panel. If a greater number of aerosol units are desired to be connected to the extinguishing output, the aerosol extinguishing units connected to the extinguishing output of the panel are activated sequentially and in a delayed manner by using the so-called "Activation Sequencer". For more information,

see " **Appendix-A Electrical Connection Examples of Aerosol Extinguishing Units"** at the end of this manual.

5. The aerosol extinguishers are electrically connected to the extinguishing output of the fire extinguishing panel via the electrical connection port on their bodies. Make sure that the fire extinguishing panel is de-energized when electrical connections of the aerosol units are made. The connection of the aerosol unit and extinguishing output is made by using a connection socket provided in the product packaging with the aerosol extinguishing unit, which can be plugged into the electrical connection port on the body of the aerosol unit. The connection line from the extinguishing output of the panel is connected to the ends of the connection socket and the connection socket is plugged into the electrical connection port of the aerosol and locked.

WARNING

Personnel performing the operation and installation of the AeroFOT extinguishing units are required to be familiar with the safe handling, transport, proper installation and disposal of the generators after the discharge.

The following points should be observed for carrying, transportation and storage.

Carrying: The aerosol units should be carried in their original packaging and in a vertical direction. They should be properly fixed in the vehicles they are transported, they should not be toppled over or dropped during transportation. **Do not install the aerosol units that have been dropped or damaged.**

Severe Intervention: The aerosol extinguishing units should not be severely crashed each other or hard surfaces during transport and installation and they should be protected against severe impacts that may cause damage to the units during transport and installation.

Storage: The aerosol extinguishing units should be stored on places where they will not be exposed to extreme adverse environmental conditions and will not be physically or chemically damaged.

Post-Installation Checks

After the installation of AeroFOT extinguishing units and electrical connection of it to a fire detection and extinguishing system, the following checks are recommended.

1. Check that the correct aerosol extinguishing unit model specified in the installation plans and system design is used.

2. Make sure that the mounting apparatus of the aerosol units are correctly installed and that all fastening bolts are tightened.

3. Check that all electrical connections are made correctly and make sure that the connections are electrically stable with an Ohmmeter and there is no disconnection or short circuit.

4. Make sure that all aerosol extinguishing units are located in the right place and that the discharge paths are open. Make sure that the safe discharge clearance distances of the Aerosol extinguishing units are maintained, that they will not discharge towards walls, equipment in the environment or

each other, and that they will operate in a manner that will not damage the environment and the living beings in the environment during the discharge.

5. Ensure that the fire extinguishing panel is set to meet the extinguishing delay time of at least 30 seconds.

6. Ensure that the fire extinguishing panel, manual start and stop buttons for extinguishing are installed outside the protected environment and are easily accessible.

7. Make sure that the entire detection and extinguishing system is designed, installed and tested in accordance with those described in this manual and the relevant national and international standards.

6 OPERATION OF AEROSOL EXTINGUISHING SYSTEM

The aerosol extinguishing units comprise tablets of alkali metal salts and auxiliary chemicals compressed in a solid state in a metal carrier casing. When the aerosol extinguishers are triggered by an electric or thermo-mechanical activator, a redox (reduction-oxidation) combustion reaction begins in solid aerosol extinguishing tablets, and very fine alkali metal carbonate and bicarbonate particles in a few micron size with fire-extinguishing effect produce aerosol fog with fire-extinguishing effect consisting of carbon dioxide, water vapor and nitrogen. Then, this fire extinguishing aerosol fog is passed through the cooling and filtration layer in the aerosol extinguishing unit, the combustion product residues in it are cleaned, the temperature of the aerosol fog is decreased and it is sent into the environment to be protected from fire and homogeneously distributed in the enclosure.

6.1 Electrical Activation

When a fire is detected, after a waiting period of at least 30 seconds, an activation voltage is sent to the aerosol extinguishing units from the extinguishing output of the fire extinguishing panel and the electrical activation of the aerosol extinguishing units is initiated. If people are present in the protected enclosure, evacuation of those in the enclosure should be immediately when an audible fire alarm is heard, nobody should enter the enclosure after the extinguishing process starts and the fire department should be informed immediately.

6.2 Thermal & Glass Bulb Activation

The activation of the aerosol fire extinguishers can be performed without electricity by using the AeroFOT Thermal cord or glass bulb actuator, which has been developed to provide mechanical activation by increasing the ambient temperature. The electrical actuator on the aerosol extinguishing unit is removed and replaced by a AeroFOT thermal cord or glass bulb actuator and the safety pin on the actuator is removed to make the extinguishing unit ready for activation in case of increase in heat level of an enclosure.

6.3 Post-Fire Procedures

After AeroFOT extinguishing system is activated and discharged in case of fire, trained fire extinguishing system maintenance personnel must follow the post-fire and re-installation procedures described in this manual. In particular, before entering the environment in which the system is installed and where the fire is intervened, warnings regarding the length of time elapsed after the intervention must be observed.

WARNING

DO NOT ACCESS TO ENCLOSURE, WHERE THE FIRE IS INTERVENED, WITH CIGARETTE OR ANY OPEN FLAME SOURCE AGAINST THE POSSIBILITY OF COMBUSTIBLE AND FLAMMABLE VAPOR ACCUMULATION.

BEFORE VENTILATING THE ENCLOSURE, MAKE SURE THAT THE FIRE IS ABSOLUTELY OFF AND ENSURE PROPER VENTILATION BEFORE ENTERING.

After the discharge of the AeroFOT extinguishing system, the following steps should be followed:

1. After the discharge of the extinguishing system, it must be ensured that the extinguishing fog produced by the aerosol extinguishing units is kept in the protected volume for a minimum of 10 minutes.

2. It should be ensured to ventilate the environment well by operating the ventilation system or opening doors and windows in the environment. If the environment must be entered before it is fully ventilated, a protective respiratory equipment or mask should be worn to prevent unintentional inhalation of the by-products of the fire and aerosol.

3. The enclosure should be carefully inspected to ensure that the fire is completely extinguished and that there are no hot spots in the environment that may re-ignite.

4. There must be portable fire extinguishers in the environment to be used in case of re-ignition after fire intervention.

5. If there is still a small amount of residues in the environment after the environment is ventilated, it should be cleaned with a vacuum cleaner, by blowing, brushing or washing with a mixture of water and alcohol. Make sure that no excessive aerosol particle condensation occurs on the equipment or walls in the environment after discharge. If there is any excessive particle condensation, it should be wiped away and washed out not too long before.

6. After discharge, any aerosol residues present in the environment that are not cleaned may absorb moisture in time. Therefore, aerosol residues, especially in environments with high humidity, should be removed within a few hours at the latest, before absorbing the moisture in the environment.

7. After discharge, the metal bodies of the aerosol extinguishing units become hot in a way that it is not touched with bare hands, and may take some time to cool. Therefore, heat-resistant gloves should be used when disassembling the aerosol extinguishing units after discharge.

8. The aerosol extinguishers removed after discharge should be disposed of in accordance with local regulations.

9. For replacement of discharged aerosol extinguishing units, contact your local AeroFOT distributor or manufacturing company to obtain new ones.

WARNING

The AeroFOT extinguishers do not damage electronic equipment, metal and other non - metallic materials that may be present when activated, and produce particles that are composed of very fine alkali metal carbonates and bicarbonates of micron size which have a fire extinguishing effect and can remain suspended for more than one hour without collapsin g by completely filling the protected volume. Therefore, the accumulation of particles on the equipment in the environment usually occurs on horizontal surfaces and very little. This small amount of particle accumulation can be removed by simply cleaning the surfaces with tools such as a vacuum cleaner or a blower fan after aeration of the environment following the aerosol discharge. It is not possible that a small amount of particle condensation that can accumulate on the surfaces will cause electrical conductivity on the accumulation surfaces.

However, in environments where aerosol discharge occurs, it is recommended to inspect the environment after ventilation and to clean the surfaces in case of particle accumulation as a precautionary measure. Because although the aerosol itself is a clean extinguisher, a number of polluting fire products may be released as a result of the fire occurring in the environment and may have accumulated in the environment or on the equipment surfaces in the environment. Or du st or dirt already accumulated in the environment may be dispersed and contaminated the equipment surfaces by venting from the surfaces it accumulates in the environment with the effect of aerosol discharge during the fire response.

In addition, even in rare cases, there may be an intense accumulation of particle on the surfaces of the equipment after discharge, due to the discharge direction being blocked as a result of the presence of improperly discharged aerosol extinguishers in the environment or the displacement of materials and equipment in the environment after the system installation. In the case of such intense particle accumulation that may be experienced, when the surfaces where the particle accumulation occurs are not cleaned for a long time, the intense particles accumulated in a region or at some point may absorb moisture in the environment in time and cause surface corrosion effects over time, especially on copper, nickel and bronze surfaces. For this reason, after the aerosol discharge, the environment is controlled and, if there is regional and intense aerosol particle accumulation on the equipment surfaces within the enclosure, the surfaces where the particle accumulation is observed should be cleaned by wiping with water and alcohol solu tion or appropriate cleaning concentration within a few hours, without waiting too long.

7. MAINTENANCE

AeroFOT extinguishing systems require much less maintenance than other systems that require piping and use pressurized water or gaseous extinguishing tubes. AeroFOT extinguishing systems require simple observations and controls to monitor system integrity, which will only be performed periodically after the installation. It is recommended that a maintenance and control card is created and that it is visibly attached to the body of the aerosol extinguishing units to ensure that at least the following information regarding periodic checks is to be followed:

Control period and date

If there is a need for maintenance as a result of the inspection, the reason and the type of operation
Name of personnel performing inspection and maintenance

7.1 Periodic Control of Aerosol Extinguishing Systems

Appropriate control, testing and monitoring procedures are required to be implemented for the aerosol fire extinguishing system installed during the periods given in Table below:

Schedule of Control and Monitoring of the Aerosol Extinguishers

Control Period	Scope of Observations and Controls To Be Performed
Monthly	Visual examination. Check for possible damage and mounting position.
	Checking of the electrical connections.
Semi-Annual	Visual examination. Check for possible damage and mounting position.
10-Year	Checking and testing of the electrical connections.
	Testing of the detection and extinguishing system functions.
	Service life has expired. Replace the extinguishing unit.

Control and Monitoring Procedures

Monthly Control

1. In the event of a possible fire, check all electrical connections to ensure that the aerosol extinguishing system is electrically activated and becomes a part of the activity.

2. Visually inspect all installed aerosol extinguishing units to ensure that they are undamaged and that they have not parts that lost their functions.

3. Make sure that the discharge paths of all the aerosol extinguishing units in the environment are open and unobstructed by the equipment in the environment.

Semi-Annual Control

1. Visually inspect all installed aerosol extinguishing units to ensure that they are undamaged and that they have not parts that lost their functions. If damaged units are detected, replace them with new units by taking into account the points described in Article 5.1.

2. Check the mounting apparatus of the aerosol extinguishing units to make sure they are undamaged. Check that the connection apparatus bolts are secure and tightened. Replace any loose connection apparatus or retighten them if they are loose.

3. Ensure that the discharge paths of all aerosol extinguishing units in the environment are open and unobstructed by the equipment in the environment.

4. In the event of a possible fire, check all electrical connections to ensure that the aerosol extinguishing system is electrically activated and becomes a part of the activity. Check the continuity of the connection lines between the fire extinguishing panel and the aerosol extinguishing units by using the Ohmmeter. Repair any open and short circuit problems that may be detected on the lines.

5. Test that the fire detection and extinguishing system functions are operational. Make sure that the fire detection and extinguishing panel, extinguishing hold and manual extinguishing start buttons at the entrance to the protected environment are functional and easily accessible.

Service Life and Replacement

The service (useful) life of the AeroFOT extinguishing units is 10 (ten) years. The label on the body of the extinguishing unit indicates the date of manufacture and the date on which the service life ends. The aerosol extinguishing units, which have reached the end of their service life, must be removed and replaced with new units.

7.4 Recycling of Discharged Aerosol Extinguishing Units

The discharged aerosol extinguishing units can be disposed of by sending them to any recycling facility where industrial waste is processed.

Stainless steel outer body for AeroFOT 500,1000,2000 and 3000 model

Electrostatic powder coated DKP sheet metal outer body for AeroFOT 4500 and 6000 models.

LIMITED WARRANTY STATEMENT

Fotfire Control declare and undertake that the aeroFOT extinguishing units produced are flawless in terms of materials and workmanship, and to repair or replace the product within twelve (12) months from the date of shipment if it is proved that the products are defective in terms of workmanship or materials used. Defective aerosol extinguishing units must be shipped by cargo to the manufacturer whose contact details are given below.

AeroFOT®

Unit 3 Merchant,
Evegate Business Park,
Ashford, Kent,
England, Tn25 6sx.
+44 333 2244 360
sales@fotfirecontrol.co.uk

Safety Data Sheet

1 DEFINITION OF HARMFULNESS

1.1 Classification of the substance or mixture:
According to the SEA Regulation
This product does not meet the classification criteria for any damage class according to the Regulation on the Classification, Labeling and Packaging of Substances and Mixtures.

1.2 Label elements
According to the SEA Regulation
In accordance with SEA Regulation, there is no need to label the product as a hazardous substance.

1.3 Other damages
The product does not present a hazard during normal contact.
When the unit is activated, the active chemical substance may cause temporary slight irritation to the mucous membranes if it is inhaled.

The components are blended and pressed into a highly stable, molded form. The molded composition is contained in a closed-walled stainless steel housing - there is no environmental exposure.

2 INFORMATION ON COMPOSITION/CONTENTS

2.2 Mixture
Substances it contains:

Chemical Name	CAS No.	EC No.	%	Classification
Potassium Nitrate (powder)	7757-79-1	231-818-8	70 - 73	Not classified.
Melamine	108-78-1	203-615-4	15 - 18	Not classified.
Phenolic Resin	9003-35-4	500-005-2	11 - 13	Not classified.
Additional Information:	All H-statements related to the subject matter are given in section 16.			

3 FIRST AID MEASURES

3.1 Description of first aid measures

After inhalation : After prolonged exposure to the device contents (min. 1 day), go out to fresh air, place on the floor and rest.
Eye contact : Keep eyes open and wash with water.
After skin contact : Change clothing and shoes, wash skin with soap.

If additional treatment is required, seek medical attention for observation and support.

3.2 Important acute and subsequent symptoms and effects
Unknown.

3.3 First indications for requirement of medical intervention and special treatment
No special treatment was recommended. Treat according to symptoms.

4 FIRE-FIGHTING MEASURES

4.1 Fire extinguishers

Product flammability : It is non-flammable in case of device.
Suitable extinguishing materials : This is a firefighting equipment.

4.2 Special hazards arising from the substance or mixture
The material does not pose an explosion hazard. Can ignite through a fire. Hot gases are generated near the outputs of the device.

4.3 Advices for firefighters
In the event of a fire, wear personal protective equipment and clothing;

5 MEASURES FOR DIFFUSION AS A RESULT OF THE ACCIDENT

5.1 Personal precautions, protective equipment and emergency procedures
Gloves, goggles are used when needed.

5.2 Environmental precautions
Avoid release to the environment..
If these tools are to be spilled, they must be safely collected by hand and inspected for possible damage before repacking. Suspected or damaged substances should be labeled and shipped to ensure proper disposal.
Mechanically cleaned.

6 HANDLING AND STORAGE

6.1 Precautions for safe handling
Avoid contact with flammable materials.
Warnings for protection against fire and explosion
No special measures required.

6.2 Conditions for safe storage, including any incompatibilities
Products should be stored in their original packaging in a dry, cool and well-ventilated place.
Storage Class
5.1

6.3 Specific end uses
Fire Extinguisher

7 EXPOSURE CONTROLS / PERSONAL PROTECTION

7.1 Control parameters
Contains no substances with exposure limit.

7.2 Exposure controls

General protective cleaning measures
Wash your hands before breaks and at the end of work.

Hand/Skin protection : Wear gloves conforming to EN 374 standard to prevent skin exposure.

Eye protection	:	Wear suitable protective goggles or chemical protective goggles.
Limit values required for monitoring in the workplace and contents	:	The product does not contain critical materials that require Monitoring in the workplace.

8 PHYSICAL AND CHEMICAL PROPERTIES

8.1 Information on basic physical and chemical properties

Appearance	:	Solid
Color	:	Light Yellow
Odor	:	Odorless
Relative density	:	Not applicable
Boiling point Boiling range/ (°C)	:	Not applicable
Vapor Density	:	Not applicable
Flash Point	:	Not applicable
Flare Limits in Air (% by volume)	:	Not applicable
Auto-Flash Temperature (°C)	:	300
Explosion Hazard	:	Not applicable

8.2 Other information

The mechanism (igniter) that enables the device to be operated is completely explosive free.

9 STABILITY AND REACTION

9.1 Reaction

No specific test data for this product are available. See next sections of this chapter for more information.

9.2 Chemical stability

It is stable under normal temperature conditions and recommended conditions of use.

9.3 Possibility of hazardous reactions

Avoid contact with organic solvents.

9.4 Conditions to avoid

Not available under recommended storage and handling conditions

9.5 Incompatible substances

Information is not available.

9.6 Hazardous decomposition products

Under normal conditions of storage and use, no hazardous decomposition products should be formed.

9.7 Other information

These instruments are extremely stable below 125^{o}C. Protect from fire, electric power sources, electric shock and high temperature degrees.

10 TOXICOLOGICAL INFORMATION

10.1 Information on toxic effects

Acute Toxicity

No data available.

Skin corrosion / irritation

No data available.

Serious eye damage / irritation

No data available.

Respiratory tract or skin sensitization

No data available.

Gamete mutagenicity

No data available.

Carcinogenicity

No data available.

Reproductive system toxicity

No data available.

Specific target organ toxicity - single exposure

According to the available data, it does not meet the classification criteria.

Specific target organ toxicity - repeated exposure

According to the available data, it does not meet the classification criteria.

Aspiration damage

According to the available data, it does not meet the classification criteria.

11 ECOLOGICAL INFORMATION

The product is not classified as dangerous for the environment. However, it does not eliminate the possibility that large quantities or frequent spills have a harmful or damaging effect on the environment.

11.1 Toxicity

No data available.

11.2 Persistence and degradability

No data available.

11.3 Bioaccumulation potential

No data available.

11.4 Mobility in soil

No data available.

11.5 Results of PBT and vPvB assessment

This mixture does not contain any substance considered to be a PBT or a vPvB.

11.6 Other adverse effects

No data available.

12 DISPOSAL INFORMATION

12.1 Waste treatment methods

Product

Waste materials must be disposed of in accordance with the Local Regulation on General Principles of Waste Management. Do not allow to enter surface and underground water, drinking water supplies, standing and running water, sewage. Leave the chemicals in their original containers. Do not mix with other waste. Treat uncleaned containers as the product itself.

13 TRANSPORT INFORMATION

The product is not classified as dangerous according to transportation legislations (ADR/RID, ADNR, IMDG, ICAO/IATA).

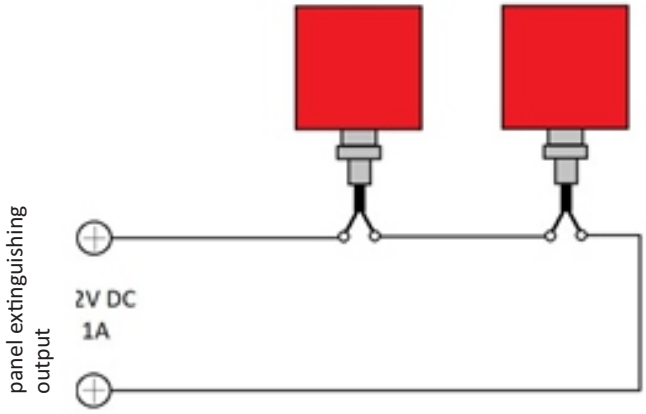
14 Risk:

The information provided in this document is based on the best available information. This information applies only to the designated substance/preparation and may not apply if this substance/preparation is mixed with other substances/preparations or used in any other process.

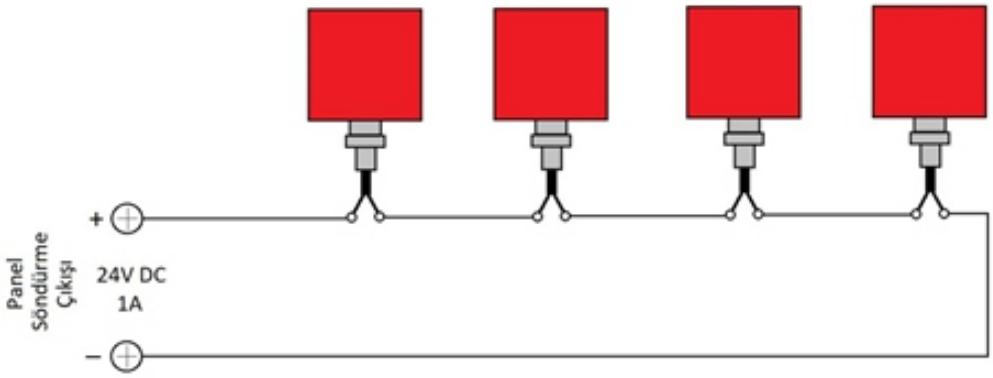
The information provided in this document does not constitute a warranty/guarantee for the properties of the product and does not constitute a legally binding agreement/contractual legal relationship. This document complements the technical documentation but cannot be replaced.

The information provided is based on our knowledge of this product at the time of publication. It is based on good faith.

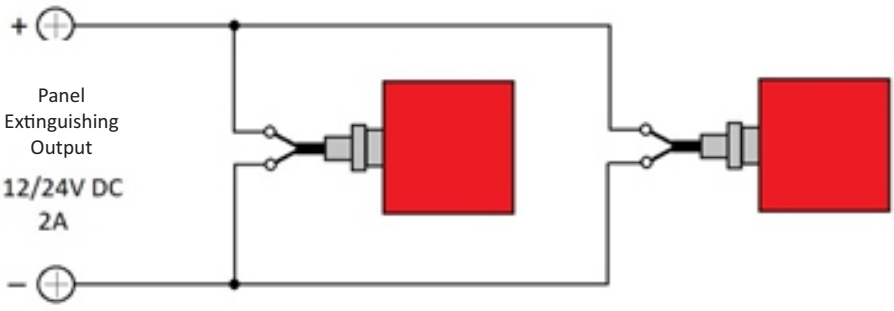
ANNEX-A
EXAMPLES OF ELECTRICAL CONNECTION OF AEROSOL EXTINGUISHING UNITS



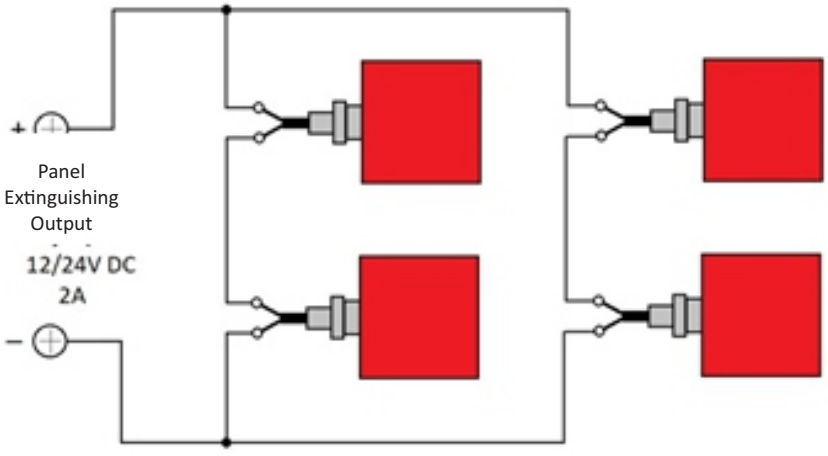
Serial connection of aerosol extinguishing units for 12V DC 1A extinguisher output



Serial connection of aerosol extinguishing units for 24V DC 1A extinguisher output



Parallel connection of aerosol extinguishing units for 12/24V DC 2A extinguisher output

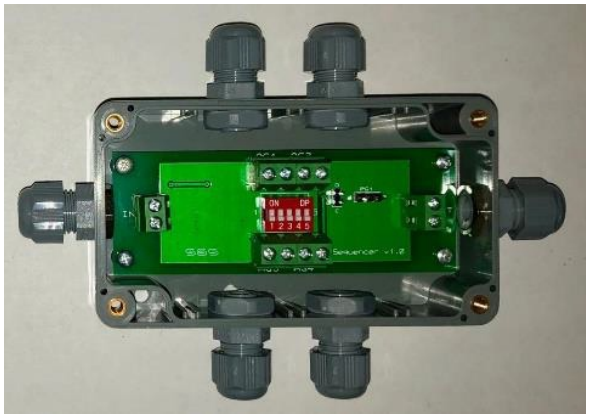


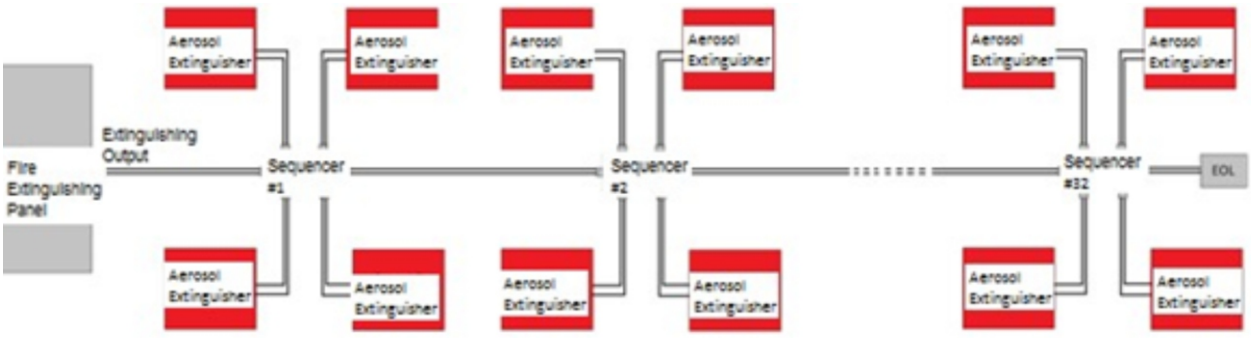
Serial and parallel maximum aerosol extinguishing unit connection for 12/24V DC 2A extinguisher output

Use of Activation Sequencer for Connection of Multiple Aerosol Extinguishing Units

It is recommended that maximum 4 aerosol fire extinguishing units are connected in parallel to the extinguishing output of a fire extinguishing panel operating at 24V DC supply voltage. When more aerosol extinguishing units are connected to the extinguishing output of the fire extinguishing panel, excessive current will be drawn from the extinguishing output to trigger a large number of aerosol extinguishing units, therefore the fuse protecting the extinguishing output against over-current may cause the extinguishing output to be disabled or all aerosol extinguishing units may not be triggered due to excessive voltage drop. In cases where it is necessary to connect and use a large number of aerosol extinguishing units to the extinguishing output of the fire extinguishing panel, the devices called "Activation Sequencer" are used to prevent overload of the extinguishing output.

In the event of a fire, when the fire extinguishing panel energizes the extinguishing output to initiate the extinguishing process, the Activation Sequencers trigger the aerosol fire extinguishing units on the extinguishing output in groups and sequentially and ensure to trigger a large number of aerosol extinguishing units sequentially and systematically without overloading the extinguishing output of the panel. Maximum 4 aerosol extinguishing units can be connected to each activation sequencer, and there can be maximum 32 activation sequencing devices connected to a extinguishing output. In this case, it is possible to connect up to 128 aerosol extinguishing units to the extinguishing output of a fire extinguishing panel by using the activation sequencers.





The activation sequencing devices are connected directly to the extinguishing output of the fire extinguishing panel, regardless of polarity. When the extinguishing output of the panel is energized, the sequencing devices are activated and trigger the aerosol extinguishers in sequential and chained manner in groups of up to four. In order to ensure that the aerosol extinguishing units on the extinguishing output of the panel trigger in sequential and chained manner, each activation sequencing device triggers maximum 4 groups of aerosol extinguishing units connected to it after waiting for the delay value set during installation.

When each of the activation sequencing devices connected on the extinguishing output of the panel is given sequential and different delay values, the aerosol extinguishing groups connected to the sequencing devices are triggered sequentially and successively by sending a brief triggering signal. Thus, no more than 4 aerosol extinguishing units are triggered from the extinguishing output of the panel and the instantaneous overloading of the extinguishing output is prevented.

On the activation sequencing devices there are a set of five DIP-switches to set the triggering sequence (with how long delay) of the aerosol extinguisher group connected to it during installation.

DIP- Switch Set
1=2=3=4=5=OFF
Sequence No=0
Delay=0 sec

DIP- Switch Set
1=2=ON
3=4=5=OFF
Sequence No=3

This DIP-switch set is set according to the following table, and an activation sequence number or, in other words, the activation delay time is assigned to each sequencing device.

Sequence No	Delay (sec)	DIP - Switch Set 1	2	3	4	5	Sequence No	Delay (sec)	DIP - Switch Set 1	2	3	4	5
0	0	OFF	OFF	OFF	OFF	OFF	16	16	OFF	OFF	OFF	OFF	ON
1	1	ON	OFF	OFF	OFF	OFF	17	17	ON	OFF	OFF	OFF	ON
2	2	OFF	ON	OFF	OFF	OFF	18	18	OFF	ON	OFF	OFF	ON
3	3	ON	ON	OFF	OFF	OFF	19	19	ON	ON	OFF	OFF	ON
4	4	OFF	OFF	ON	OFF	OFF	20	20	OFF	OFF	ON	OFF	ON
5	5	ON	OFF	ON	OFF	OFF	21	21	ON	OFF	ON	OFF	ON
6	6	OFF	ON	ON	OFF	OFF	22	22	OFF	ON	ON	OFF	ON
7	7	ON	ON	ON	OFF	OFF	23	23	ON	ON	ON	OFF	ON
8	8	OFF	OFF	OFF	ON	OFF	24	24	OFF	OFF	OFF	ON	ON
9	9	ON	OFF	OFF	ON	OFF	25	25	ON	OFF	OFF	ON	ON
10	10	OFF	ON	OFF	ON	OFF	26	26	OFF	ON	OFF	ON	ON
11	11	ON	ON	OFF	ON	OFF	27	27	ON	ON	OFF	ON	ON
12	12	OFF	OFF	ON	ON	OFF	28	28	OFF	OFF	ON	ON	ON
13	13	ON	OFF	ON	ON	OFF	29	29	ON	OFF	ON	ON	ON
14	14	OFF	ON	ON	ON	OFF	30	30	OFF	ON	ON	ON	ON
15	15	ON	ON	ON	ON	OFF	31	31	ON	ON	ON	ON	ON

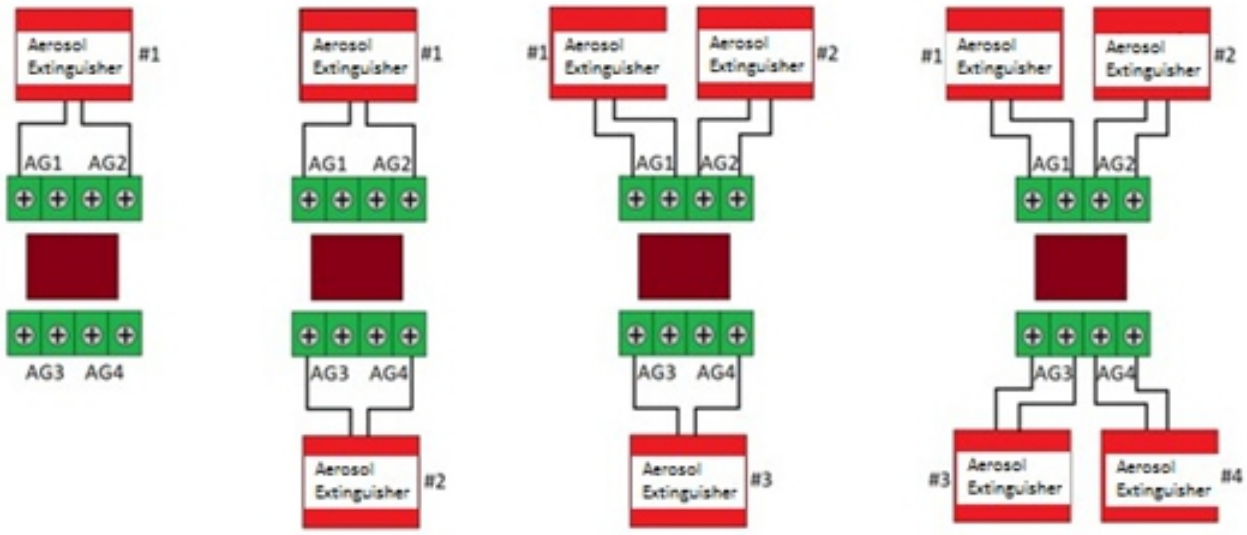
A large number of aerosol extinguishing units (maximum 128 pieces) can be triggered in groups and sequentially via an extinguishing output by placing the DIP-switches in the appropriate positions and assigning sequential sequence numbers to the sequencers connected on the extinguishing line.

A maximum of 32 sequence (between 0 and 31) numbers (delay time) can be specified with the DIP switch set on the sequencing device. Since the sequencing devices are connected to the extinguishing output, it is generally necessary to connect an end-of-line element (a diode and/or resistor depending on the brand and model of the fire extinguishing panel) to the output of the last sequencer on the line to control the continuity of the extinguishing output.

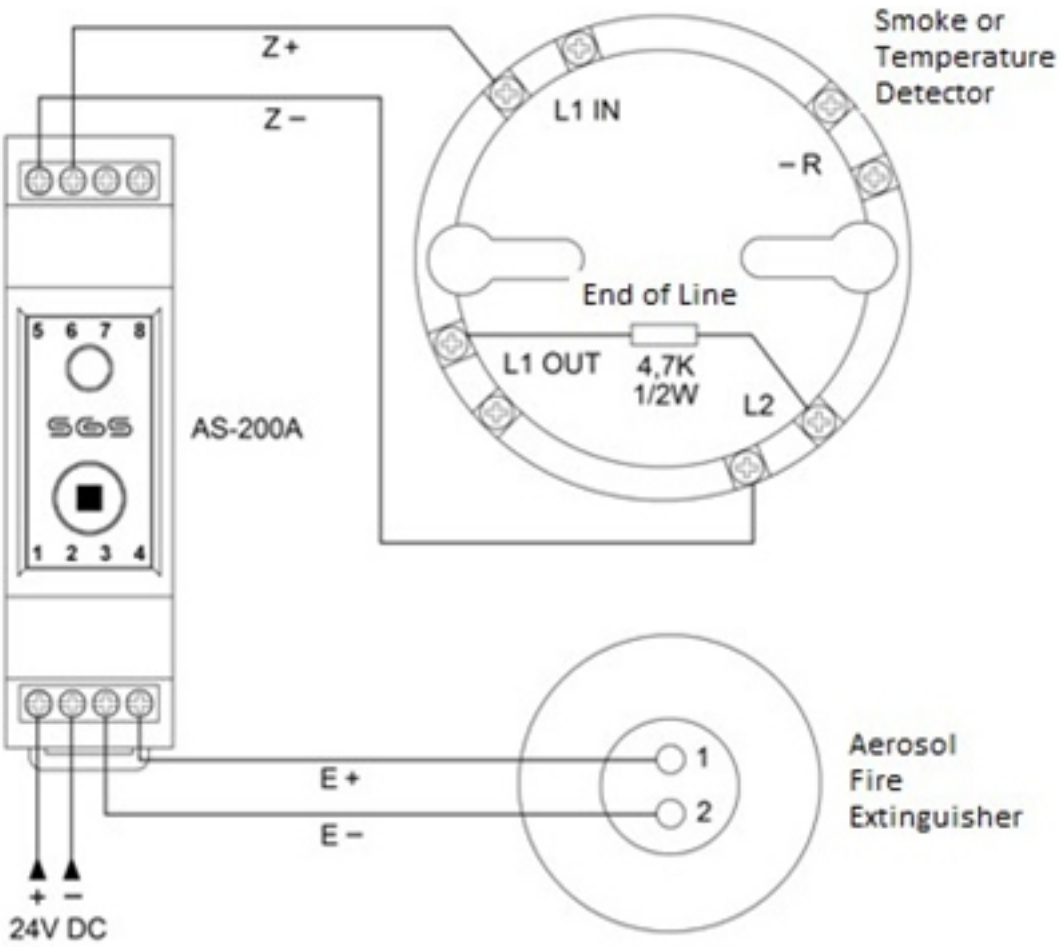
Electrical Specifications

Supply voltage : 9 – 35V DC
Quiescent current : 5 mA
Aerosol triggering current: 1.2 A
Triggering time : 0.9 – 1.0 sec
Short circuit protection : Electronic current limitation

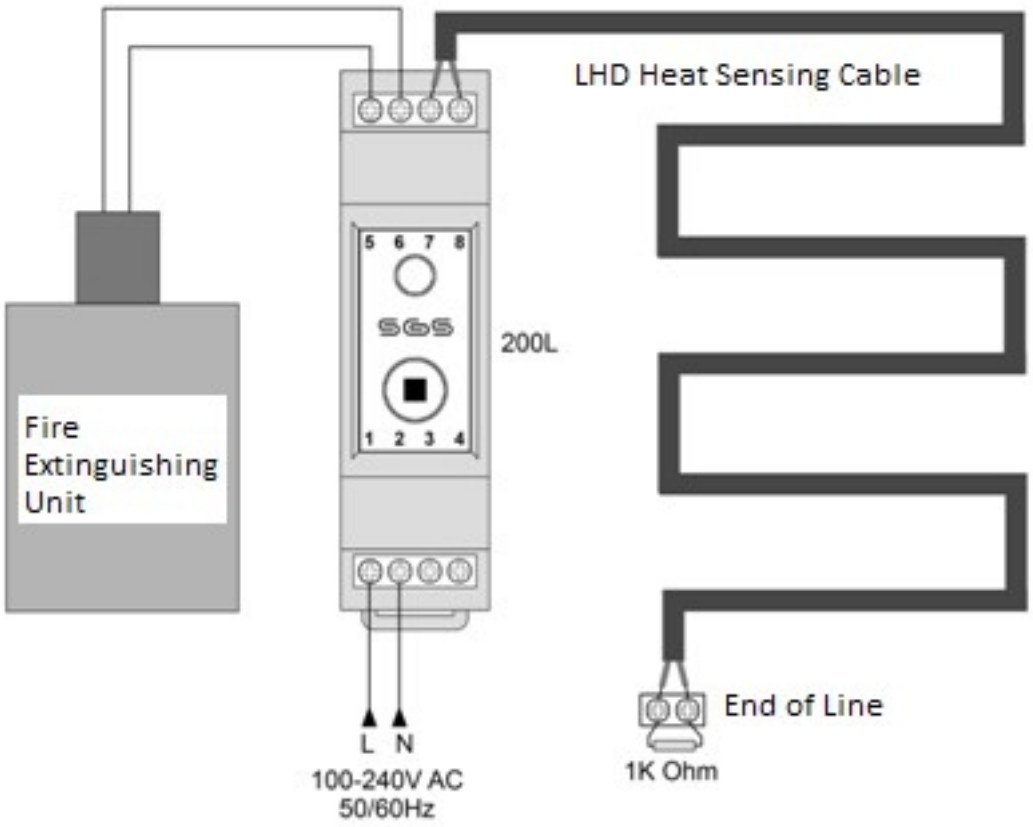
When connecting the extinguishing line input (IN) and output (OUT) terminals of the activation sequencer, it is not necessary to observe polarity (+ and - direction of the terminals). The polarity of the IN and OUT connections is not important for the device. The activation sequencer has 4 aerosol extinguisher connection outputs (AG1, AG2, AG3 and AG4). How to make 1 to 4 aerosol extinguisher connections is shown below.



Aerosol Extinguishing Unit Connection to 200A Micro Fire Control Panel



Aerosol Extinguishing Unit Connection to 200L Micro Fire Control Panel



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