

# FireNET Xtinguish

## Condensed Aerosol Fire Extinguishing System Installation and Operation Manual



Hochiki America Corporation  
7051 Village Drive, Suite 100  
Buena Park, CA 90621-2268  
714.522.2246 Corporate Headquarters  
800.845.6692 Technical Support  
<http://www.hochiki.com>

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***Read this installation and operation manual carefully before  
installing the condensed aerosol generators!!***

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# 1 Introduction

This manual is written for those who are installing a condensed aerosol fire extinguishing system for total flooding applications.

**Hochiki America Corporation** assumes no responsibility for the application of any system other than those addressed in this manual.

The technical data contained in this manual is strictly limited for information only. **Hochiki America Corporation** believes this data to be accurate, but it is published and presented without any warranty or guarantee whatsoever. Hochiki America Corporation disclaims any liability for any use that may be made of the data and information contained herein by any and all other parties.

Any questions concerning the information presented in this manual should be addressed to:

**Hochiki America Corporation**

7051 Village Drive Suite 100  
Buena Park, CA 90621  
United States of America

Phone: 1-(714)-522-2246, Fax: 1-(714)-522-2268

E-mail: [technicalsupport@hochiki.com](mailto:technicalsupport@hochiki.com)

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

The FireNET Xtinguish and HCVR-3 systems must be installed, serviced and maintained only by Hochiki America factory-trained and authorized technicians.

## 2 Administration

### 2.1 Scope

This manual is a comprehensive guide that contains all the necessary information to design, install, operate and maintain a condensed aerosol fire extinguishing system for total flooding applications.

This manual does not address information related to fire detection.

### 2.2 Purpose

This manual is prepared and intended for use by those charged with purchasing, designing, installing, operating, and maintaining condensed aerosol fire extinguishing systems. This manual provides basic guidance designed to supplement factory-certified training, with the goal that the system will function as intended for its lifetime. Authorized Hochiki training is necessary and required to design, install, operate and maintain the FireNET Xtinguish system! Do not attempt to install or service this system if you have not been provided with authorized training!

The requirements of this manual are considered necessary to provide a sufficient level of protection from loss of life and property from fire. The manual reflects the state of the art at the time it was issued.

### 2.3 Trademark and Patent

**FireNET Xtinguish** condensed aerosol fire extinguishing systems for total flooding applications is a registered trade mark of **Hochiki America Corporation**

**FireNET Xtinguish** condensed aerosol fire extinguishing systems for total flooding applications is a proprietary patent of:

**Celanova Limited,**  
Cyprus Registered Company, Certificate of Incorporation no. HE 142136  
6, Koumandarias & Spyrou Araouzou Str.  
Tonia Court II, 6<sup>th</sup> Floor,  
3036 Limassol  
Cyprus

P.O.Box 54080 Limassol-3720, CYPRUS  
Phone: +357 25 379999, Fax: +357 25 354432

### 2.4 Units and Formulas

Metric units of measurement in this manual are in accordance with the modernized metric system known as the International System of Units (SI). See IEEE/ASTM SI 10, Standard for Use of the International System of Units (SI): The Modern Metric System.

The values in this manual are given in SI. If followed by an equivalent value in other units, the first stated in SI is to be considered as the requirement; the equivalent value in other units could be approximate.

### 2.5 Referenced Publications

Referenced Publications as per NFPA 2010 shall apply to this manual. See Appendix "E"

### 2.6 Definitions

Definitions as per NFPA 2010 shall apply to this manual. See Appendix "F"

### 3 Environmental Summary

#### 3.1 Significant New Alternatives Policy (SNAP List)

Submission to the U.S. Environmental Protection Agency's (EPA) SNAP Program. The SNAP Program was originally outlined in 59 FR 13044.



Significant New Alternative Policy

SNAP List Listed

Protection of Stratospheric Ozone: Listing of Substitutes for  
Ozone-Depleting Substances--Fire Suppression and Explosion  
Protection

Direct Final Rule – Acceptable Substitute:

Powdered Aerosol E

The official EPA document, issued by the Federal Register, is available at Vol. 71, No. 187/ Wednesday, September 27, 2006/ Rules and Regulations.

Under paragraph II, Listing Decisions: Fire Suppression and Explosion Protection – Total Flooding, at pages 56363/56364.

C. Powdered Aerosol E – Acceptable subject to use conditions.



### 3.2 Condensed Aerosol Environmental Parameters

Environmental parameters	FireNET Xtinguish
<p style="text-align: center;"><b>ODP</b> (Ozone Depletion Potential)</p>	Zero
<p style="text-align: center;"><b>GWP</b> (Global Warming Potential)</p>	Zero
<p style="text-align: center;"><b>ALT</b> (Atmospheric Life Time)</p>	Negligible
Toxicity for human life	Very low within the parameters for use
Electrical conductivity	Nil up to 75KV
Corrosion	Negligible within the parameters for use
Extinguishing efficacy	High
Oxygen depletion after agent discharge	Negligible within the parameters for use

## 4 Safety Summary

*For Material Safety Data Sheet refer to Appendix A*

### 4.1 General

The discharge of an aerosol extinguishing system could potentially create a hazard to personnel due to the nature of the aerosol. Unnecessary exposure of personnel to the agent, the by-products generated by the fire, and the fire itself should be avoided.

#### 4.1.1 Health Effects

The potential adverse health effects are minimal as:

- Hazard for humans related to the SBK (solid aerosol forming compound) has not been found.
- Hazard to humans related to the aerosol released by the reaction of the solid compound (SBK) have not been established because the TLV's are not applicable. However, it is reputed that hazards to humans are not present when the aerosol is applied as guided by this manual.
- Signs and symptoms related to the aerosol phase are only referred to for acute exposure and /or chronic overexposure. In a real life situation the exposure to the generated aerosol will only occur accidentally and the exposure time will be very short, as in the event of an accidental or unexpected discharge when an occupant of the protected space has not evacuated previously. The aerosol extinguishing system shall be installed in normally unoccupied spaces and /or in spaces where personnel may be present utilizing suitable safeguards.

### 4.2 Hazards to Personnel

#### 4.2.1 Potential Hazards

Potential hazards to be considered for individual systems in the protected space and other areas where the aerosol agent can migrate are the following:

- **Noise:**  
The discharge of a system or aerosol generator may cause noise loud enough to be startling but insufficient to cause traumatic injury.
- **Turbulence:**  
The high-velocity discharge from generator outlets may cause enough turbulence inside the protected enclosure to move unsecured paper and light objects.
- **Reduced Visibility**  
When activated, the condensed aerosol generators reduce visibility both during and after the discharge period.
- **Thermal hazard:**  
The condensed aerosol discharges at elevated temperatures. Depending on the intended application(s) of the aerosol system, the temperature and minimum clearance from the discharge outlet are specified by the generators' data sheets. Immediately after discharge, the aerosol generators can be hot; protective gloves should be worn by personnel handling generators after discharge.
- **Eye irritation:**  
Direct contact with the aerosol solid particles being discharged by the system can result in irritation of the eyes. Exposure of the condensed aerosol to the eyes should be avoided.

#### **4.2.2 Pre-Discharge Alarms and Time Delay**

Human exposure to the condensed aerosol agents shall be prevented by providing a warning of a pending discharge, and a delay prior to the discharge, to allow personnel to exit the protected space. Suitable exits shall be provided to assure safe egress of personnel, in case of failure of the pre-discharge alarm and/or the time delay.

#### **4.2.3 Egress**

Suitable egress shall be provided to allow the personnel to exit the protected space within the time delay. The effect of reduced visibility on egress time shall be considered.

#### **4.2.4 Reduced Visibility**

The discharged condensed aerosol will cause occupants to evacuate the protected space under conditions of low visibility. Appropriate safety measures shall be used so that occupants can evacuate safely. The safety measures shall include, but are not limited to:

- personnel training,
- goggles,
- audio devices,
- floor mounted directional lighting,
- evacuation plans and exit drills.

#### **4.2.5 Toxicity**

See the Material Safety Data Sheet contained in Appendix A and the information in section 3.2 of this manual.

#### **4.2.6 Thermal Hazards**

Condensed aerosol generators shall not be employed at less than the minimum safe distance from personnel and combustible materials. See the aerosol generator datasheets for minimum safe distance information.

Protective gloves shall be worn by personnel removing discharged aerosol generators.

## 5 Condensed Aerosol Fire Extinguishing Action

Traditionally, there were three distinct elements assumed as necessary for combustion: heat, fuel, and oxygen, popularly known as 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 theory had to be modified as halons became more widely used and better understood.

The halons, as well as other agents like the condensed aerosol, do not extinguish fire in any of these ways, but instead break up the uninhibited chain reaction of the combustion process. This extinguishing mechanism is not completely understood, yet 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 SBK (patented solid compound contained in the 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,  $K_2CO_3$ ,  $H_2O$ ,  $N_2$ ,  $CO_2$ , 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 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.

Potassium is an alkaline metal and 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 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”.

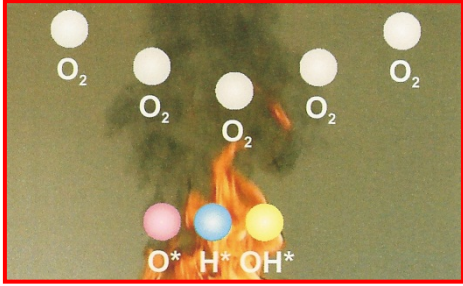
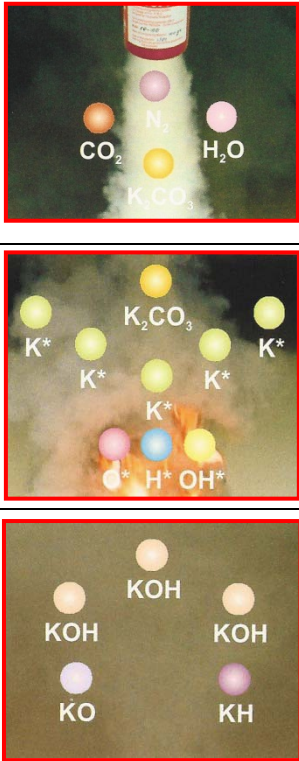
Since the radicals are unstable, they tend to reach a final stable condition. The stable final products, among others, are carbon dioxide ( $CO_2$ ) and water ( $H_2O$ ).

The potassium atoms derived by the disassociation of the potassium compounds contained in the 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 following page.

## 5.1 Condensed Aerosol Fire Extinguishing Reaction Sequence

<p>Oxidation of hydrogen in the flames:</p> $\text{H}_2 + \text{O}_2 \rightarrow 2 \text{OH}^\cdot$ $\text{OH}^\cdot + \text{H}_2 \rightarrow \text{H}_2\text{O} + \text{H}^\cdot$ $\text{H}^\cdot + \text{O}_2 \rightarrow \text{OH}^\cdot + \text{H}^\cdot$ $\text{O}^\cdot + \text{H}_2 \rightarrow \text{OH}^\cdot + \text{H}^\cdot$	
<p>Oxidation of carbon monoxide in the flame:</p> $\text{H}_2 + \text{O}_2 \rightarrow 2 \text{OH}^\cdot$ $\text{OH}^\cdot + \text{CO}^{+\cdot} \rightarrow \text{CO}_2 + \text{H}^\cdot$ $\text{H}^\cdot + \text{O}_2 \rightarrow \text{OH}^\cdot + \text{O}^\cdot$	<p>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).</p>
<p>The chain reaction is interrupted by the Potassium atoms, which react with the unstable hydroxyl as follows:</p> $\text{OH}^\cdot + \text{K}^+ \rightarrow \text{KOH} \text{ (and flames are thus extinguished)}$ <p>Notice that the potassium hydroxide (KOH) is formed in quantities smaller than micrograms.</p> <p>The KOH reacts further in the presence of <math>\text{CO}_2</math> and form <math>\text{K}_2\text{CO}_3</math>.</p> <p>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.</p>	
<p>Legend:</p>	
<p><math>\text{H}_2</math></p>	<p>hydrogen stable</p>
<p><math>\text{O}_2</math></p>	<p>oxygen stable</p>
<p><math>\text{OH}^\cdot</math></p>	<p>hydroxyl radicals unstable</p>
<p><math>\text{H}_2\text{O}</math></p>	<p>water stable</p>
<p><math>\text{H}^\cdot</math></p>	<p>hydrogen atoms unstable</p>
<p><math>\text{O}^\cdot</math></p>	<p>Oxygen atoms unstable</p>
<p><math>\text{CO}^{+\cdot}</math></p>	<p>carbon monoxide unstable</p>
<p><math>\text{CO}_2</math></p>	<p>carbon dioxide stable</p>

## 5.2 Particle Distribution in the Aerosol Phase

The condensed aerosol phase consists of a gas phase with micro sized solid particles in suspension.

Laser beam diffraction tests analyses have shown the correlation between solid and gaseous components of 52% solid and 48% gas.

The percentage distribution of the solid compounds as per their diameter's size expressed in microns is as follows

Particle's size (dia. $\mu\text{m}$ )	Percent %
< 1	52
1 ÷ 2	19
2 ÷ 5	17
> 5	12

## 6 Condensed Aerosol Fire Use and Limitations

### 6.1 Systems

The condensed aerosol systems shall be installed to protect hazards within the limitations that have been established by this installation manual.

### 6.2 Use and Application

Condensed aerosol extinguishing systems are effective in extinguishing Class A, B, and C fires.

Condensed aerosol extinguishing systems provide an efficient and effective means to extinguish gas and liquid fires, burning solid substances, burning substances derived from hydrocarbons (natural gas, oil products, flammable lubricants, etc.), as well as fires in electrical equipment with an operating voltage not exceeding 75,000 Volts.

Condensed aerosol extinguishing systems shall not be used to protect areas, hazards or spaces containing flammable liquids, vapors, or dusts that may form an explosive air/fuel mixture unless they have been tested to the satisfaction of the authority having jurisdiction and/or proven by experimental testing carried out by a third party laboratory.

Condensed aerosol extinguishing systems shall not be used on metal fires, on substances generating self-sustaining combustion, and on the following substances unless they have been tested to the satisfaction of the authority having jurisdiction and/or proven by experimental testing carried out by a third party laboratory.

- ▶ **Deep seated fires in Class A materials**
- ▶ **Class D fires:**
  - ▶ **D1 - light metals (aluminum - Al; magnesium - Mg Titanium ...)**
  - ▶ **D2 - alkali metals (potassium - K; sodium - Na; lithium - Li ...)**
  - ▶ **D3 - organic-metallic compounds (methyl magnesium chloride - CH<sub>3</sub>MgCl; methyl magnesium iodide - CH<sub>3</sub>MgI; triethyl aluminum - (C<sub>2</sub>H<sub>5</sub>)<sub>3</sub>Al...)**
  - ▶ **Metal hydrides (aluminum hydride - AlH<sub>3</sub>) lithium hydride - LiH ...)**
  - ▶ **Reactive metals such as, lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium.**
  - ▶ **Chemical compounds containing oxidizers such as sodium chlorate or sodium nitrate.**
  - ▶ **Certain chemicals or mixtures of chemicals, such as cellulose nitrate and gunpowder, that are capable of rapid oxidation in the absence of air**
  - ▶ **Chemicals capable of undergoing auto-thermal decomposition, such as certain organic peroxides and hydrazine**

The above list may be not exhaustive. Contact **Hochiki America Corporation** or your local **Hochiki America** dealer if additional information is required.

The condensed aerosol generators shall not be employed at less than the minimum safe distances specified in the present manual (see the aerosol generator datasheets for details).

The minimum safe distance between the condensed aerosol generator discharge ports and personnel shall be based on an aerosol agent discharge temperature, at that distance, not exceeding 75°C (167° F). See Appendix C for generator datasheets and minimum safe distance information.

The minimum safe distance between the condensed aerosol generator discharge ports and combustible materials shall be based on an aerosol agent discharge temperature, at that distance, not exceeding 200°C (392° F). See Appendix C.

The total flooding condensed aerosol extinguishing system shall be installed in enclosures protecting the hazards that allows the specific agent design application density to be achieved and maintained for the specified period of time.

Where the condensed aerosol extinguishing agents are used in spaces containing sensitive equipment, the potential adverse effects of condensed aerosol particulate residue shall be considered.

### **6.3 Environmental Factors**

Despite that condensed aerosol extinguishing systems do not represent any significant environmental concern the unnecessary emission of aerosol extinguishing systems shall be avoided. All phases of design, installation, testing, and maintenance of condensed aerosol extinguishing systems shall be performed with the goal of no emission to the environment.

### **6.4 Compatibility with Other Agents**

Unless specifically approved, systems employing the simultaneous discharge of different agents to protect the same enclosed space shall not be permitted. Where unrelated extinguishing or suppression systems are provided, and can operate prior to, or during the hold time of the condensed aerosol extinguishing systems, the other agent shall not adversely affect the aerosol.



## 7 Condensed Aerosol Generator Description

### 7.1 General Description of the Aerosol Generator Units

The range of condensed aerosol generators is shown in the appendix "B".

The condensed aerosol generator is formed by the following main components:

#### 7.1.1 The Solid Aerosol-Forming Compound, SBK:

The solid aerosol-forming compound SBK is the originator of the condensed extinguishing aerosol (generated by the SBK activation):

Upon actuation, the solid aerosol-forming compound will undergo a combustion reaction generating the fire extinguishing condensed aerosol.

Condensed Aerosol composition			
Compound	Chemical Formula	CAS #	% by Weight
Gas			
Carbon Dioxide	CO <sub>2</sub>	124-38-9	13%-14%
Nitrogen	N <sub>2</sub>	7727-37-9	21%-22%
Water Vapor	H <sub>2</sub> O	7732-18-5	10%-12%
Carbon Monoxide	CO		1%-2%
Methane	CH <sub>4</sub>		
Hydrogen	H <sub>2</sub>		
Particulate			
Potassium Carbonate	K <sub>2</sub> CO <sub>3</sub>	584-08-7	47%-49%
Potassium Nitrate	KNO <sub>3</sub>	7757-79-1	2%-3%
Potassium Chloride	KCl	7447-40-7	> 1%
Other elements	See KEMA report	---	> 1%

#### 7.1.2 The Ignition Device (Initiator):

Condensed aerosol generators are initiated by applying the appropriate voltage across the electric wire terminals of the aerosol generator so that the solid aerosol forming compound will be activated and transformed into the condensed aerosol (the extinguishing agent).

#### 7.1.3 The Cooling Mechanism:

Condensed aerosol generators are equipped with a physical heat-absorbing mechanism (the cooling mechanism). The generated aerosol will exit the generator via the cooling mechanism, and the condensed aerosol will be cooled down before flooding the protected volume.

#### **7.1.4 The Housing (External Steel Casing):**

The condensed aerosol generator casing is formed by a non-pressurized container. The aerosol is generated by a reaction (combustion process) of the solid aerosol-forming compound SBK, and the condensed aerosol is then carried by gases generated by this reaction.

#### **7.1.5 The Mounting Brackets:**

Mounting brackets are provided for each condensed aerosol generator, allowing the generator appropriate orientation. The mounting brackets are constructed by galvanized carbon steel plate of suitable shape and strength to hold the condensed aerosol generators.

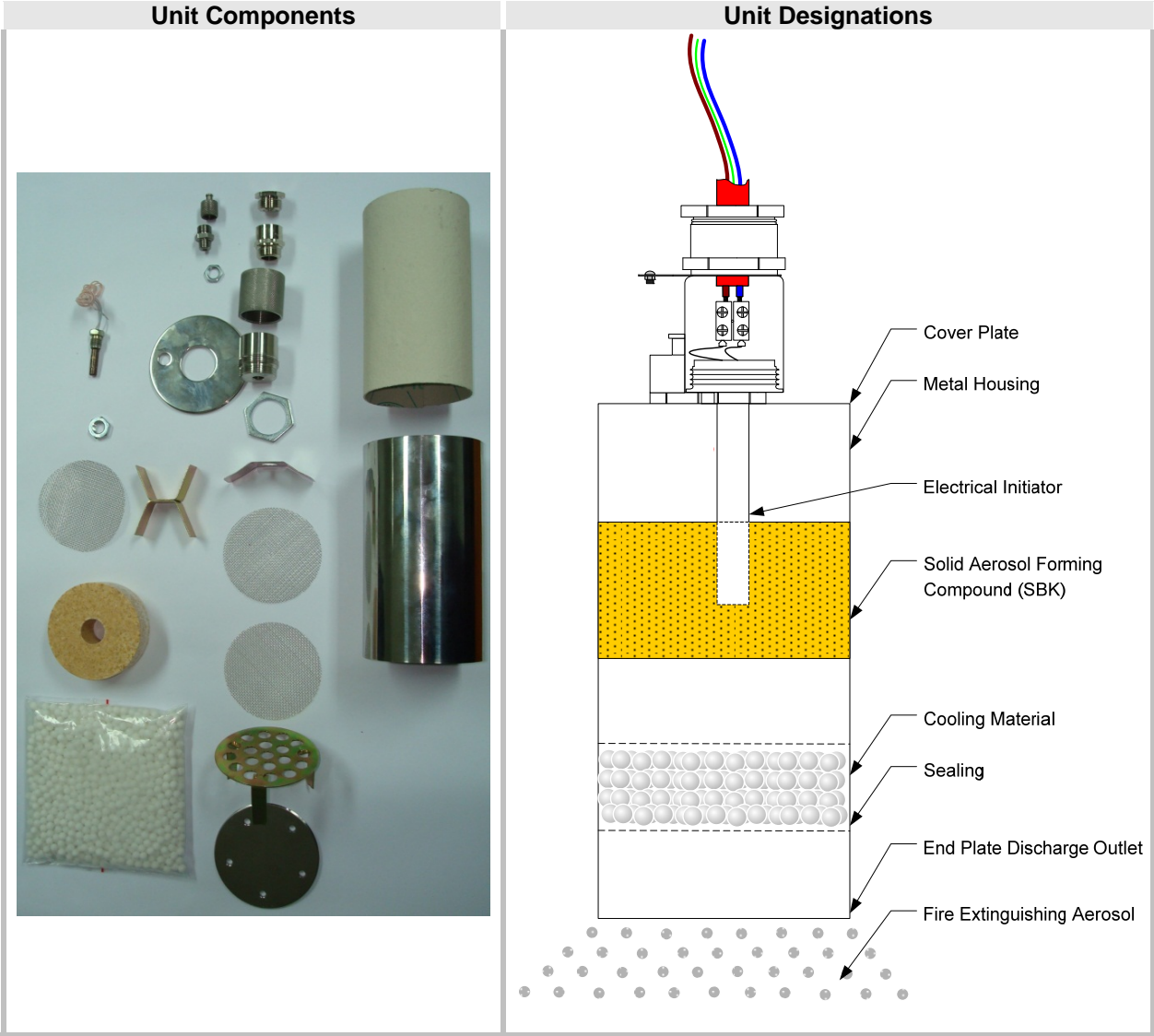
#### **7.1.6 The End Plate Discharge Outlets:**

The end plate discharge outlet holes ensure a smooth and fast discharge of the aerosol.

#### **7.1.7 The Seal**

A special membrane of adhesive polymer sheet is applied internally at the discharge outlets, protecting against the entry of moisture, dirt, or anything undesirable. The membrane will be broken by the generated aerosol when the unit is activated.

## 7.2 Aerosol Generator Components



### Initiator (electrical activator)

The initiator is connected to the activation power circuit (minimum current required 0.8 A for 3 - 4 seconds) by heat resistant wires. The activation power will heat up the electric coil (4) thus the (5) solid aerosol forming compound (SBK) will initiate an exothermal reaction. The heat developed will transfer through the cylinder (7) outlets starting the exothermal reaction of the (9) SBK, thus the thermal energy will be sufficient to start the reaction of the whole mass of SBK contained inside the aerosol generator, transforming the SBK into a particulate aerosol and carrier gases.

Initiator cut-off view		Legend	
	1	heat resistant wires (feed)	
	2	steel housing	
	3	polymeric resin	
	4	electric coil	
	5	SBK (solid bound compound)	
	6	chemical stabilizer	
	7	cylinder with 2 outlets	
	8	sealing	
	9	SBK (solid bound compound)	
	10	leagured surface	
<b>Electrical values</b>			
<b>Bridge Resistance</b>			1.6-3.0 Ohms( $\Omega$ )
<b>Ignition Pulse</b>			From 1- 2 mWs/ $\Omega$
<b>No Fire Value</b>			$\leq 20$ mA t = 300s
<b>Direct Current (DCV)</b>			6-36V / 0.8 A
<b>Ignition Time</b>			3 - 4 sec.
<b>Working Temperature (not to exceed)</b>			
<b>Deployment Temperature</b>			-54° C to 100° C
<b>Storage Temperature</b>			-54° C to 54° C
<b>The initiator is a standard component of all the aerosol generators</b>			

## 8 Total Flooding Systems Design

### 8.1 Working Documents

The design of a condensed aerosol total flooding fire extinguishing system shall be prepared only by a person qualified and experienced in designing extinguishing systems, in accordance with the advice of the authority having jurisdiction.

Deviation from the working documents shall require the permission and agreement of the authority having jurisdiction.

The working documents shall include, as a minimum requirement, the following:

#### 8.1.1 Specifications

- ▶ Designation of the authority having jurisdiction,
- ▶ Variances from the standard to be permitted by the authority having jurisdiction,
- ▶ Design criteria,
- ▶ System sequence of operation,
- ▶ Functional testing to be performed after installation of the system,
- ▶ System owner/user training requirements.

#### 8.1.2 Working Plans

- ▶ Point of compass and symbol legend.
- ▶ Name of owner and identification of the occupant/user;
- ▶ Location of building, including address;
- ▶ Location and construction characteristics of protected enclosure walls and partitions; location of fire walls.
- ▶ Enclosure cross-section, full height or schematic diagram, including raised access floor and suspended ceiling;
- ▶ Description of occupancies and hazards to be protected; identification of enclosures normally occupied
- ▶ Description of enclosures/facilities/exposures surrounding the enclosure.
- ▶ Plan view of protected area showing enclosure partitions (full and partial height); detection, alarm, and control system including all devices and schematic of wiring interconnection; end-of-line device locations; location of controlled devices such as dampers and shutters; location of instructional signage.
- ▶ Type of condensed aerosol generators used; including nominal capacity expressed as agent solid compound mass.
- ▶ Condensed aerosol design application density.
- ▶ Drawings indicating the location and distribution of condensed aerosol generators.
- ▶ Equipment list of materials showing device identification, model or part number, quantity and description;
- ▶ Description of fire detection, actuation and control systems
- ▶ Enclosure pressurization report and venting calculations where applicable;
- ▶ Description of wire or cable used including classification, gauge [American Wire Gauge (AWG)], shielding, number of strands in conductor, conductor material, and color coding schedule, with the segregation requirements of various system conductors clearly indicated and the required method of making wire terminations detailed.
- ▶ Description of the detector mounting.
- ▶ Scale drawing showing the layout of the annunciator panel graphics if required by the authority having jurisdiction.

- ▶ Complete step-by-step description of the system sequence of operations including functioning of abort and maintenance disconnect switches, delay timers, and emergency power shutdown.
- ▶ Point-to-point wiring schematic diagrams showing all circuit connections to the system control panel, to the graphic annunciator panel and to external or add-on relays.
- ▶ Complete calculations to determine the size of backup batteries and method used to determine number and location of audible and visual indicating devices and number and location of detectors.
- ▶ Minimum clearances to combustible materials and the means of egress.
- ▶ Details of any special features.

Information shall be submitted for approval to the authority having jurisdiction pertaining to the location and function of:

- ▶ Detection devices,
- ▶ Operating devices,
- ▶ Auxiliary equipment,
- ▶ Electrical circuitry, if used.

All the apparatus and devices used shall be identified.

Any special features shall be explained.

The as-built installation drawings and the instruction and maintenance manual that includes a full sequence of operations.

A full set of drawings and calculations shall be maintained on site.

### **8.1.3 Approval of Plans**

Plans and calculations shall be approved prior to installation.

Where field conditions necessitate any change from approved plans, the change shall be approved prior to implementation.

When such changes from approved plans are made, the working plans shall be updated to accurately represent the system as installed.

## **8.2 Enclosure**

In the design of a condensed aerosol total flooding fire extinguishing system, the integrity of the protected enclosure shall be considered.

The area of non-closable openings in the protected enclosure shall be kept to a minimum.

### **8.2.1 Loss of Agent**

To prevent loss of agent through openings to adjacent hazards or work areas, openings shall be permanently sealed or equipped with automatic closures.

Where reasonable confinement of agent is not practicable, protection shall be expanded to include the adjacent connected hazards or work areas or additional agent shall be introduced into the protected enclosure using an extended discharge configuration.

Forced-air ventilating systems shall be shut down or closed automatically where their continued operation would adversely affect the performance of the fire extinguishing system or result in propagation of the fire.

Completely self-contained recirculation ventilation systems shall not be required to be shut down.

The volume of the ventilation system and associated ductwork shall be considered as part of the total hazard volume when determining the quantity of agent.

The protected enclosure shall have the structural strength and integrity necessary to contain the agent discharge.

If the developed pressures present a threat to the structural strength of the enclosure, venting shall be provided to prevent excessive pressures.

### 8.3 Condensed Aerosol System Agent Supply

#### 8.3.1 Quantity

- ▶ **Primary condensed aerosol Agent Supply.**  
The primary condensed aerosol agent supply shall be determined by calculating the required mass of the solid aerosol forming compound needed to meet the design application density.
- ▶ **Reserve condensed aerosol Agent Supply.**  
Where required, a reserve condensed aerosol agent supply shall consist of as many multiples of the primary agent supply as the authority having jurisdiction considers necessary.

### 8.4 Design Application Density

#### 8.4.1 Determining Design Application Density

The condensed aerosol extinguishing application density shall be used in determining the minimum design application density for a particular fuel. For combinations of fuels, the extinguishment value for the fuel requiring the greatest condensed aerosol design application density shall be used, unless specific tests are made on the actual mixture.

#### 8.4.2 Fuel Types:

- ▶ **Class B Fuels:**  
The **extinguishing application density** of condensed aerosol for **Class B fuels** has been determined by test as per UL 2775.  
The **minimum design application density for a Class B fuel hazard** is the extinguishing application density multiplied by a safety factor of 1.3.
- ▶ **Class A Fuels:**  
The **extinguishing application density** of condensed aerosol for **Class A fuels** has been determined by test as per UL 2775.  
The **minimum design application density for a Class A Fuels** fire hazard is the extinguishing application density multiplied by a safety factor of 1.3.
- ▶ **Class C Fuel:**  
The **minimum design application density** of condensed aerosol for **Class C hazards** shall be at least that for the Class of fire hazard being protected ""
- ▶ **Fuel combination:**  
For combinations of Class A and B fuels the design application density shall be the value for the fuel requiring the greatest design application density.

<b>Table 8.4.1</b>		
<b>Class of Fire</b>	<b>Extinguishing application density</b>	<b>Minimum design application density</b>
<b>Class B Fuels:</b>	84 g/m <sup>3</sup>	109.20 g/m <sup>3</sup>
<b>Class A Fuels:</b>	84 g/m <sup>3</sup>	109.20 g/m <sup>3</sup>
<b>Class C Fuel:</b>	.....	.....
<b>Fuel combination:</b>	.....	.....



## 8.5 Total Flooding Quantity

### 8.5.1 Quantity Calculation

The mass of condensed aerosol forming compound required shall be calculated from the following formula:

$$m = d_a \times f_a \times V$$

where

- ▶  $m$  = total flooding quantity, in [g(lb)]
- ▶  $d_a$  = design application density, in [g/m<sup>3</sup> (lb/ft<sup>3</sup>)]
- ▶  $f_a$  = additional design factors (see 8.5.2)
- ▶  $V$  = protected volume, [m<sup>3</sup> (ft<sup>3</sup>)]

### 8.5.2 Additional Design Factors

In addition to the condensed aerosol agent quantity determined by the design application density, additional quantities of agent are required through the use of additional design factors to compensate for any special conditions that would affect the extinguishing efficiency.

The designer shall assign and document other design factors for each of the following:

1. Non-closable openings and their effects on design application density
2. Height of protected volume (As per maximum height related to each generator)
3. Re-ignition from heated surfaces
4. Fuel type, configurations, scenarios not fully accounted for in the extinguishing application density, enclosure geometry, and obstructions and their effects on distribution.

### 8.5.3 Duration of Protection

The condensed aerosol agent design application density shall be maintained for the specified period of time to prevent re-ignition of the fire before effective emergency action can be taken by trained personnel.

### 8.5.4 Discharge Time

For the condensed aerosol generator discharge time see the generator Data Sheets.

### 8.5.5 Extended Discharge

When an extended discharge is necessary to maintain the design application density for the specified period of time, additional condensed aerosol agent quantities shall be applied.

When an extended discharge is necessary, the rate shall be sufficient to maintain the desired factor for the required hold time. In such applications the condensed aerosol generators may be activated in sequence.

### 8.5.6 Safety Vents

When condensed aerosol is discharged into a closed volume, a certain overpressure may be developed due to the amount of gases generated and the effects of increased temperature of the atmosphere.

Later, the combined volume of aerosol and air will become greater than the initial room volume; the final result will increase the pressure or will exhaust the excess volume through vent openings. The

air temperature is increased during the discharge but will return to normal levels as heat is adsorbed by solid surfaces in the room.

The designer/installer shall provide reliable calculations for venting requirements for each system if applicable, since experience has shown that most ordinary rooms have a sufficient leakage through cracks around doors and windows, and a general porosity that will prevent noticeable pressure build up.

In rooms that may be sealed or close to being sealed, a safe vent area for low-strength structures can be estimated on the basis of the discharge flow rate.

### **8.5.7 Generator Choice and Location**

The condensed aerosol generators shall be suitable for the intended purpose and shall be placed within the protected enclosure in compliance with the instruction and limitations contained in this manual with regard to spacing, floor coverage, thermal clearances and alignment.

The type of condensed aerosol generators selected, their number, and their placement shall be such that the design application density will be established in all parts of the hazard enclosure.

## 9 Condensed Aerosol Fire Extinguishing System Arrangement

The condensed aerosol generators and ancillary system components shall be arranged to allow easy inspection and maintenance activities, minimizing the interruption of protection.

Condensed aerosol generators shall not be located where they can be mechanically damaged, exposed to chemicals, or to adverse weather conditions which may render them inoperative. Suitable protective provisions shall be adopted, if necessary.

Condensed aerosol generators shall be securely installed following the guidance given by this manual.

### 9.1 Minimum Safe Distances

Minimum safe distances:

- ▶ Condensed aerosol generators shall not be installed at less than the minimum safe distances as specified in the condensed aerosol generator data sheets. The generator datasheets are in Appendix C of this manual.
- ▶ The minimum safe distance between the condensed aerosol generator casing and personnel shall be the distance from the generator casing to where the temperature does not exceed 75°C (167°F) during and after discharge.
- ▶ The minimum safe distance between the condensed aerosol generator casing and combustible materials shall be the distance from the generator casing to where the temperature does not exceed 200°C (392°F) during and after discharge.

### 9.2 Safety Requirements

Personnel shall not enter a protected space during or after the agent discharge.

Safeguards shall be provided to ensure prompt evacuation of personnel prior to system discharge, and to prevent entry or re-entry into the protected enclosure after system discharge.

There shall be provided a means for prompt rescue of any trapped personnel, including the following:

- a. Provision for adequate egress pathways, and procedures to keep them clear at all times
- b. Provision for emergency lighting and directional signs if necessary to ensure quick, safe evacuation.
- c. Provision for alarms in such areas that will operate immediately on detection of the fire.
- d. Provision for only outward-swinging, self-closing doors at exits from hazardous areas and, where such doors are latched, panic hardware shall be installed.
- e. Provision for continuous alarms at entrances to such areas until the atmosphere has been restored to normal.
- f. Provision for warning and instruction signs at entrances to and inside such areas. These signs should inform persons in or entering the protected area that an aerosol system is installed and shall contain additional instructions pertinent to the conditions of the hazard.
- g. Provision for the prompt discovery and rescue of persons rendered unconscious in such areas. This should be accomplished by having such areas searched immediately by trained personnel equipped with proper breathing equipment. Self-contained breathing equipment and personnel trained in its use and in rescue practices, including cardiopulmonary resuscitation, should be readily available.
- h. Provision for instruction and drills for all personnel in or in the vicinity of such areas, including maintenance or construction people, to ensure their correct action when a condensed aerosol system operates.

- i. Provision for prompt ventilation of such areas, including forced ventilation if necessary. Use caution to avoid spreading condensed aerosol residue to other areas.
- j. Smoking should be prohibited until the atmosphere has been determined to be free from the condensed aerosol.
- k. Removal of condensed aerosol generators after discharge shall be done according to the instructions given in this manual. Protective clothing, gloves and goggles should be worn, including a respirator or mask if necessary.
- l. Any further provision or safeguards shall be adopted if a particular situation indicates it as necessary to prevent injury or death.
- m. Specific attention shall be given to the possibility that the condensed aerosol may potentially spread to adjacent areas outside of the protected space.

### 9.3 Electrical Clearances

All system components shall be located to maintain no less than minimum clearances from energized electrical parts as per:

- ANSI C2
- NFPA 70
- 29 *CFR* 1910, Subpart S
- Canadian Electrical Code, CSA C22.1

Where the design basic insulation level (BIL) is not available, and where nominal voltage is used for the design criteria, the highest minimum clearance listed for this group shall be used.

The selected clearance to ground shall satisfy the greater of the switching surge or BIL duty, rather than being based on nominal voltage.

The clearance between non insulated, energized parts of the electrical system equipment and any portion of the condensed aerosol extinguishing system shall not be less than the minimum clearance provided elsewhere for electrical system insulations on any individual component

### 9.4 Precautions While Handling the Generator Units

While handling the aerosol generators do not:

- ▶ Disassemble the condensed aerosol generators.
- ▶ Exert force of impact or carry out other actions to the condensed aerosol generators which may cause distortion and physical or other mechanical damage to the casing.
- ▶ Carry out any welding work in the vicinity of the condensed aerosol generators and/or condensed aerosol fire extinguishing system components.
- ▶ Smoke in the vicinity of the condensed aerosol generators and/or condensed aerosol fire extinguishing system components.
- ▶ Where a condensed aerosol generator, during handling or installation, is dropped or subjected to an impact, ensure that the electric circuit of the ignition and the other condensed aerosol generator components have not been damaged.
- ▶ Where a condensed aerosol generator shows external damages to the casing it shall not be installed.

## 9.5 Storage and Transport

The condensed aerosol generators are classified as Hazard Class or Division as 9.

The units shall be transported by ships and by airfreight in accordance with the regulations and requirements applicable to the above category of cargo.

Transport by road of the condensed aerosol generators is permitted utilizing all types of transport vehicles without any restrictions.

The containers carrying the condensed aerosol generators shall be firmly secured on the vehicle and be protected against dirt, moisture and shocks.

Do not drop aerosol generators or the containers carrying them during vehicles loading/unloading operations.

The aerosol generators shall be stored in their own packaging on racks in warehouses (either heated, or unheated with natural ventilation, at a distance of at least one meter from heating appliances).

The condensed aerosol generators comply with the requirements of the U.S. Department of Transportation (DOT) and the Canadian Transport Commission, and are classified IAW 49 CFR 172.101, Subpart B or the Canadian equivalent.

## 9.6 Storage Conditions

- ▶ Temperature : between –54 and +54°C
- ▶ Humidity : maximum 98% RH

## 9.7 Replacement / Removal from Service

Service life: 10 years (the year of manufacture appears on each generator)

## **10 Detection, Actuation, Alarm and Control Systems**

This manual does not address information related to fire detection; however the following general information shall be considered. Always apply national and local code requirements.

### **10.1 General**

Detection, actuation, alarm, and control systems shall be installed, tested, and maintained in accordance with NFPA 70, NFPA 72, NFPA 2010, and local requirements.

In Canada the equipment shall be certified to the requirements of CAN/ULC S524-01 and CAN/ULC-S 529-02.

Automatic detection and automatic actuation shall be used unless a manual-only actuation is approved by the authority having jurisdiction.

### **10.2 Raceways**

System initiating circuits and auxiliary equipment releasing circuits shall be installed in raceways. National and local requirements shall be observed.

### **10.3 Automatic Detection**

Automatic detection shall be a UL listed system capable of detecting and indicating heat, flame, smoke, combustible vapors, or an abnormal condition in the hazard that is likely to produce fire.

Automatic detection shall be UL listed and compatible with the control panel.

Reliable primary and secondary power sources shall be used, in compliance with national and local requirements, to provide for operation of the detection, signaling, control, and actuation of the system.

### **10.4 Operating Devices**

Operating devices shall include system actuation devices, discharge controls, and shutdown equipment.

All operating devices shall be UL listed and compatible with the control panel.

The system actuation shall cause simultaneous operation of condensed aerosol generators.

All devices/components shall be designed to be suitable for the specific intended service and working conditions. Devices shall not be susceptible to being rendered inoperative or to accidental operation.

All devices/components shall be installed in appropriate locations or adequately protected to avoid being subject to mechanical, chemical, or any other damages that would render them inoperative.

System manual actuation/release shall be accomplished by an electrical manual release; the arrangement shall include the control equipment monitoring the battery condition, including a low battery signal/alarm.

System manual control(s) for actuation shall be located for easy accessibility at all times, including at the time of a fire.

The system manual control(s) shall be of distinct appearance and clearly recognizable for the purpose intended.

Operation of any control station shall cause the complete system to operate.

Manual controls shall not require a pull of more than 178 N (40 lb) nor a movement of more than 356 mm (14 in.) to secure operation.

At least one system manual control station for activation shall be located not more than 1.2 m (4 ft) above the floor.

All devices for shutting down auxiliary/supplementary equipment shall be considered integral parts of the system and shall function with the system operation.

All the manual operating devices shall be identified as to the hazard they protect.

## 10.5 Fire Alarm Control Panel

The fire alarm control panel shall supervise the actuating devices and associated wiring and, as required, cause the system actuation.

The fire alarm control panel shall be UL listed, and shall be listed as compatible with the extinguishing system units. ***The UL-listed HCVR-3 fire alarm control panel is the only fire alarm control panel that may be used with FireNET Xtinguish products.*** See Section 12.

Refer to the Control Panel Manual for compatibility information.

## 10.6 Operating Alarms and Indicators

Alarms or indicators or both shall be used to indicate the operation of the system, hazards to personnel, or failure of any supervised device.

All alarm or indicator devices shall be UL listed and compatible with the control panel.

The type (audible, visual), number, and location of the devices shall be such that their purpose is satisfactorily accomplished.

The extent and type of alarms or indicator equipment or both shall be approved.

## 10.7 Warning Devices

Audible and visual pre-discharge alarms shall be provided within the protected area to give positive warning of the impending discharge.

The operation of the warning devices shall continue after condensed aerosol discharge, until positive action has been taken to acknowledge the alarm and proceed with appropriate action.

## **10.8 Abort Switches**

Where provided, the system abort switches shall be located within the protected area and shall be located near the means of egress for the area.

All abort switches shall be UL listed and compatible with the control panel.

A telephone should be located near the abort switch.

An abort switch shall not be operated unless the cause for the condition is known and corrective action can be taken.

The abort switch shall be of a type that requires constant manual pressure to cause abort.

The abort switch shall not be of a type that would allow the system to be left in an aborted mode without personnel present. In all cases the manual emergency control shall override the abort function.

Operation of the abort function shall result in both audible and distinct visual indication of system impairment.

The abort switch shall be clearly recognizable.

## **10.9 Alarms Indicating Failure of Supervised Devices and Equipment**

Alarms indicating failure of supervised devices or equipment shall give prompt and positive indication of any failure and shall be distinctive from alarms indicating operation or hazardous conditions.

## **10.10 Warning and Instruction Signs**

Warning and instruction signs at entrances to and inside protected areas shall be provided.

## **10.11 Pre-Discharge Alarms and Time Delays**

For the aerosol extinguishing system, a pre-discharge alarm and time delay, sufficient to allow personnel evacuation prior to discharge, shall be provided.

For hazard areas subject to fast growth fires, where the provision of a time delay would seriously increase the threat to life and property, a time delay shall be permitted to be eliminated.

Time delays shall be used only for personnel evacuation or to prepare the hazard area for discharge.

Time delays shall not be used as a means of confirming operation of a detection device before automatic actuation occurs.

## **10.12 Unwanted System Operation**

Care shall be taken to thoroughly evaluate and correct any factors that could result in unwanted discharges of the system.

To avoid unwanted discharge of an aerosol system during maintenance or when anyone enters the protected enclosure, a supervised disconnect switch shall be provided.

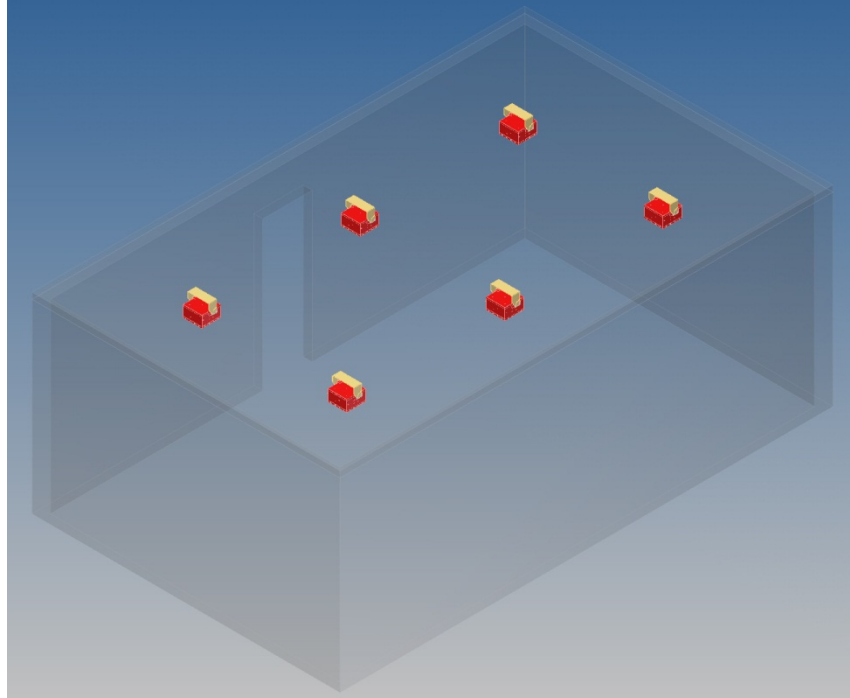
The disconnect switch shall interrupt the releasing circuit to the condensed aerosol system.

The disconnect switch shall be UL listed and compatible with the control panel.

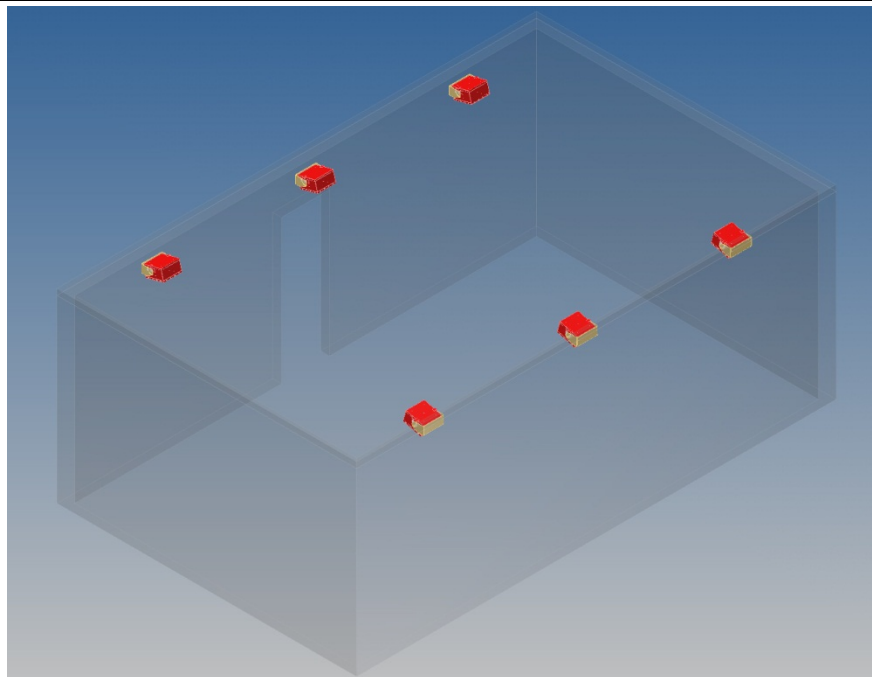


## 11 Total Flooding System – Installation Examples

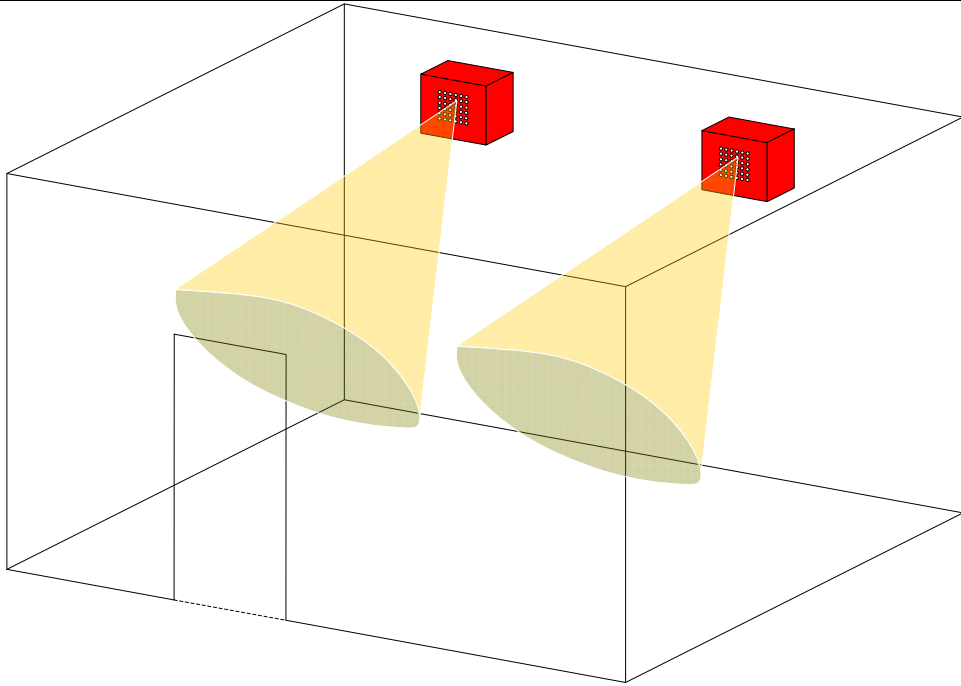
**Figure 11.1:**  
**RECOMMENDED** condensed aerosol arrangement - Ceiling



**Figure 11.2:**  
**RECOMMENDED** condensed aerosol arrangement – Top of Side Walls

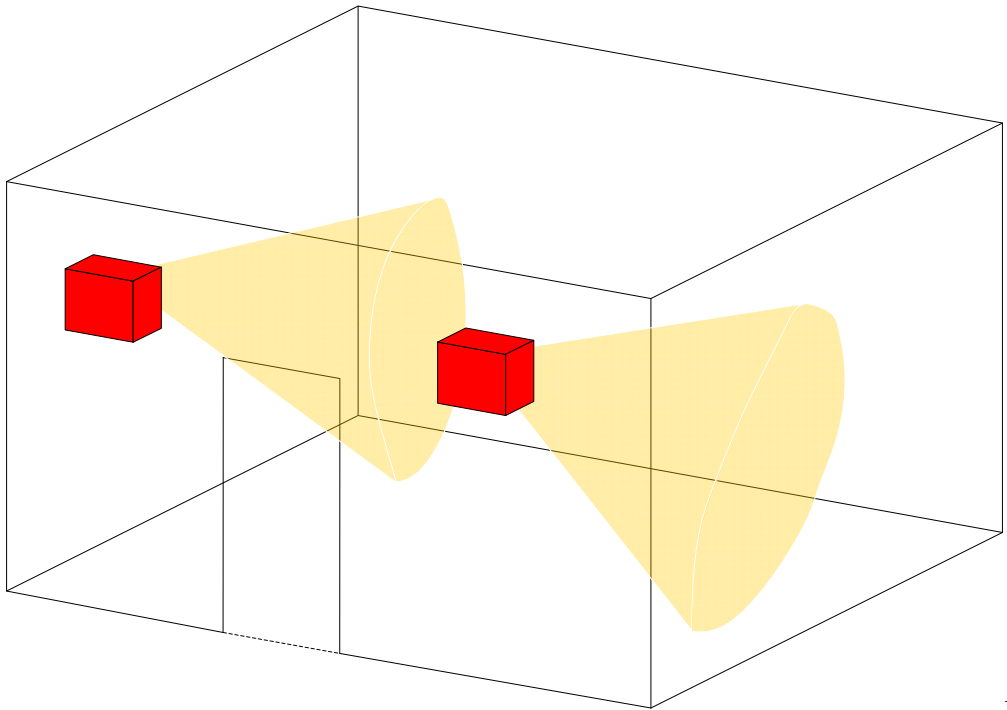


**Figure 11.3:**  
**WRONG** condensed aerosol arrangement



The location of generators shown above is incorrect. The generators aerosol outlets are pointing the aerosol stream in the direction of the opening (a door). If the door was left open at the time of generator activation, the generated aerosol would easily escape from the protected volume. This would nullify the aerosol design factor, possibly resulting in a failure to extinguish the fire.

**Figure 11.4:**  
**ALLOWED** condensed aerosol arrangement



The location of generators shown above is correct.

**WRONG** condensed aerosol arrangement

The aerosol discharge is obstructed by the equipment.

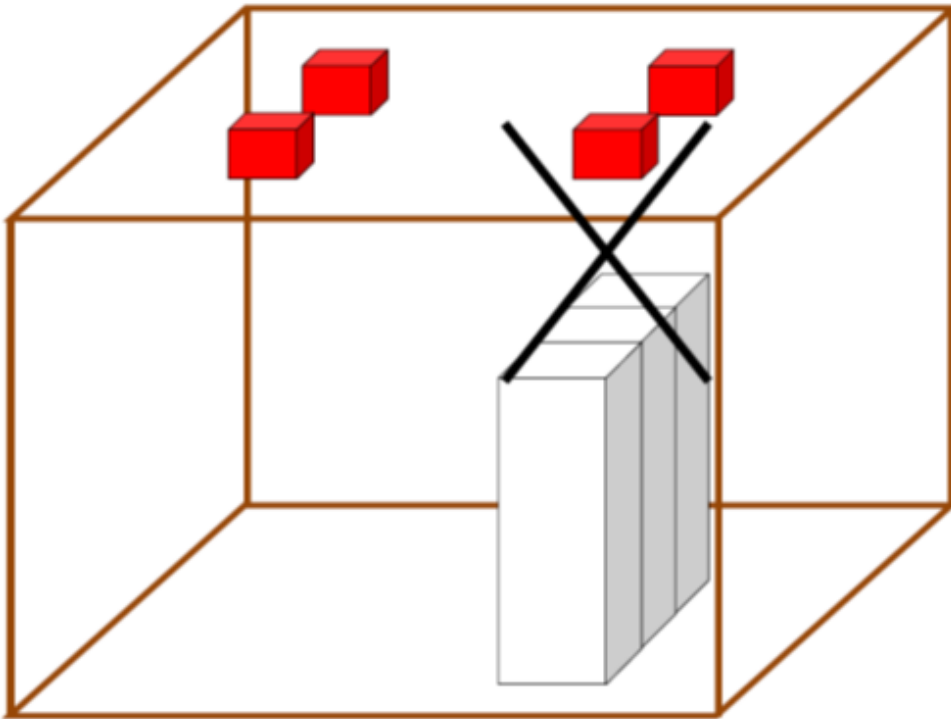


Figure 11.5 - Installation Clearance

Proper Installation - The aerosol easily reaches the likely source of the fire and homogeneous distribution is achieved

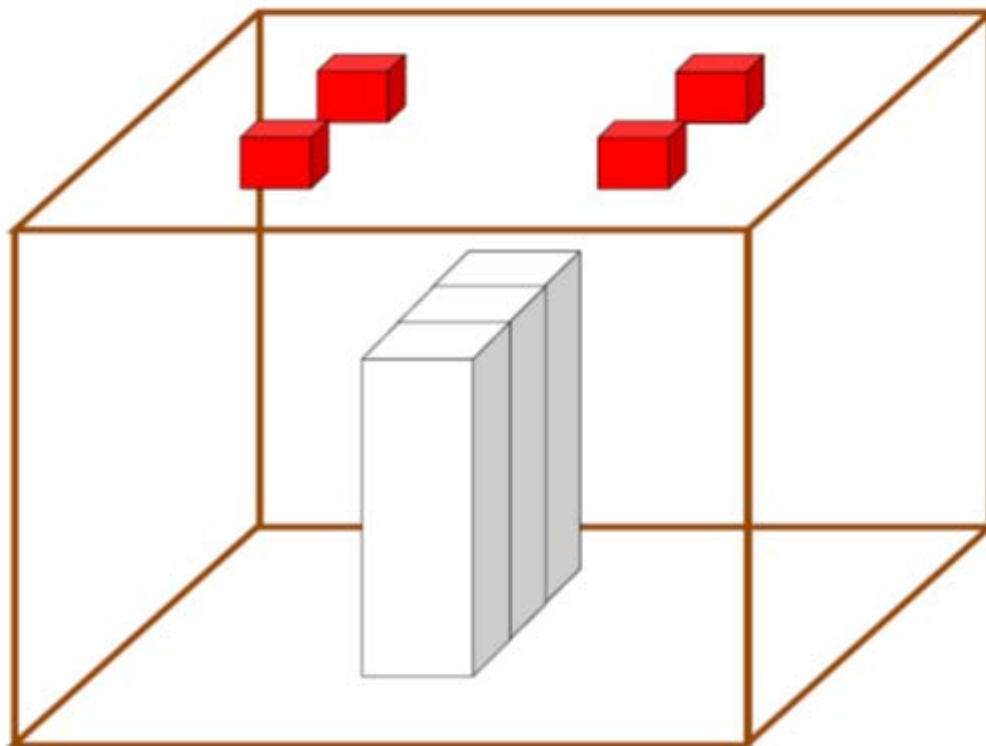


Figure 11.6

## 11.1 General

Do not install condensed aerosol generators close to openings.

The recommended optimal distance between the floor of the safeguarded volume and the condensed aerosol generator is reported on the condensed aerosol generator data sheets.

The discharge outlets of the condensed aerosol generators shall not be obstructed.

Minimum safe distances:

- ▶ Condensed aerosol generators shall not be installed at less than the minimum safe distance as specified in the condensed aerosol generator data sheet. The generator datasheets are in Appendix C of this manual.
- ▶ The minimum safe distance between the condensed aerosol generator casing and personnel shall be the distance from the generator casing to where the temperature does not exceed 75°C (167°F) during and after discharge.
- ▶ The minimum safe distance between the condensed aerosol generator casing and combustible materials shall be the distance from the generator casing to where the temperature does not exceed 200°C (392°F) during and after discharge.

The condensed aerosol generators shall be positioned in the protected space/volume so that the aerosol flow does not obstruct or impede the evacuation of personnel.

## 11.2 Condensed Aerosol Generator Installation Procedure

**Warning:** Before installing the FireNET Xtinguish condensed aerosol system, read this manual carefully along with the manuals and technical instructions for installation and management of the fire detection system and fire alarm control panel.

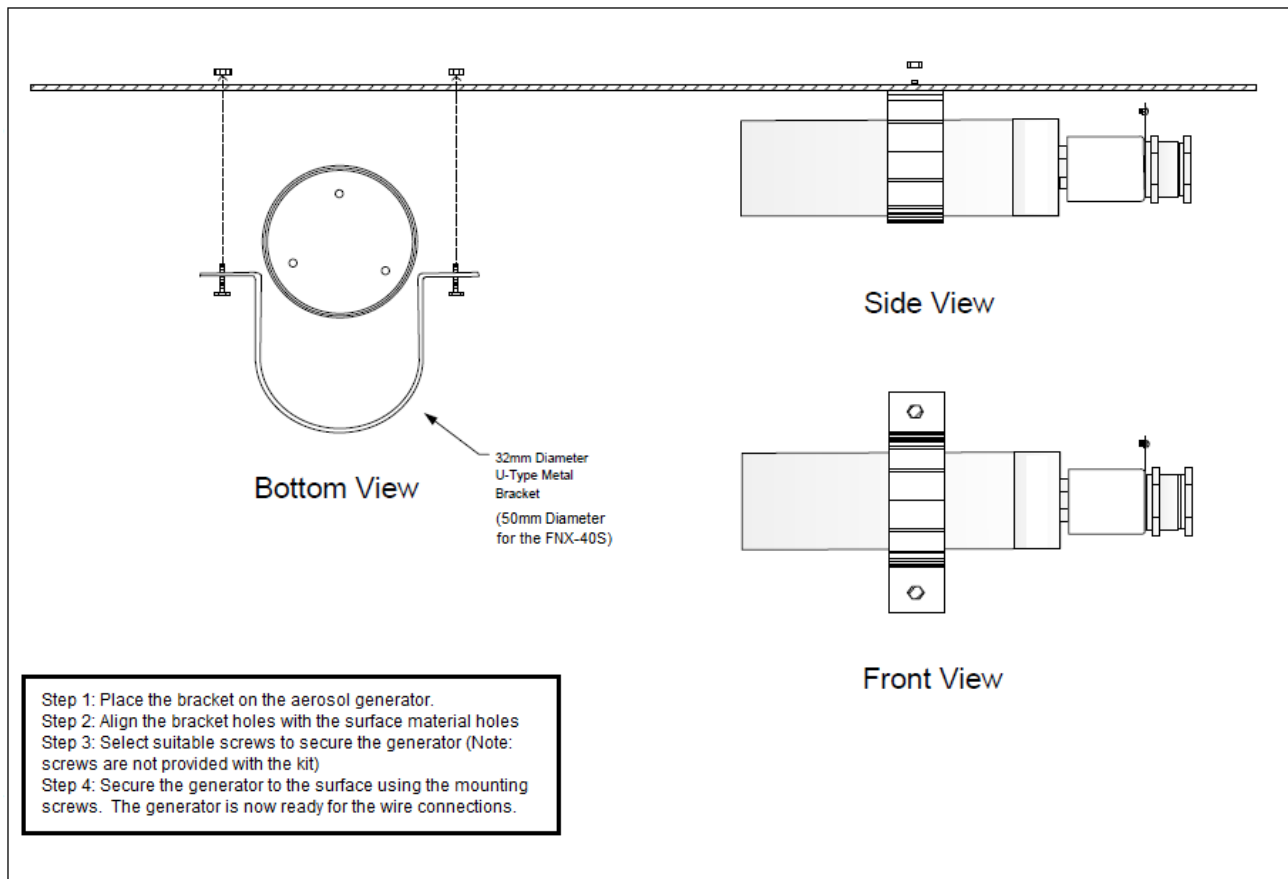
**Warning:** Ensure that the condensed aerosol generator is firmly secured!

The condensed aerosol generators are installed utilizing the brackets provided inside the package. The general installation steps are:

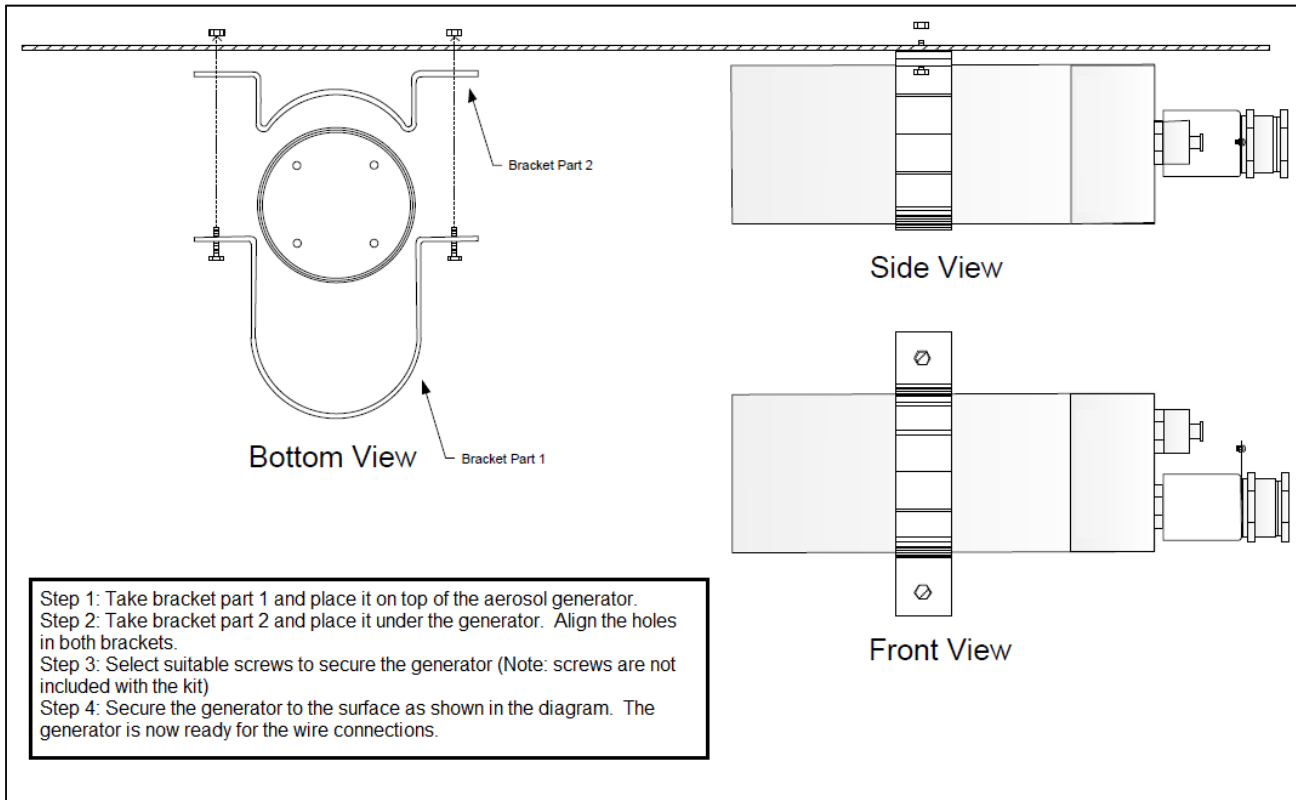
- A. Firmly attach the bracket(s) to the enclosure walls or ceiling, according the system design and the generator location.
- B. Check the resistance of the electric activation element. This value should be approximately 1.6 to 3.0 ohms (see Section 7.2)
- C. Connect the aerosol generator to the appropriate fire alarm control panel circuit.
- D. Complete all other connections to the fire alarm control panel. Apply power to the control panel when the installation is complete.

On completion, ensure that the condensed aerosol generators have been installed in the correct manner, i.e. that all requirements contained in this manual have been accomplished. Be sure to record the installation information on the installation certificate or on the technical documentation for the protected premises.

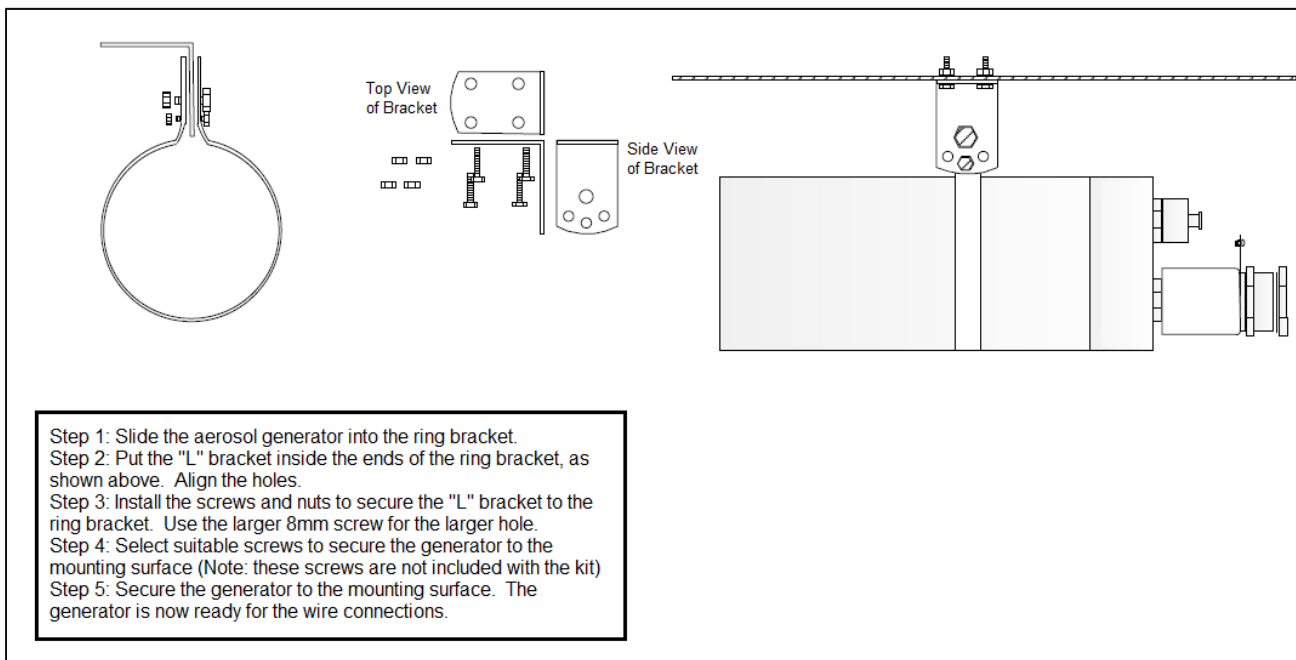
### 11.2.1 FNX-20S and FNX-40S Installation Details



### 11.2.2 FNX-80S Installation Details

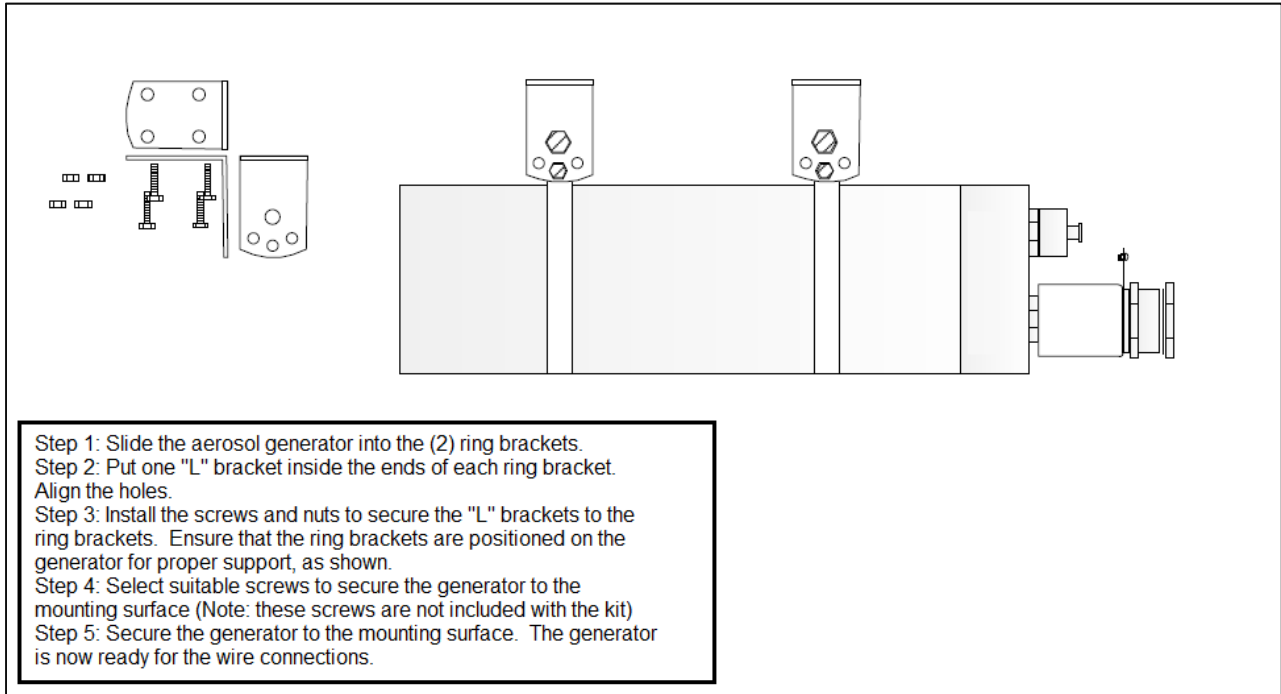


### 11.2.3 FNX-100S and FNX-200S Installation Details





## 11.2.4 FNX-500S Installation Details



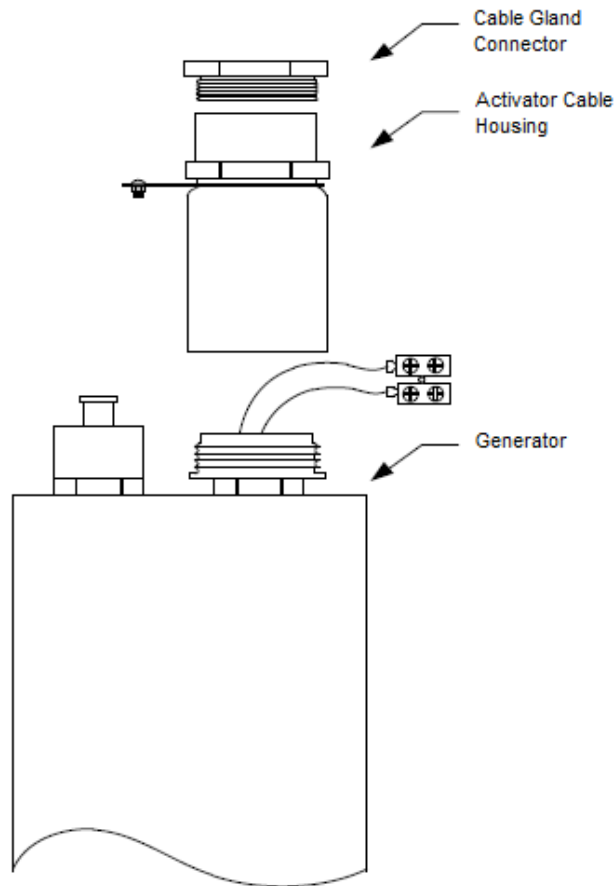
Installation of the FNX-1200 to FNX-5700 generators follows the same basic steps as those shown here. Secure the mounting bracket to the surface, and then attach the generator to the bracket. Always be sure to observe minimum safe distances (see Section 9.1).

### 11.3 Wiring Connections to the FireNET Xtinguish Aerosol Generators

Follow these steps to connect the generator to the extinguishing circuit:

**Step 1:** Disassemble the aerosol generator into three parts;

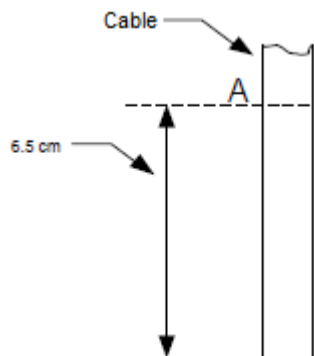
- Part 1 – the cable gland connector
- Part 2 – the activator cable housing
- Part 3 – the generator itself



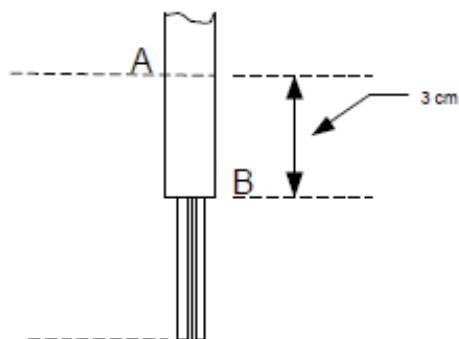
**Step 2: Prepare the wires**

NOTE: this is important! Be sure to follow the steps below.

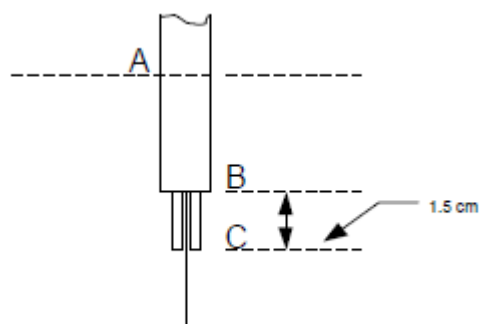
- a) Mark the cable 6.5 cm (2.56 inches) from the edge. This is point "A"



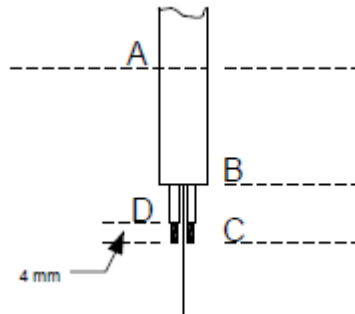
- b) Mark 3 cm (1.18 in.) from point "A" to point "B". Remove the shield of the cable from point "B" to the edge of the cable.



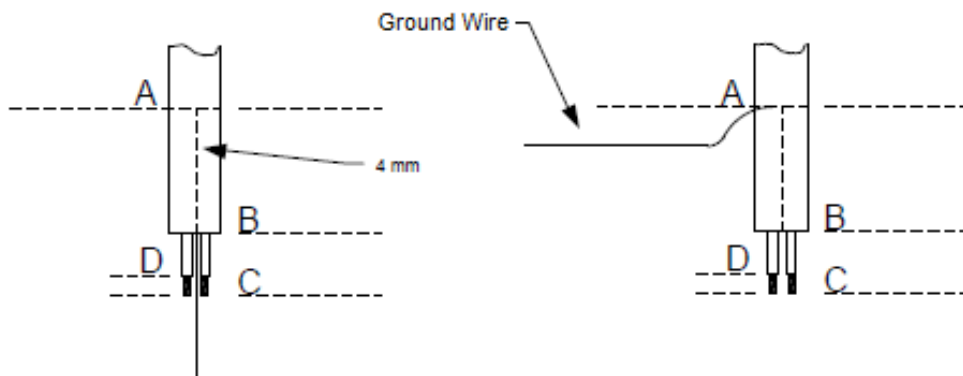
- c) Cut both wires 1.5 cm (0.59 in.) from point "B" to point "C".



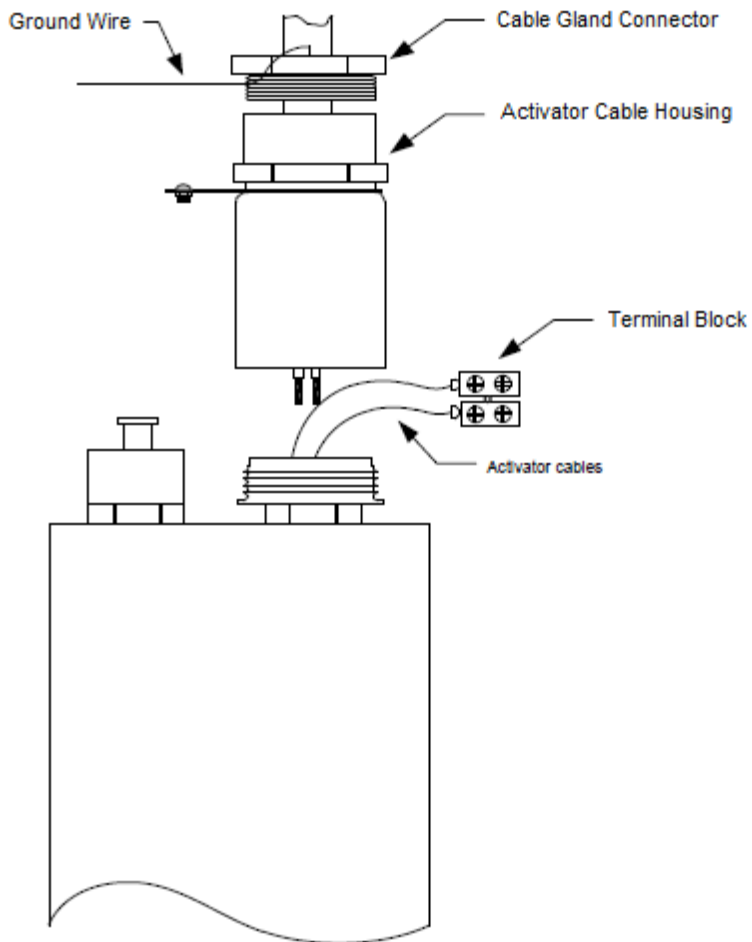
- d) Strip both wires so that approximately 4mm (0.16 in.) of the conductors are exposed. Point "C" to point "D".



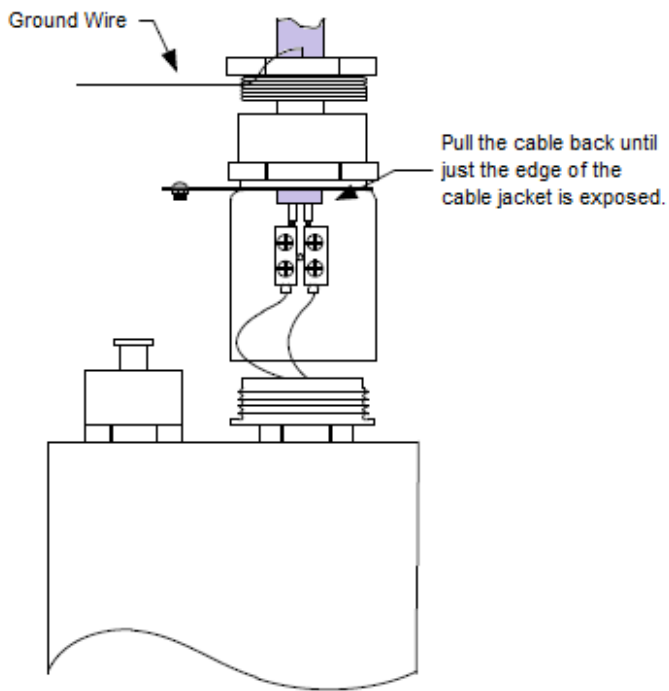
- e) Slice the jacket of the cable from point "B" to point "A" and remove the ground wire. The wire is now prepared for use.



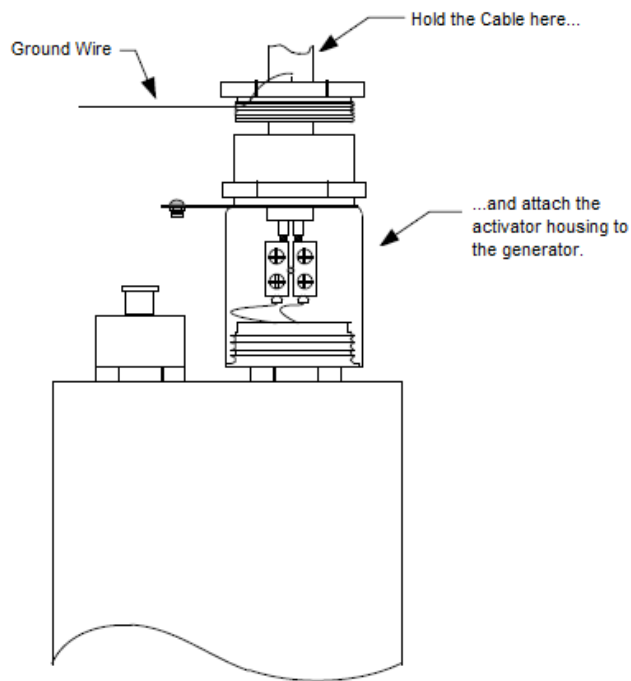
**Step 3:** Feed the prepared cable through the cable gland connector and the activator cable housing. Do not pass the ground wire through; leave it exposed on the outside of the cable gland connector as illustrated below.



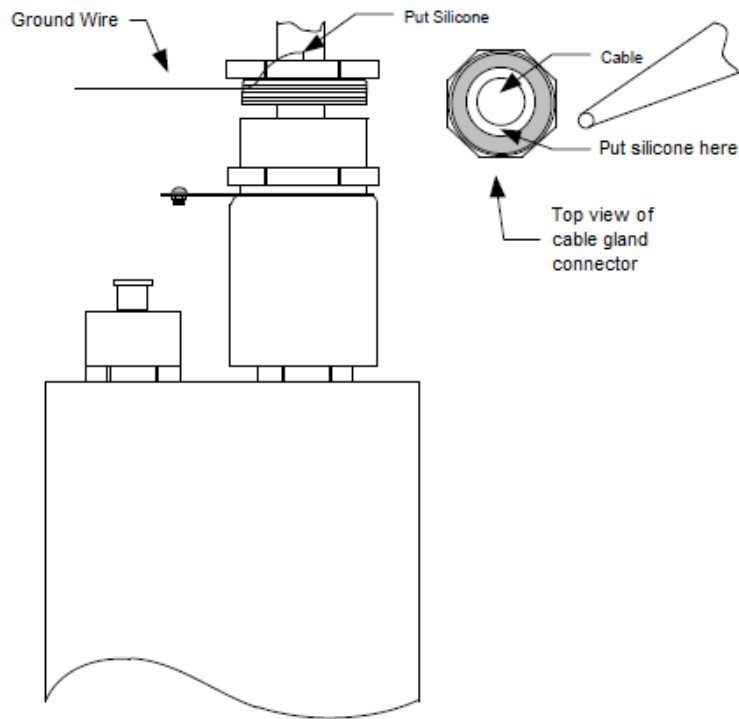
**Step 4:** Connect the wires to the aerosol generator terminal block. Then pull the cable back until the edge of the cable jacket is showing in the activator housing (see illustration below)



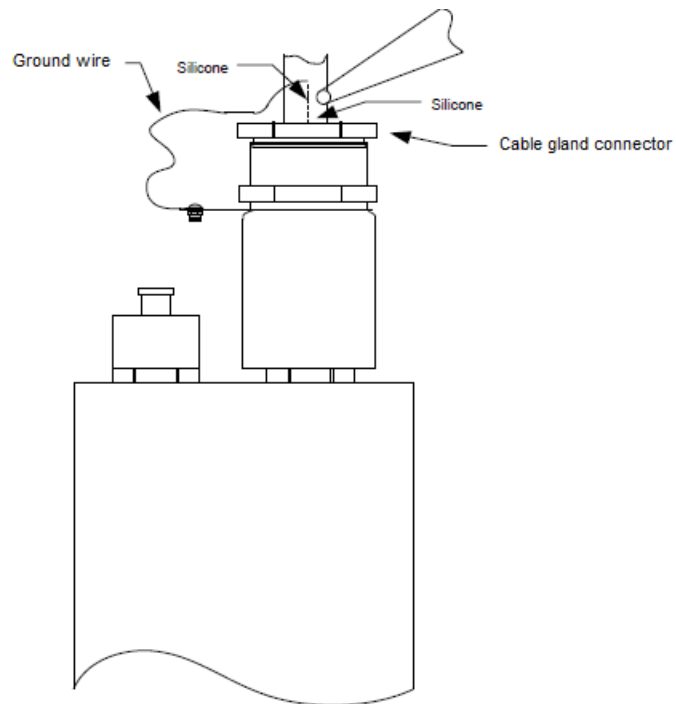
**Step 5:** While holding the cable in place to prevent it from turning, reattach the activator housing to the generator.



**Step 6:** Put silicone inside of the cable gland connector in order to seal it.



**Step 7:** Attach the cable gland connector to the activator cable housing. Connect the ground wire to the tab on the activator cable housing.



## 11.4 Condensed Aerosol Generator Height Limitations

The height limitation for each specific condensed aerosol generator is reported on the condensed aerosol generator data sheets (Appendix C).

The “Stream Length” value of each generator should be considered as the maximum height at which it should be installed above the floor or object to protect, whenever the aerosol stream from the generator’s outlet is vertical (at 90 degrees). Whenever a different angle is applied, then the height should be reduced accordingly.

In multiple condensed aerosol generator installations, they shall be distributed throughout the protected enclosure in accordance with the height limitation (coverage) of each condensed aerosol generator.

## 11.5 Condensed Aerosol Generator Initiation (Activation)

The condensed aerosol generators are initiated (activated) by means of an electric impulse of:

- ▶ 6 - 36 Volts direct-current (DC).

The required current shall be delivered through the connector to the initiator of the condensed aerosol generator.

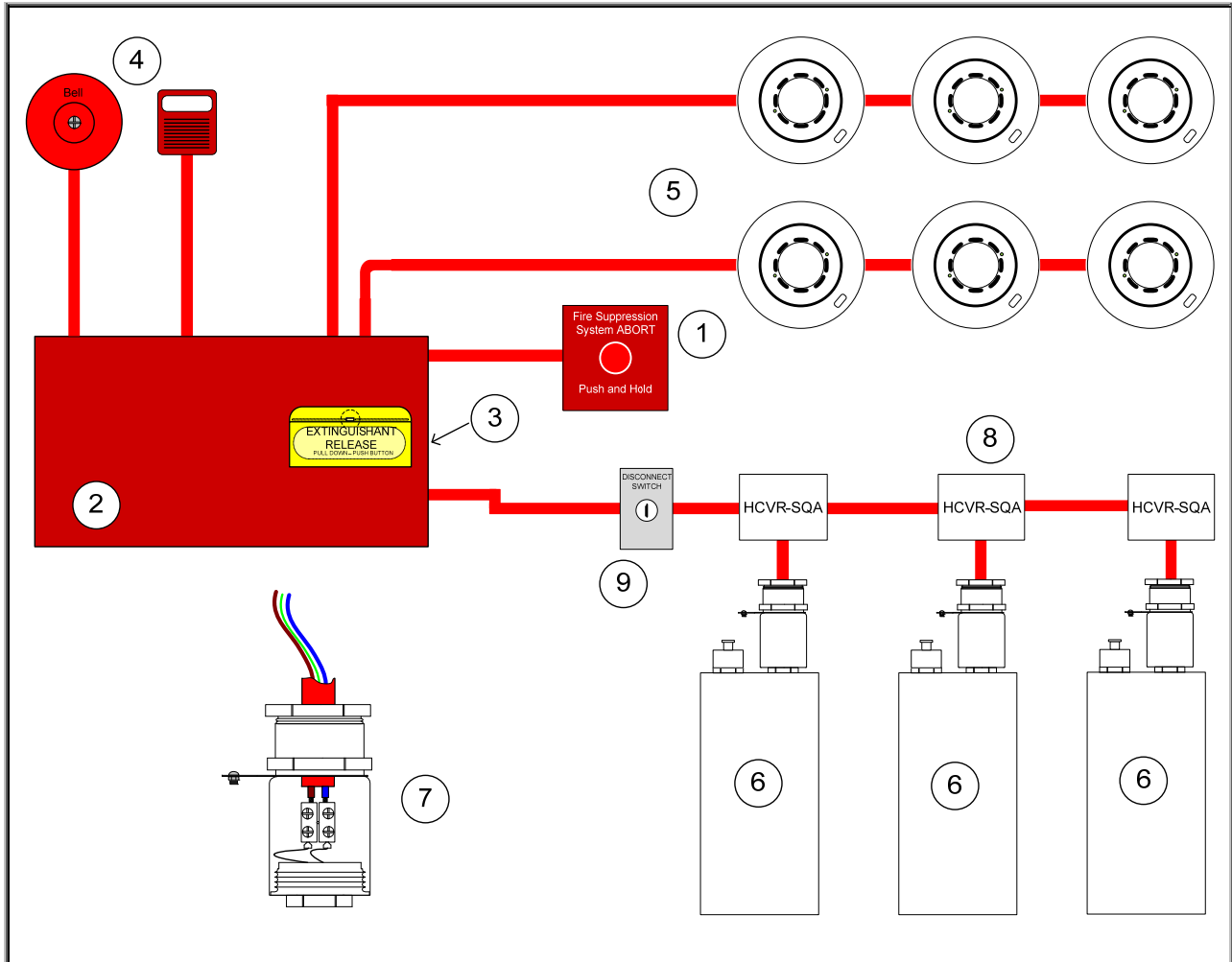
The condensed aerosol generators are equipped with the Initiator described in Section 7.1.2.

The condensed aerosol generators require a minimum of 0.8 amps of activation current each. Ensure that the necessary power is available to activate the generator(s) during an emergency condition.

### 11.5.1 Automatic Activation by means of a Fire Detection System

A fire alarm control panel may be used to automatically activate the aerosol generator(s). ***The HCVR-3 fire alarm control panel has been UL-listed for this purpose and is the only fire alarm control panel that may be used with FireNET Xtinguish products.***





LEGEND	
1	Abort Switch
2	Extinguishing Control Panel
3	Manual Release Button (Hand-operated switch)
4	Visual and/or Audible Notification Appliances
5	Automatic fire alarm detectors
6	Condensed Aerosol Generators
7	Electrical Connection to Initiator
8	Activator Module
9	Disconnect Switch

**Figure 11.5.1 – Typical System Configuration**

## 12 Hochiki HCVR-3 Releasing Fire Alarm Control Panel

The HCVR-3 is a conventional fire alarm control panel and releasing system. The panel provides connections for initiating device circuits (zones), notification appliance circuits (NACs), releasing circuits, relays outputs, and other circuits.

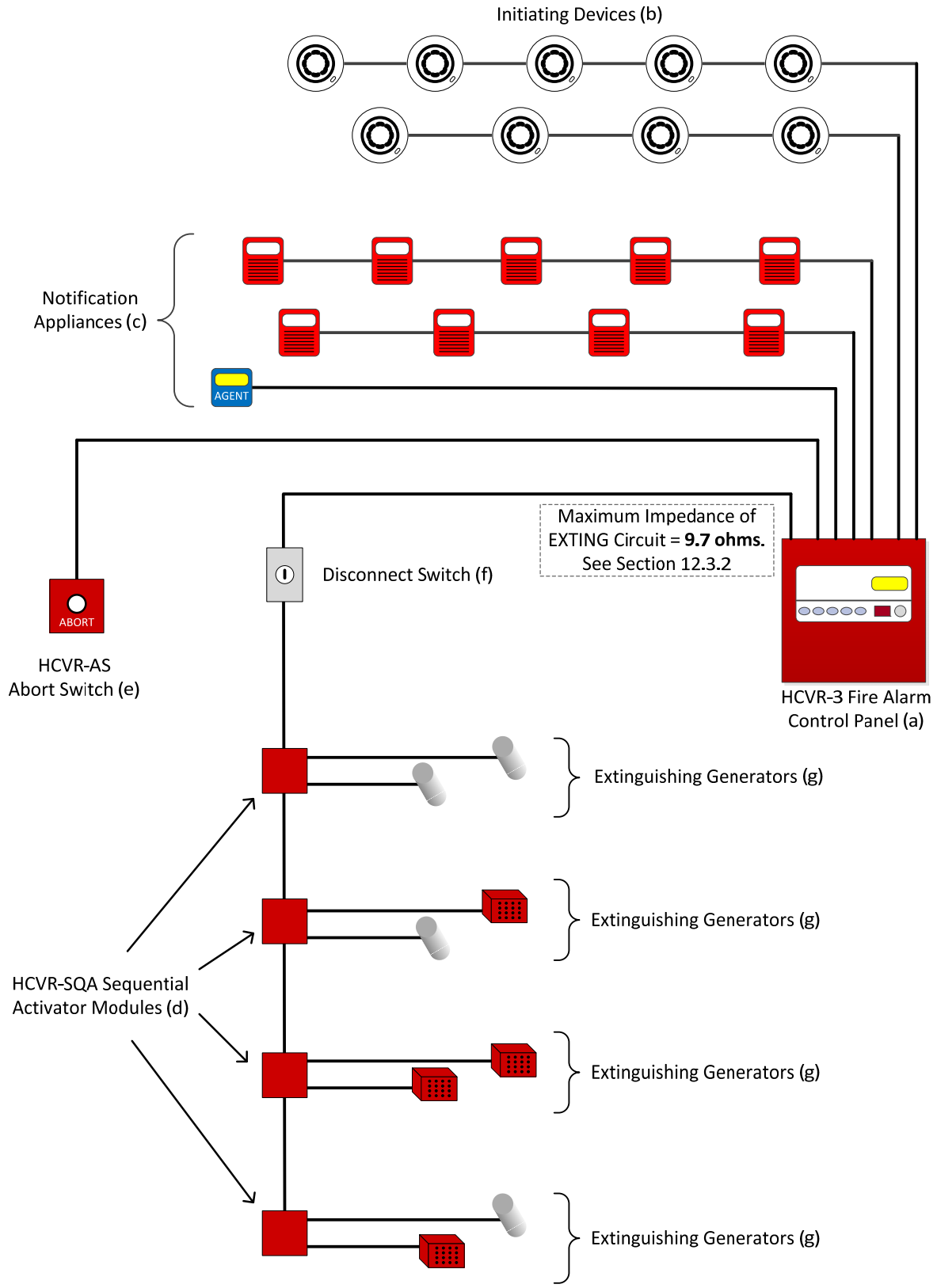
**Note: The HCVR-3 must be used with the Hochiki FireNET Xtinguish products.**

This manual provides general information about using the HCVR-3 fire alarm control panel with FireNET Xtinguish. For additional details regarding installation, programming and operation of the HCVR-3, please see the *HCVR-3 Installation and Operation Manual*, HA document # HA-06-294.

### 12.1 System Components

The HCVR-3 system is made up of several components:

- a) The HCVR-3 Fire Alarm Control Panel – the main control panel where all devices terminate, including initiating devices, notification appliances and the releasing circuit. The panel also has a manual release switch which may be used to activate the condensed aerosol generators.
- b) Initiating Devices – typically smoke detectors connected to the zones on the HCVR-3 panel. The HCVR-3 employs a “cross-zone” operation so that at least two zones must be in alarm before the releasing sequence begins. This reduces the possibility of unwanted activation of the aerosol generators.
- c) Notification Appliances – these circuits are provided to notify building occupants of fire alarm events and to indicate the status of the release process. Pre-release notification informs building occupants to leave the protected area immediately, while post-release notification warns to stay out of an area where the extinguishing agent has been discharged.
- d) The HCVR-SQA Sequential Activator Module – this module is used to activate FireNET Xtinguish aerosol generators (g). Up to 20 HCVR-SQA modules may be used, with up to two (2) aerosol generators connected to each HCVR-SQA.
- e) HCVR-AS Abort Switch (optional, as required) – the HCVR-AS Abort Switch may be used to stop the pre-release countdown when it gets to 10 seconds. As long as the button is depressed the countdown timer will remain at 10 seconds, preventing the discharge of the aerosol generator(s). This button may only be operated one time during a countdown sequence; if it is released, the countdown will resume at 10 seconds. See the HCVR-3 manual for more details.
- f) Disconnect Switch – this switch is used to electrically disconnect the aerosol generators from the HCVR-3 fire alarm control panel for testing and maintenance purposes.
- g) The Extinguishing Generator(s) – one or more FireNET Xtinguish condensed aerosol generators used to extinguish a developing fire.
- h) Other Options – these include the HCVR-SDU Status Display Unit and the HCVR-AB Ancillary Board. See the HCVR-3 manual for more details.



**Figure 12.1.1 – System Components**

## 12.2 System Layout

Specifications for total flooding aerosol fire-extinguishing systems shall be prepared under the supervision of a person fully experienced and qualified in the design of such systems and with the advice of the authority having jurisdiction. The specifications shall include all pertinent items necessary for the design of the system, such as the designation of the authority having jurisdiction, variances from the standard to be permitted by the authority having jurisdiction, design criteria, system sequence of operation, the type and extent of the approval testing to be performed after the installation of the system, and owner training requirements.

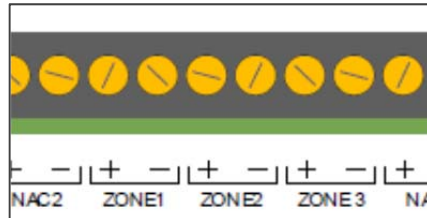
Install the HCVR-3 control panel, initiating devices, notification appliances, Xtinguish aerosol generators, and all other equipment as stated on the design plans. Always check with the system designer in the event of questions; do not change the mounting location of any device without proper approval.

Ensure that the installation environment is appropriate for the equipment. If the environmental conditions are harsh or unsuitable for the equipment, notify the system designer immediately.

## 12.3 HCVR-3 Connection Overview

### 12.3.1 Detection Zones and Notification Appliances

The HCVR-3 fire alarm control panel has three initiating device circuits (zones). Connect smoke detectors and other initiating devices as indicated on the system design plans. Only compatible smoke detectors may be used; see Appendix B of the *HCVR-3 Installation and Operation Manual* for details. Be sure to observe correct polarity.



**Figure 12.3.1 – Zone Connections**

There are three notification appliance circuits (NACs) on the HCVR-3. NACs 1 and 2 are used to signal a general fire alarm condition. NAC 3 is used to indicate one of two things; 1) the system is preparing to activate the aerosol generators to discharge the extinguishing agent, or 2) the aerosol generators have already been activated and the aerosol has been discharged into the compartment. The distinction between these two different events is achieved in the way that the panel operates the output; when the release is imminent NAC 3 provides a pulsing output, but after the aerosol has been discharged the circuit provides a continuous output. Because NAC 3 provides a pulsed output when the panel is counting down prior to activating the aerosol generators, a strobe may not be used on this circuit.

See the *HCVR-3 Installation and Operation Manual* for more information about the zones and NACs on the panel.

### 12.3.2 HCVR-SQA Sequential Activator

The HCVR-3 fire alarm control panel connects to one or more HCVR-SQA Sequential Activator modules. A maximum of 20 HCVR-SQA modules may be connected to the HCVR-3 panel.

The HCVR-SQA connects to the EXTING circuit on the control panel. The End-of-Line Diode (EOLD) that comes with the HCVR-3 panel must not be used with the HCVR-SQA. In addition, the HCVR-SQA requires 24 volt auxiliary power which is provided by the control panel. See Figure 12.3.2.

As shown in Figure 12.3.2, the last HCVR-SQA module in the circuit must have the termination jumper installed. If only one HCVR-SQA is used, install the jumper on the module. In summary, one HCVR-SQA module shall have the jumper installed and it must always be the last module on the circuit, even if only one module is used.

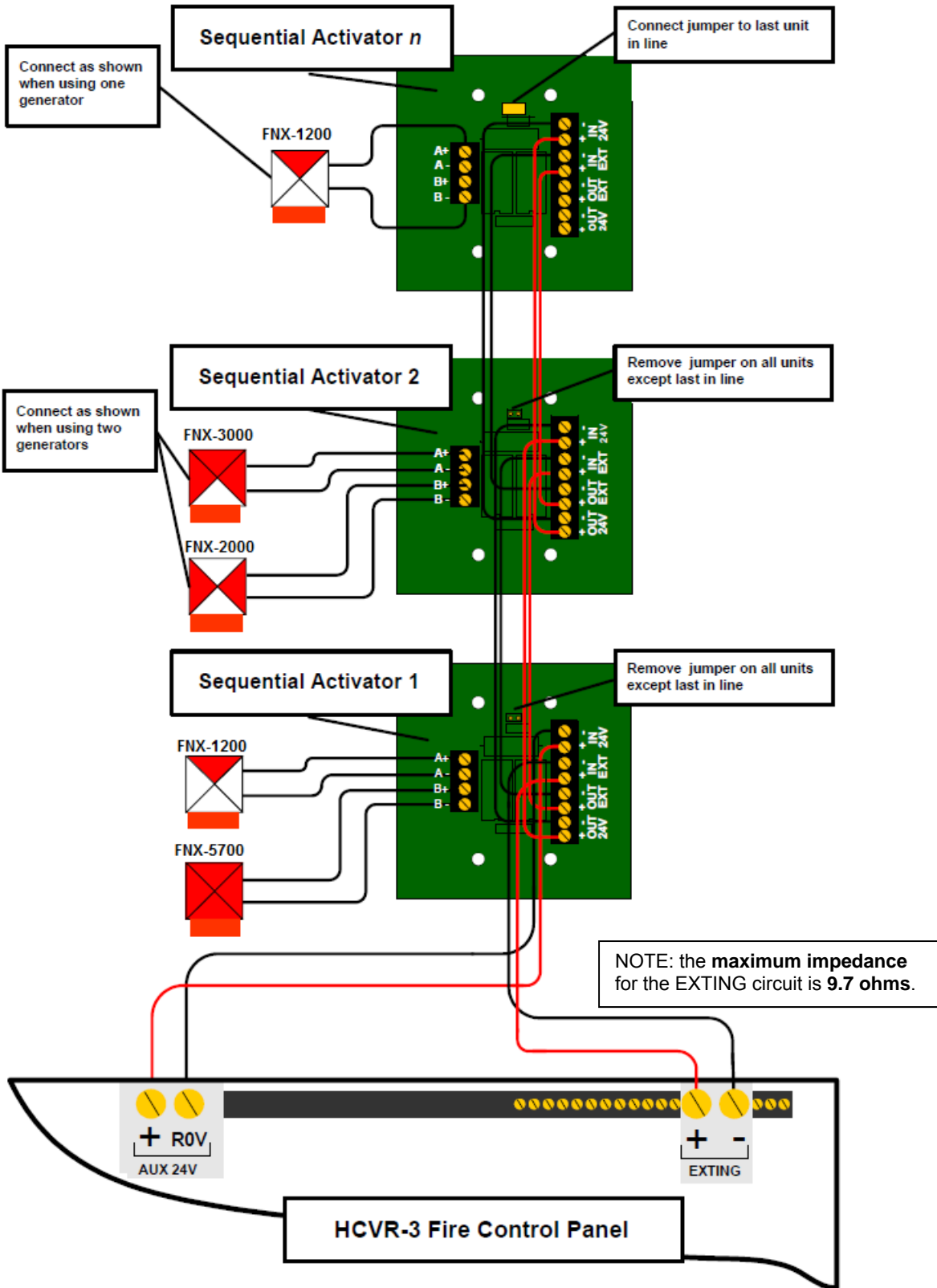


Figure 12.3.2 – Wiring Diagram for the HCVR-SQA

Each HCVR-SQA has two output circuits and will support a maximum of two aerosol generators. Note that if only one generator is used with the HCVR-SQA, the wires are connected to the A+ and B- terminals. If two generators are used, one generator must be connected to the A+ and A- terminals while the other generator is connected to the B+ and B- terminals. Only one aerosol generator may be connected to each output circuit on the HCVR-SQA. DO NOT connect more than one generator to an output circuit!

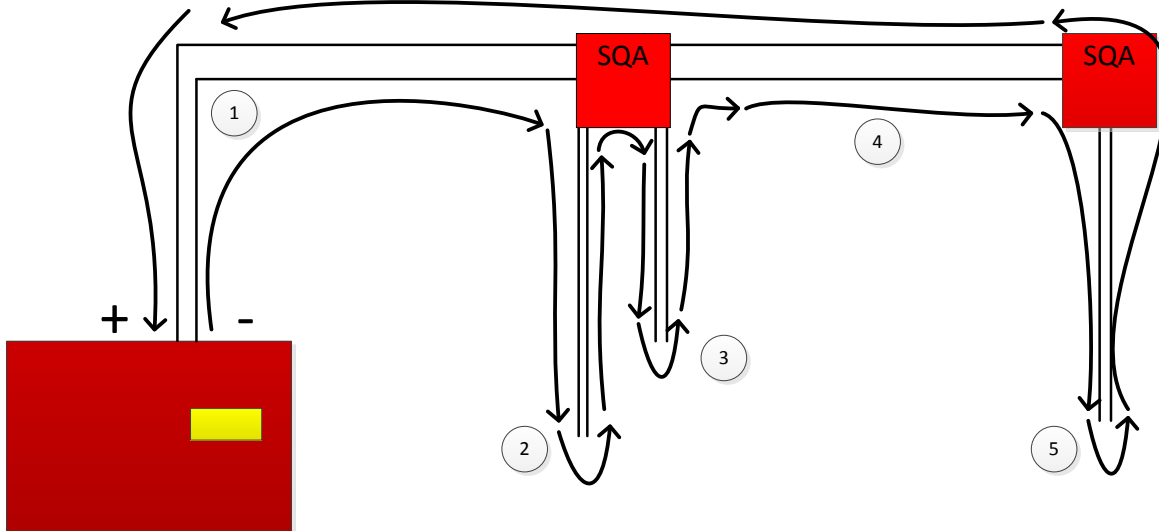
### 12.3.2.1 Maximum Wire Length for the EXTING Circuit

Based on information contained in the National Electrical Code (2011 Edition), the following lengths and gauges of wire may be used on the EXTING (Extinguishing) circuit:

- 18 AWG – 380 ft.
- 16 AWG – 606 ft.
- 14 AWG – 960 ft.

Do not use any wire sizes other than those shown above!

These distances are measured from the HCVR-3 control panel to the last generator on the circuit and back to the panel again. For example:



In this example, the first HCVR-SQA Sequential Activator module is installed **50** feet from the HCVR-3 fire alarm control panel. This wire is indicated as section 1 in the illustration. There are two generators connected to the first HCVR-SQA; section 2 (the first generator circuit) has **20** feet of wire, and the second circuit (3) has **15** feet of wire. Section 4 is the wiring between the sequential activator modules and is another **50** feet. Finally, section 5 is for the generator and is **20** feet of wire.

The wire length is added from the EXTING + terminal until it returns to the EXTING – terminal. In this example, there is 310 feet of wire in use -  $(50+20+15+50+20)*2 = 310$ .

When designing the system, anticipate the size of wire needed for the EXTING circuit by the distance from the panel to the last sequential activator module and the number of generator circuits in use. This will help ensure that the maximum circuit impedance is not exceeded.

**Always confirm the maximum impedance of the EXTING circuit by measurement.** Before connecting the generators to the sequential activator module circuits, connect the generator circuits at the ends to make a complete circuit. Measure the resistance of the circuit where the wire connects to the HCVR-3 EXTING circuit. Ensure that the resistance is 9.7 ohms or less.

***Do not measure the circuit with the generators connected.*** The generators will introduce additional resistance into the circuit and will affect the accuracy of your measurement.

See the HCVR-SQA Sequential Activator Installation Sheet for additional details.



### 12.3.3 Disconnect Switch (Hochiki America model SOM-R-DS)

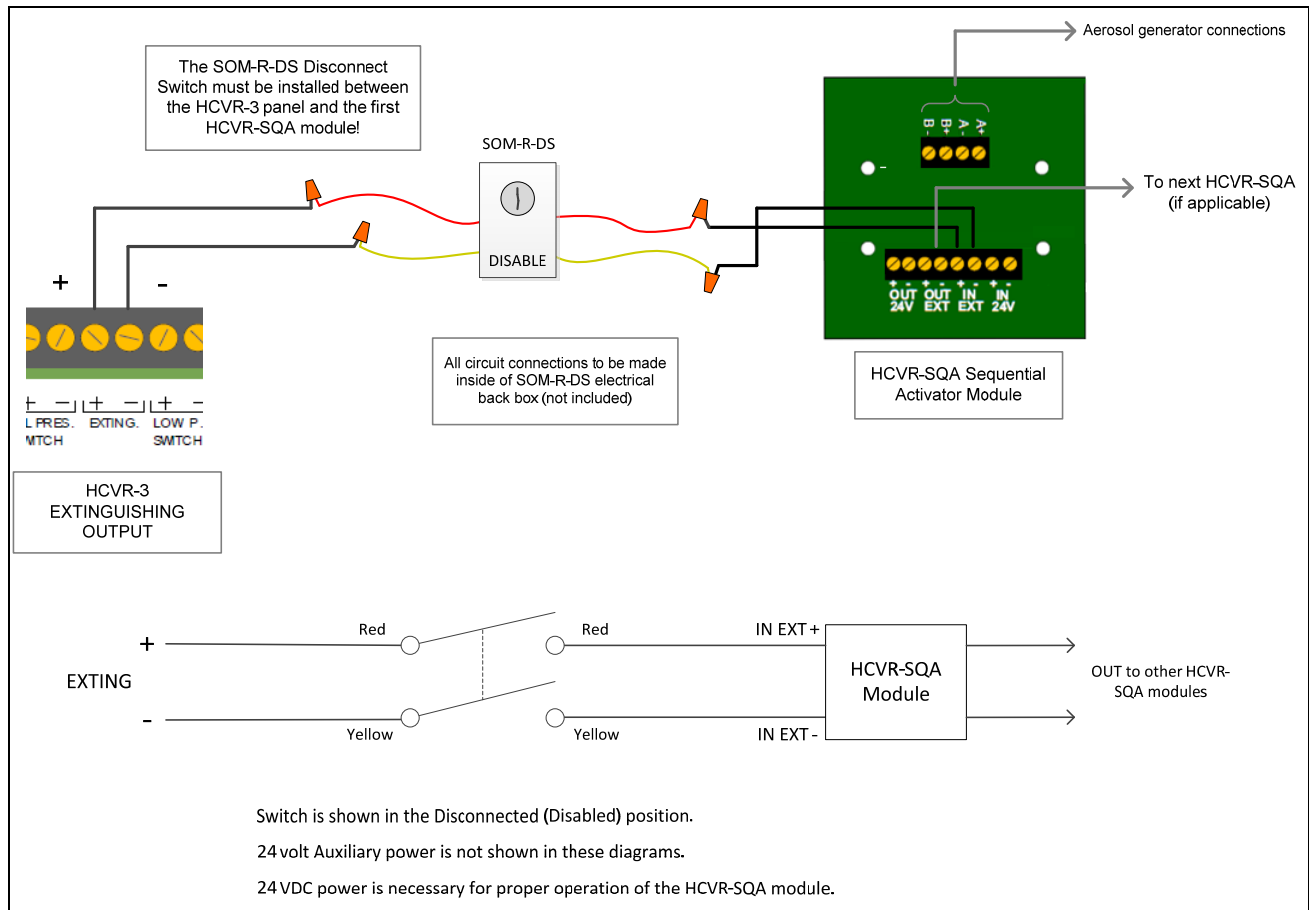
To comply with NFPA requirements, a Disconnect Switch (model SOM-R-DS) may be installed in the EXTING circuit. The purpose of this switch is to help prevent accidental activation of the aerosol generators during testing and maintenance of the system.

***The Disconnect Switch must not be used to Abort an activated release countdown sequence!***

Install the Disconnect Switch as indicated on the plans. A single-gang back box (or similar) must be used to securely mount the switch. Ensure that all connections are secure and protected. See Figure 12.3.3.

Under normal circumstances the Disconnect Switch is in the *Enable* position. When the switch is moved to the *Disable* position, the HCVR-3 control panel will indicate a trouble. As long as the switch remains in the *Disable* position, the HCVR-3 is disconnected from the sequential activator modules, preventing the panel from activating the aerosol generators. System testing and maintenance may be performed while the Disconnect Switch is in the *Disable* position.

***WARNING: ALWAYS ensure that the HCVR-3 panel is in a normal state before returning the Disconnect Switch back to the Enable position! Setting the switch to Enable while the HCVR-3 is in a release state will activate the aerosol generators!***



**Figure 12.3.3 – Disconnect Switch Diagram and Circuit Wiring**

## 13 Total Flooding System Commissioning

### 13.1 General

The completed condensed aerosol system shall be reviewed and verified by qualified personnel to meet the approval of the authority having jurisdiction.

All condensed aerosol system components and auxiliary devices used shall be UL-listed. Non-listed equipment shall not be used under any circumstances.

### 13.2 Installation Acceptance

#### 13.2.1 Basic Checks

- Confirm that the protected enclosure is in conformance with the construction documents.
- The condensed aerosol generators shall be securely fastened to prevent unacceptable vertical or lateral movement during discharge.
- The condensed aerosol generators shall be oriented in such a manner that optimum agent dispersal can be effected.
- The condensed aerosol generator stream shall not directly impinge on areas where personnel may be located.
- The condensed aerosol stream shall not directly impinge on any loose objects or shelves, cabinet tops, or similar surfaces where loose objects could be present and become missiles.
- An adequate number/quantity of condensed aerosol generators to produce the desired specified design application density shall be provided.
- The actual room volumes shall be checked against those indicated on the system drawings to ensure the proper quantity of condensed aerosol agent.
- Fan coast down (inertia) and damper closure time shall be taken into consideration.

#### 13.2.2 Review Enclosure Integrity

All condensed aerosol total flooding systems shall have the enclosure examined and tested to locate and then effectively seal any air leaks that could result in a failure of the enclosure to hold the specified condensed aerosol design application density for the specified holding period.

#### 13.2.3 Review Electrical Components

##### *13.2.3.2 Wiring*

All wiring systems shall be installed in compliance with local codes and the system drawings.

Alternating current (ac) and direct current (dc) wiring shall not be combined in a common conduit or raceway.

##### *13.2.3.3 Field Circuits*

All field circuits shall be free of ground faults and short circuits.

Where field circuitry is being measured, all devices such as smoke detectors and notification appliances shall be removed and jumpers installed to prevent the possibility of damage within these devices. The devices shall be replaced after measuring.

#### 13.2.3.4 Power Supply

Reliable primary and 24-hour minimum standby sources of energy shall be used to provide for operation of the detection, signaling, control, and actuation requirements of the system.

#### 13.2.3.5 Auxiliary Functions

All auxiliary functions such as a remote annunciator, air-handling shutdown, and power shutdown, shall be checked for operation in accordance with system requirements and design specifications.

If possible, all air-handling and power-cutoff controls shall be of the type that, once interrupted, requires manual restart to restore power.

Silencing of alarms, if desirable, shall not affect other auxiliary functions such as air handling or power cutoff if required in the design specification.

The detection devices shall be checked for proper type and location as specified on the system drawings.

Location:

- ▶ Detectors shall not be located near obstructions or air ventilation and cooling equipment that would appreciably affect their response characteristics.
- ▶ Where applicable, air changes for the protected area shall be taken into consideration.

The detectors shall be installed in a professional manner and in accordance with technical data regarding their installation.

Manual pull stations shall be installed, readily accessible, accurately identified, and protected to prevent damage.

All manual stations used to release agents shall require two separate and distinct actions for operation.

- ▶ All manual station used to release condensed aerosol system shall be identified.
- ▶ Particular care shall be taken where manual release devices for more than one condensed aerosol system are in close proximity and could be confused or the wrong system actuated.
- ▶ Manual stations in this instance shall be clearly identified as to which zone or suppression area they affect.

For systems using abort switches, the switches shall be of the dead man type requiring constant manual pressure. The switch shall be installed and readily accessible within the hazard area, and clearly identified.

- ▶ Switches that remain in the abort position when released shall not be used for this purpose.

The control unit shall be installed and readily accessible.

## 13.2.4 Functional Testing

### 13.2.4.1 Preliminary Functional Tests

At minimum, the following preliminary functional tests shall be performed:

1. If the system is connected to an alarm monitoring station (Central Station), notify them that the fire system test is to be conducted and that an emergency response by the fire department or alarm station personnel is not desired.
2. Notify all concerned personnel at the facility that a test is to be conducted. Instruct personnel as to the sequence of operation.
3. Disable the condensed aerosol system actuation mechanism so that activation of the release circuit will not actuate the condensed aerosol generators.
4. Check each detector for response.
5. Check that polarity has been observed on all polarized alarm devices and auxiliary relays.
6. Check that all end-of-line resistors have been installed across the detection and notification appliance circuits where required.
7. Check all supervised circuits for trouble response.

### 13.2.4.2 System Functional Operational Test

The following system functional operational tests shall be performed:

1. Operate detection initiating circuit(s).
2. Verify that all alarm functions and time delays occur according to design specification.
3. Operate the necessary circuit to initiate a second alarm circuit if present.
4. Verify that all second alarm functions occur according to design specifications.
5. Operate manual release.
6. Verify that manual release functions occur according to design specifications.
7. Operate abort switch circuit if supplied.
8. Verify that abort functions occur according to design specifications.
9. Confirm that visual and audible signals are indicated by the control panel.

### 13.2.4.3 Secondary (Standby) Power Test

The following testing of secondary power shall be performed:

1. Disconnect primary power. Confirm the correct trouble indication.
2. Operate one of each type of input device. Verify that each event is processed properly.
3. Reset the panel after each event.
4. Disconnect a device from each circuit and confirm correct trouble indication.
5. Reconnect primary power supply. Confirm that the panel returns to normal standby condition.

The control panel shall be readily accessible, yet restricted from unauthorized personnel.

#### *13.2.4.4 Return of Condensed Aerosol System to Operational Condition*

When all testing has been completed, the condensed aerosol generators shall be reconnected so that activation of the release circuit will actuate the condensed aerosol generators, releasing the condensed aerosol agent.

The condensed aerosol system shall be returned to its fully operational design condition.

The central station and all concerned personnel at the end-user's facility shall be notified that the condensed aerosol fire system test is complete and that the system has been returned to full service condition.

## 14 Total Flooding Systems Inspection and Maintenance

### 14.1 Inspection

At least every 30 days, an inspection shall be conducted to assess the condensed aerosol fire system operational condition.

### 14.2 Enclosure Inspection

At least every 12 months, the enclosure protected by the condensed aerosol fire system shall be thoroughly inspected to determine if penetrations or other changes have occurred that could adversely affect agent leakage or change volume of hazard or both.

- ▶ Where the inspection indicates conditions that could result in an inability to maintain the condensed aerosol design application density, these conditions shall be corrected immediately.
- ▶ If uncertainty still exists, the enclosure shall be retested for integrity.

### 14.3 Maintenance

- ▶ At least annually, all condensed aerosol systems shall be subjected to the manufacturer's test and maintenance procedures by competent personnel.

A periodic inspection of the aerosol fire extinguishers and fire extinguishing systems shall check the following components:

- ▶ Electric wiring
- ▶ Terminals of the electrical ignition
- ▶ Electric contacts (clamped fit?)
- ▶ Mounting bolts (tightened firmly?)
- ▶ The maintenance report with recommendations shall be filed with the owner.
- ▶ Replace generators after 10 years

### 14.4 Penetrations

- ▶ Any penetrations made through the enclosure protected by the condensed aerosol fire system shall be sealed immediately.
- ▶ The method of sealing shall restore the original fire resistance rating of the enclosure.

### 14.5 Condensed Aerosol Generator Inspection

Inspections to condensed aerosol generators shall be executed by competent personnel only and the results recorded on both of the following:

1. A record tag permanently attached to each condensed aerosol generator.
2. An inspection report

A completed copy of the inspection report shall be delivered to the owner of the system or to the Authority Having Jurisdiction (or both, as required); the records shall be retained by the owner/user for the life of the condensed aerosol system.

Where external visual inspection indicates that the condensed aerosol generator casing or the generator itself has been damaged, the unit shall be replaced.

## **14.6 Training**

All persons who could be expected to inspect, test, maintain, or operate the condensed aerosol fire extinguishing system shall be thoroughly trained and kept thoroughly trained in the functions they are expected to perform.

Personnel working in an enclosure protected by a condensed aerosol fire system shall receive training regarding agent safety issues.

## **14.7 Safety**

Safe procedures shall be observed during installation, servicing, maintenance, testing, and managing of the condensed aerosol fire system.

*Always observe all local and national inspection and maintenance requirements.*

## 15 Total Flooding System Post-Discharge Intervention

### 15.1 Residue Removal

When activated, the solid aerosol forming compound SBK is transformed into a rapidly expanding aerosol, formed by solid particles suspended in a gas phase. The size of such particles is of a few microns; see Section 5.2.

The condensed aerosol composition is of Potassium compounds. It is non-corrosive and is not electrically conductive. It does not cause any damage to sensitive protected equipment and does not react on electronic components, metals, etc.

The solid aerosol forming compound SBK does not contain any Halogen compounds that may react with the flame; thus the condensed aerosol does not produce corrosive halogen-acid by products in its reaction with the flames.

The condensed aerosol solid particles suspended into the aerosol phase are in concentration of a few milligrams per cubic meter. These particles are in an anhydrous phase and will settle at the bottom of the protected enclosure after a period of time as a fine dust. This dust can be easily removed by cleaning, before absorbing humidity.

The condensed aerosol by-products after the extinguishing action consists mainly of KOH in very low concentration (transformed rapidly in  $K_2CO_3$ ) in an anhydrous phase, as the condensed aerosol particles.

### 15.2 Guidelines to Clean the Residue of Condensed Aerosol

- ▶ Clean the residues shortly after discharge (within a few hours maximum)
- ▶ Wipe off dry residues on floor and metal surfaces using a wet cloth or brush
- ▶ Dust away the residues on electrical components using a fan/blower
- ▶ Use special sprays suitable to clean the residues that have settled on electronic components

If the condensed aerosol particles are removed before they can absorb moisture and mix with the combustion residues present in the atmosphere after the fire, they will not react with or affect electronic components, metals, etc.

If the condensed aerosol particles (dust) remain for a longer period, they will absorb moisture. The moisture will react with metals (especially uncoated metals), causing oxidation to occur.



### 15.3 Dismantling Condensed Aerosol Generators

When the condensed aerosol generators have to be dismantled, the following steps shall be accomplished:



- Remove power from the fire detection system and ensure that it cannot be switched on;



- Disconnect the power wires from the condensed aerosol generators and ensure that they cannot be connected;



- Ensure that you are standing firmly and comply with the rules for working at height (Working Conditions Act);



- Remove the condensed aerosol generators by unscrewing the bolts and nuts holding them;



- Carefully remove the condensed aerosol generator from the brackets and place it on a stable surface;



- After removing the condensed aerosol generators, put the fire detection and alarm installation back into operation in accordance with the guidance of the Authority Having Jurisdiction.



- If the condensed aerosol generators have been activated and are still warm, wear heat-resistant gloves.

### 15.4 Waste and Environment

After activation the condensed aerosol generators may be disposed of as normal waste after dismantling.

If a condensed aerosol generator has been removed from service *but it has not been activated and it still contains the solid aerosol-forming compound SBK*, the generator must be returned to Hochiki America Corporation for proper disposal.

## 16 Appendix A – Material Safety Data Sheets (MSDS)

### **Hochiki America Corporation**

Issue date: 09.05.2012

<b>1. Identification of the Substance/Company</b>						
1.1	Trade name	: <b>FireNET Xtinguish</b>				
1.2	Manufacturer/Supplier	: Hochiki America Corporation Phone : (714)-522-2246 Fax : (714)-522-2268 e-mail : technicalsupport@hochiki.com website : www.hochiki.com				
1.3	Telephone number in case of emergency: (714)-522-2246					
<b>2. Composition/Information on Ingredients</b>						
2.1	Component	Wt. %	CAS No.	EINECS	Class, R and S phrases	
	Potassium Nitrate	77	7757-79-1	231-818-8	See section 15	
	Potassium Carbonate	4	584-08-7	209-529-3	See section 15	
	Magnesium	<1	7439-95-4	231-104-6	See section 15	
	Epoxy Resin Polymer	18	25068-38-6	any "polimerizate, polycondensate, or polyadduct" is exempted by 81/437/EEG	See section 15	
<b>3. Hazards Identification</b>						
3.	<ul style="list-style-type: none"> <li>- Hazards for humans related to the SBK solid compound has not been found.</li> <li>- Hazards for humans related to the aerosol released by the solid compound have not been established because TLV's are not applicable.</li> <li>- Signs and symptoms related to the aerosol phase are only referred to acute exposure and/or chronic overexposures, while in real life the exposure will be very short (i.e. in the event of an accidental discharge when people were not evacuated on time).</li> </ul>					
	For humans					
3.1	Threshold Limit Values		: None established			
	Signs and Symptoms by acute exposure					
	Eye Contact		: At normal contact no injury			
	Inhalation		: Not a likely route of entry			
	Skin Contact		: At normal contact no injury			
	Ingestion		: At normal contact no injury			
Chronic Overexposure		: At normal contact no injury				
Medical Conditions Generally Aggravated by Exposure		: None known				
For Environment		: None established				
<b>4. First-Aid Measures</b>						
First-Aid measures are referred to acute exposure and/or chronic over exposure						
4.1	Inhalation		: Remove from exposure area to fresh air.			
	Eye Contact		: If necessary wash eyes.			
	Skin Contact		: Change clothing and shoes. Wash skin with soap.			
	Ingestion		: Not likely.			

<b>5.</b>	<b>Firefighting Measures</b>	
5.1	Extinguishing Media	: This is an Extinguishing Agent
5.2	Unusual Fire and Explosion Hazards	: The material does not present an explosion danger. It can be ignited by means of a fire. Hot aerosol is present in the close up area of the outlets
5.3	Special Procedures	: In places where there is a fire always wear personal protecting equipment and clothing
<b>6.</b>	<b>Accidental Release Measures</b>	
	Personal Precautions	
6.1	Respiratory Protection	: at normal contact not needed
	Hand Protection	: at normal contact not needed
	Eye Protection	: at normal contact not needed
	Skin and Body Protection	: at normal contact not needed
6.2	Environmental Precautions	
	Waste Disposal Methods	: See section 13
6.3	Clean up Precautions	: Sweep up
<b>7.</b>	<b>Handling and storage</b>	
7.1	Handling Precautions	: Avoid contact with combustible materials.
7.2	Storage Precautions	: Should be stored in original container. Keep dry.
	Storage Class	: 9 miscellaneous , solid
<b>8.</b>	<b>Exposure Controls and Personal Protection</b>	
8.1	Exposure	: Before entering a room with the material in aerosol phase vent properly to avoid unnecessary exposure.
	Personal protection	
8.2	Respiratory Protection	: at normal contact not needed
	Hand Protection	: at normal contact not needed
	Eye Protection	: at normal contact not needed
	Skin and Body Protection	: at normal contact not needed
<b>9.</b>	<b>Physical and Chemical Characteristics</b>	
.1	Appearance	: Solid
	Color	: Off white
	Odor	: None
	Relative Density	: Not applicable
	Solubility in water	: Insoluble
	Ph (if in water, % Conc.)	: Not determined
	Boiling Point	: Not applicable
	Vapor Pressure (mm Hg)	: Not applicable
	Vapor Density	: Not applicable
	Flash Point	: Not applicable
	Flammability Limits in Air (% by volume)	: Not applicable
	Auto Flammability	: Not applicable
	Explosive Properties	: Not applicable
	Oxidizing Properties	: Not determined
<b>10.</b>	<b>Stability and Reactivity</b>	
10.1	Stability	: Stable
	Conditions to avoid	: None known
10.2	Hazardous Reactions	: Will not occur
	Conditions to avoid	: None known
10.3	Materials to Avoid	: None known
10.4	Hazardous Decompositions Products	: None ascertained

<b>11. Toxicological Information</b>	
11.	The TLV's (Threshold Limit Values) of the chemicals released in the aerosol phase are applicable only in case of long, as long as a complete professional life, exposure. This is not the case of a real life situation.
11.1	Product The potential damage is not caused by the product mixture composition, but by the fact that it is respirable. The TLV's apply in case of long exposure, sometimes exposure during a complete professional life, whilst in this case is once only and short (in case of accidental discharge when evacuation does not take place on time). In case of fire the toxicity is caused by the fire itself and the products involved in the fire.
<b>11.2 Components</b>	
11.2	Potassium Nitrate Toxicity : Oral LD <sub>50</sub> (rat) 3750 mg/Kg Target Organs : Blood, central nervous system
	Potassium Carbonate Toxicity : Oral LD <sub>50</sub> (rat) 1870 mg/Kg / Oral LD <sub>50</sub> (mouse) 2570 mg/Kg Target Organs : Respiratory system
	Magnesium Toxicity : Oral LD <sub>50</sub> (dog) 230 mg/Kg Target Organs : Central nervous system, liver, kidneys
	Epoxy Resin Polymer Toxicity : Oral LD <sub>50</sub> (rat) 11.4 g/Kg Irritation Data : Skin (guinea pig) 2750 mg/55 days Inert Eye (rabbit) 100 mg Mild
<b>12. Ecological Information</b>	
12.1	Mobility : with present data no problems Absorption/Desorption : with present data no problems
12.2	Degradability : with present data no problems Biotic and Abiotic Degradation : with present data no problems Aerobic and Anaerobic Degradation : with present data no problems Persistence : with present data no problems
12.3	Accumulation : with present data no problems Bioaccumulation Potential : with present data no problems Biomagnification : with present data no problems
<b>12.3 Short and Long Term Effects on</b>	
12.3	Ecotoxicity : with present data no problems Aquatic Organisms : with present data no problems Soil Organisms : with present data no problems Plants and Terrestrial animals : with present data no problems
<b>12.4 Other Adverse Effects</b>	
12.4	Ozone Depleting Potential (ODP) : none Photochemical Ozone Creation Potential : none Global Warming Potentials (GWP) : none Effects on Waste Water Treatment : none Plants : with present data no problems
<b>13. Disposal Considerations</b>	
13.1	Dispose of in Compliance with local, state and national regulations.
<b>14. Transportation Information</b>	
14.1	Hazard Class or Division : 9 miscellaneous, solid : For additional transport information contact Hochiki America Corporation

<b>Regulatory Information</b>	
15.	For 15.1 Components:
	The EU classification and R&S phrases, referred to the components of the SBK compound are related only to the single components considered as separate chemical entities. Once mixed in the production of the SBK compound, the risk sentences of the single components are not applicable being the SBK compound a separate chemical entity.

<b>Product</b>				
15.1	Potassium Nitrate	EU Classification R Phrases  S Phrases	Oxidizer 8  16  41	- Contact with combustible material may cause fire Keep away from sources of ignition – No smoking In case of fire and/or explosion, do not breathe fumes
	Potassium Carbonate	EU Classification R Phrases  S Phrases	Irritant 22 36/37/38  26  37/39	- Harmful if swallowed Irritating to eyes, respiratory system and skin In case of contact with eyes, rinse immediately with plenty of water and seek medical advice Wear suitable gloves and eye/face protection
	Magnesium	EU Classification R Phrases  S Phrases	Flammable 15  17 2 43 7/8	- Contact with water liberates highly flammable gases Spontaneously flammable in air Keep out of reach of children In case of fire never use water Keep container tightly closed and dry
	Epoxy Resin Polymer	EU Classification R Phrases  S Phrases	Irritant 36/38 43  53 28  37/39  61	- Irritating to eyes and skin May cause sensitisation by skin contact May cause long-term adverse effects in the aquatic environment In case of contact with skin, rinse with water Wear suitable gloves and eye/face protection Avoid release to the environment. Refer to special instructions/ Safety Data Sheets
	Limit Values for Exposure EINECS Status Restrictions on Marketing and Use	: None listed : All components are included in EINECS inventories : None (Refer to any other national measures that may be relevant)		

<b>16. Other Information</b>	
16.1	None Known

<b>17. Disclaimer</b>	
17.1	The data in the above material safety data sheet reflect the current state of knowledge of our product and shall be used only as a guideline. No binding statements as to the contractually agreed product characteristics may be inferred there from.

## 17 Appendix B – FireNET Xtinguish Aerosol Generators



**FNX-20S**



**FNX-40S**



**FNX-80S**



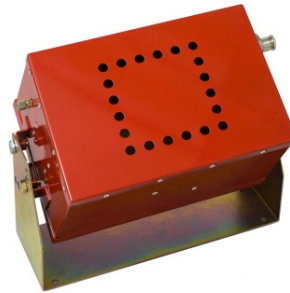
**FNX-100S**



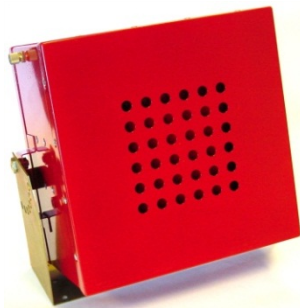
**FNX-200S**



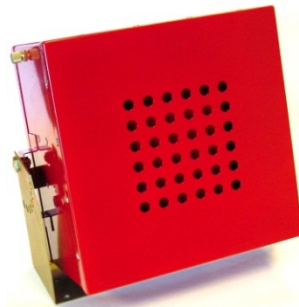
**FNX-500S**



**FNX-1200**



**FNX-2000**



**FNX-3000**







**FNX-5700**










## 18 Appendix C – FireNET Xtinguish Generator Datasheets

FireNET Xtinguish Condensed Aerosol Generators: Technical Information Summary														
Model	Weight (g)		Dimension (mm)			Activation mode <sup>(1)</sup>	Distance from generator's outlet at T <sub>N</sub> temperature (m)			Aerosol discharge time (s)		Stream length - (m)	Number of discharge outlet	
	Gross	Net	Height	Diameter			Electrical	T <sub>1</sub>	T <sub>2</sub>	Min	Max		1	2
				Height	Width									
FNX-20S	310	20	165	32		✓	0	0.1	3	6	1	✓		
FNX-40S	610	40	140	51		✓	0	0.1	5	10	1	✓		
FNX-80S	870	80	185	51		✓	0	0.1	5	10	2	✓		
FNX-100S	1370	100	155	84		✓	0	0.15	5	10	1.0	✓		
FNX-200S	1840	200	185	84		✓	0.3	0.55	5	10	2.0	✓		
FNX-500S	3340	500	280	84		✓	0.4	0.8	5	10	2.0	✓		
FNX-1200	10900	1200	167	216	300	✓	0.25	1.65	15	20	3.5	✓		
FNX-2000	15500	2000	185	300	300	✓	0.5	1.4	15	20	3.5	✓		
FNX-3000	16300	3000	185	300	300	✓	1.0	2.2	15	20	3.5	✓		
FNX-5700	26400	5700	300	300	300	✓	0.85	2.2	15	20	5.0	✓		

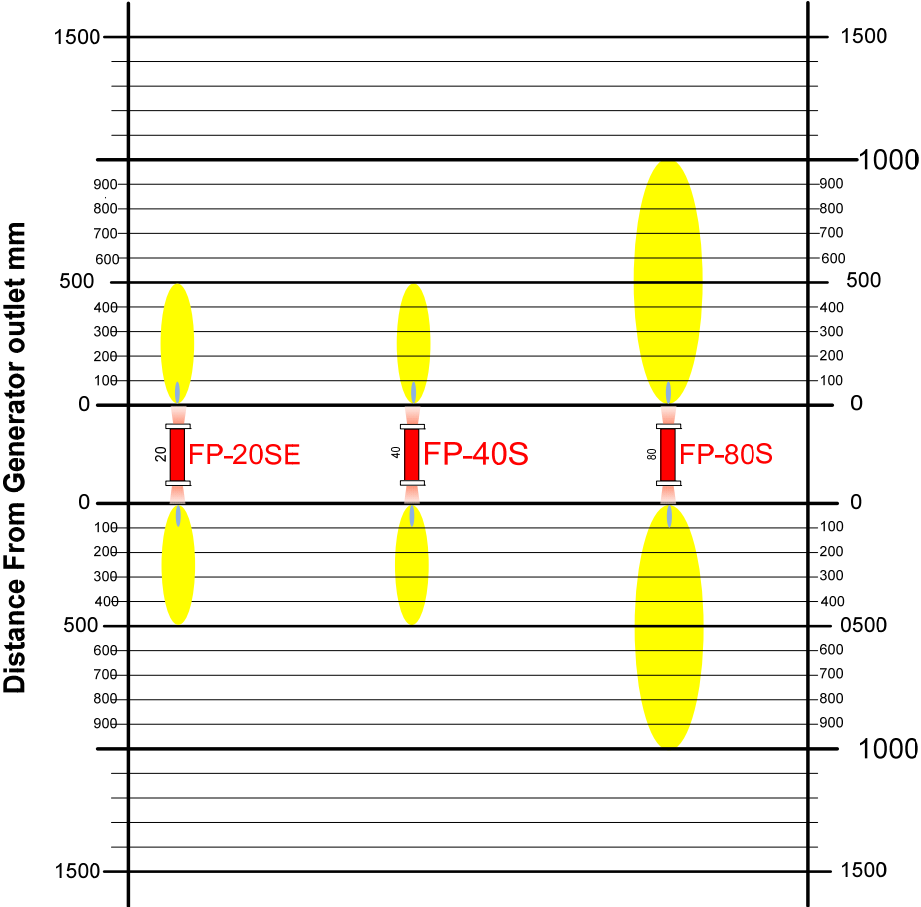
Note and Legend	
Symbol	Description
T <sub>1</sub>	Aerosol stream temperature from generator discharge outlet equal or less than 200° C
T <sub>2</sub>	Aerosol stream temperature from generator discharge outlet equal or less than 75° C
(1)	In case of generator activation failure, the SBK (solid compound) will automatically start the aerosol forming reaction when the temperature reaches 300 degrees C.

Activation Mode		Max volume protected	
	Electrical activation		Max volume protected for Class "A" Fire
			Max volume protected for Class "B" Fire
			Max volume protected for Class "C" Fire

Classification of fires			
Europe: CEN Standard EN2 * International: ISO Standard 3941		NFPA 10	
Following the <b>EN 2 Classification of Fire</b> the fire classification identify the combustible material originating the fire:		Following the <b>NFPA 10 Standard for portable fire extinguisher</b> the fire classification identify the combustible material originating the fire:	
	<b>CLASS "A"</b> Fire involving <b>solid materials</b> , usually of an organic nature (such as paper, wood, plastics and so on), in which combustion normally takes place with the formation of glowing embers.	Fire in ordinary combustible materials such as wood, cloth, paper, rubber and many plastics.	<b>CLASS "A"</b> 
	<b>CLASS "B"</b> Fires involving <b>flammable liquids</b> or liquefiable solids such as paraffin, petrol, oil and so on	Fires in flammable liquids, oil, greases, tars, oil base paints, lacquers and flammable gases.	<b>CLASS "B"</b> 
	<b>CLASS "C"</b> Fire involving <b>flammable gases</b> such as propane, butane, methane and so on.		
	<b>CLASS "D"<sup>(1)</sup></b> Fire involving <b>metals</b> such as aluminium, magnesium, titanium and so on.	Fires in combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.	<b>CLASS "D"<sup>(1)</sup></b> 
<b>E</b>	<b>CLASS "E"<sup>(2)</sup></b> Fires involving <b>electrical apparatus</b>	Fire which involve energized electrical, non-conductivity of the extinguishing medium is of importance. (When electrical equipment is de-energized, extinguishers for Class "A" or "B" fires may be used safely).	<b>CLASS "C"</b> 
	<b>CLASS "F"</b> Fire involving cooking oils and fat and such like.	Fire involving cooking grease, fats and oils.	<b>CLASS "K"<sup>(3)</sup></b> <b>K</b>
Note:		(*) Comite European de Normalisation (CEN standard EN2) closely follows ISO standard 3941 (1) FireNET Xtinguish is not suitable to extinguish Class D fires (see technical manual) (2) Code of practice definition, not included inside EN2 (3) Not tested to Class K fires	

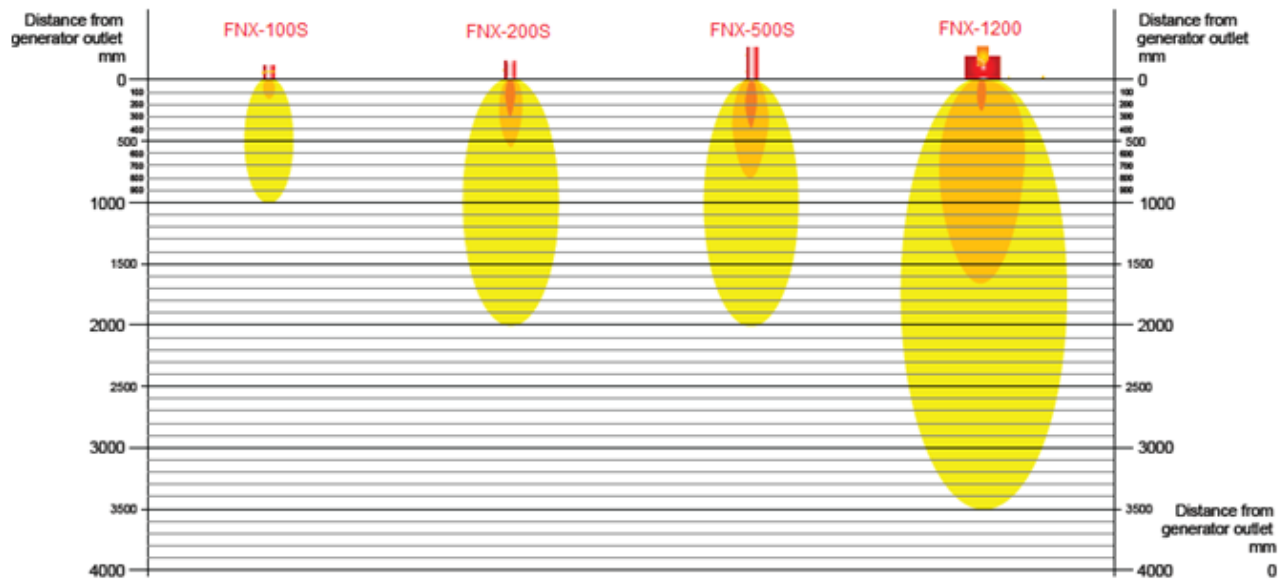


**FireNET Xtinguish - Height of Installation and Minimum Clearances**



**LEGEND**

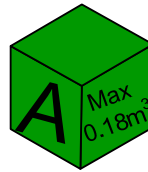
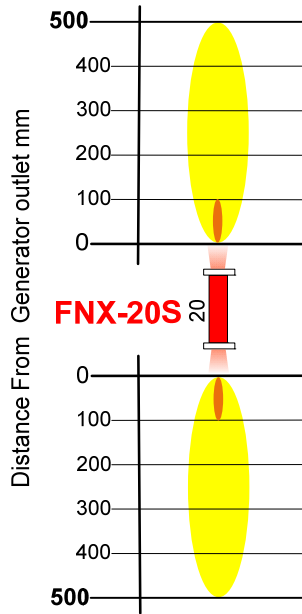
- Maximum height of installation
- Minimum clearance from persons
- Minimum clearance from combustible materials
- Minimum clearance from construction structure



**LEGEND**

- Maximum height of installation
- Minimum clearance from persons
- Minimum clearance from combustible material

## FireNET Xtinguish Condensed Aerosol Generators: FNX-20S



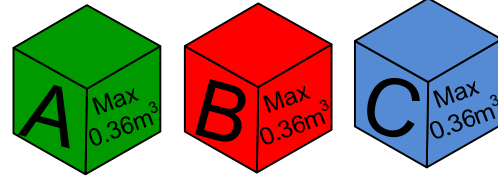
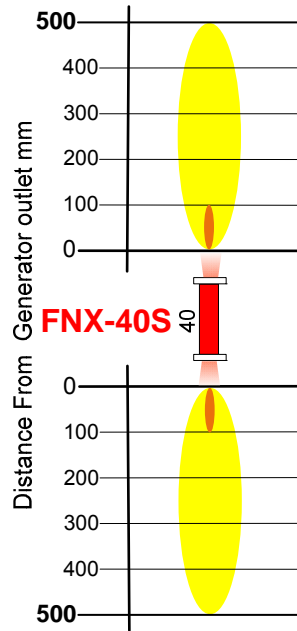
**LEGEND**

- Maximum height of installation
- Minimum clearance from persons
- Minimum clearance from combustible materials
- Minimum clearance from construction structure

### Technical Data

<b>Mass of SBK</b> (Aerosol Generating Solid Compound)	20 g				
<b>Generator gross weight</b>	<b>Weight</b>		<b>Tolerance</b>		
	310 g		± 5%		
<b>Activation mode</b>	<b>Electrical</b>				
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s				
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance				
<b>Activation line supervision current (Max)</b>	5 mA				
<b>Aerosol discharge time</b>	<b>Min.</b>		<b>Max</b>		
	3 seconds		6 seconds		
<b>Number of discharge outlets</b>	2				
<b>Generator dimensions</b>	<b>Height</b>		<b>Diameter</b>		
	165 mm		32 mm		
<b>Self-activation temperature of SBK</b>	300° C				
<b>Classes of Fire</b> (NFPA 2010)	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>K</b>
	√	√	√	NO	NO
<b>Generator Coverage Constraints</b>	Min ht.: 0.45 m	Max area: 0.24 m <sup>2</sup>		Max throw: 0.27 m	
<b>Maximum height of installation</b>	1.0 m				
<b>Minimum clearance</b> (mm)	<b>From persons</b>		<b>From combustible material</b>		<b>From Generator Casing</b>
	100 mm		0 mm		6.4 mm
<b>Environmental parameters</b>	<b>ODP<sup>1</sup></b>		<b>GWP<sup>2</sup></b>		<b>ALT<sup>3</sup></b>
	Zero		Zero		Negligible <sup>4</sup>
<b>Technical Parameters</b>	<b>Electrical conductivity</b>		<b>Corrosion</b>		<b>Oxygen depletion After discharge</b>
	Nil up to 24KV		Negligible <sup>4</sup>		Negligible <sup>4</sup>
<b>Notes</b>	<b>1</b>	ODP: Ozone Depletion Potential		<b>3</b>	ALT: Atmospheric Life Time
	<b>2</b>	GWP: Global Warming Potential		<b>4</b>	Within the parameters for use

## FireNET Xtinguish Condensed Aerosol Generators: FNX-40S

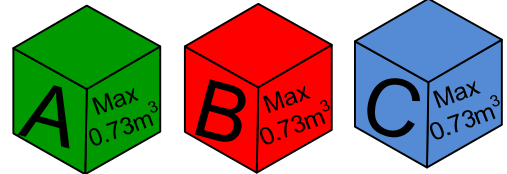
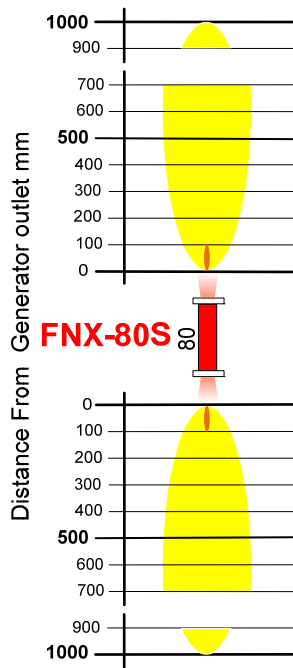


LEGEND	
<span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span>	Maximum height of installation
<span style="display: inline-block; width: 15px; height: 15px; background-color: orange; border: 1px solid black;"></span>	Minimum clearance from persons
<span style="display: inline-block; width: 15px; height: 15px; background-color: lightcoral; border: 1px solid black;"></span>	Minimum clearance from combustible materials
<span style="display: inline-block; width: 15px; height: 15px; background-color: red; border: 1px solid black;"></span>	Minimum clearance from construction structure

### Technical Data

<b>Mass of SBK</b> (Aerosol Generating Solid Compound)	40 g					
<b>Generator gross weight</b>	<b>Weight</b>		<b>Tolerance</b>			
	610 g		± 5%			
<b>Activation mode</b>	<b>Electrical</b>					
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s					
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance					
<b>Activation line supervision current (Max)</b>	5 mA					
<b>Aerosol discharge time</b>	<b>Min.</b>		<b>Max</b>			
	5 seconds		10 seconds			
<b>Number of discharge outlets</b>	2					
<b>Generator dimensions</b>	<b>Height</b>		<b>Diameter</b>			
	140 mm		51 mm			
<b>Self-activation temperature of SBK</b>	300° C					
<b>Classes of Fire</b> (NFPA 2010)	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>K</b>	
	√	√	√	NO	NO	
<b>Generator Coverage Constraints</b>	Min ht.: 0.45 m	Max area: 0.48 m <sup>2</sup>		Max throw: 0.54 m		
<b>Maximum height of installation</b>	1 m					
<b>Minimum clearance (mm)</b>	<b>From persons</b>		<b>From combustible material</b>		<b>From Generator's Casing</b>	
	100 mm		0 mm		6.4 mm	
<b>Environmental parameters</b>	<b>ODP<sup>1</sup></b>		<b>GWP<sup>2</sup></b>		<b>ALT<sup>3</sup></b>	
	Zero		Zero		Negligible <sup>4</sup>	
<b>Technical Parameters</b>	<b>Electrical conductivity</b>		<b>Corrosion</b>		<b>Oxygen depletion After discharge</b>	
	Nil up to 24KV		Negligible <sup>4</sup>		Negligible <sup>4</sup>	
<b>Notes</b>	<b>1</b>	ODP: Ozone Depletion Potential			<b>3</b>	ALT: Atmospheric Life Time
	<b>2</b>	GWP: Global Warming Potential			<b>4</b>	Within the parameters for use

## FireNET Xtinguish Condensed Aerosol Generators: FNX-80S



**LEGEND**

- Maximum height of installation
- Minimum clearance from persons
- Minimum clearance from combustible materials
- Minimum clearance from construction structure

### Technical Data

<b>Mass of SBK (Aerosol Generating Solid Compound)</b>	80 g				
<b>Generator gross weight</b>	<b>Weight</b>		<b>Tolerance</b>		
	870 g		± 5%		
<b>Activation mode</b>	<b>Electrically</b>				
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s				
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance				
<b>Activation line supervision current (Max)</b>	5 mA				
<b>Aerosol discharge time</b>	<b>Min.</b>		<b>Max</b>		
	5 seconds		10 seconds		
<b>Number of discharge outlets</b>	2				
<b>Generator dimensions</b>	<b>Height</b>		<b>Diameter</b>		
	185 mm		51 mm		
<b>Self-activation temperature of SBK</b>	300° C				
<b>Classes of Fire (NFPA 2010)</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>K</b>
	√	√	√	NO	NO
<b>Generator Coverage Constraints</b>	Min ht.: 0.45 m		Max area: 0.95 m <sup>2</sup>	Max throw: 1.06 m	
<b>Maximum height of installation</b>	2 m				
<b>Minimum clearance (mm)</b>	<b>From persons</b>		<b>From combustible material</b>		<b>From Generator Casing</b>
	100 mm		0 mm		6.4 mm
<b>Environmental parameters</b>	<b>ODP<sup>1</sup></b>		<b>GWP<sup>2</sup></b>		<b>ALT<sup>3</sup></b>
	Zero		Zero		Negligible <sup>4</sup>
<b>Technical Parameters</b>	<b>Electrical conductivity</b>		<b>Corrosion</b>		<b>Oxygen depletion After discharge</b>
	Nil up to 24KV		Negligible <sup>4</sup>		Negligible <sup>4</sup>
<b>Notes</b>	<b>1</b>	ODP: Ozone Depletion Potential		<b>3</b>	ALT: Atmospheric Life Time
	<b>2</b>	GWP: Global Warming Potential		<b>4</b>	Within the parameters for use

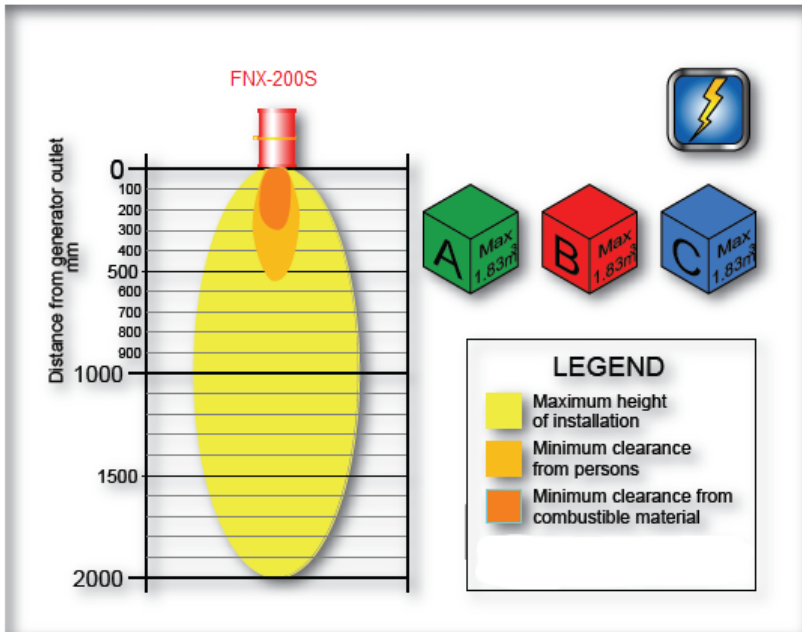
## FireNET Xtinguish Condensed Aerosol Generators - FNX-100S

FNX-100S

### Technical Data

<b>Mass of SBK (Aerosol Generating Solid Compound)</b>	100 g				
<b>Generator gross weight</b>	Weight	Tolerance			
	1370g	± 5%			
<b>Activation mode/s</b>	Electrically				
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s				
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance				
<b>Activation line supervision current (Max)</b>	5 mA				
<b>Aerosol discharge time</b>	Min.	Max			
	5 seconds	10 seconds			
<b>Number of discharge outlet</b>	1				
<b>Generator dimension</b>	Height	Diameter			
	155mm	84mm			
<b>Self activation temperature of SBK</b>	300° C				
<b>Classes of Fire (NFPA 2010)</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>K</b>
	✓	✓	✓	NO	NO
<b>Minimum height and Maximum area coverage</b>	0.45m (h)			2.65 m <sup>2</sup>	
<b>Maximum height of installation</b>	1 m				
<b>Minimum clearance (mm)</b>	From persons	From combustible material		From generator casing	
	150	0		6.4	
<b>Environmental parameters</b>	ODP <sup>1</sup>	GWP <sup>2</sup>		ALT <sup>3</sup>	
	Zero	Zero		Negligible <sup>4</sup>	
<b>Technical Parameters</b>	Electrical conductivity	Corrosion		Oxygen depletion After discharge	
	Nil up to 24KV	Negligible <sup>4</sup>		Negligible <sup>4</sup>	
<b>Note</b>	1 ODP: Ozone Depletion Potential		3 ALT: Atmospheric Life Time		
	2 GWP: Global Warming Potential		4 Within the parameters for use		

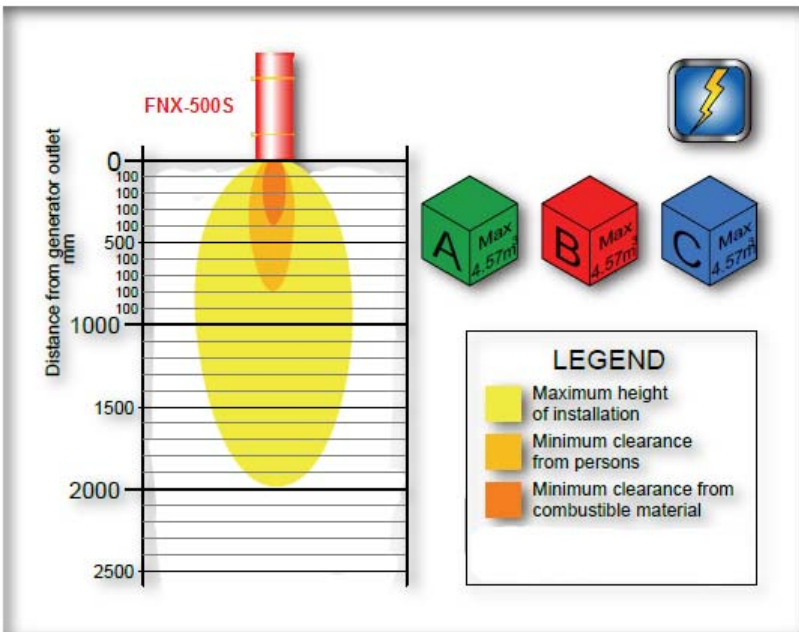
FireNET Xtinguish Condensed Aerosol Generators - FNX-200S



Technical Data

<b>Mass of SBK (Aerosol Generating Solid Compound)</b>	200 g				
<b>Generator gross weight</b>	Weight	Tolerance			
	1840g	± 5%			
<b>Activation mode/s</b>	Electrically				
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s				
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance				
<b>Activation line supervision current (Max)</b>	5mA				
<b>Aerosol discharge time</b>	Min.	Max			
	5 seconds	10 seconds			
<b>Number of discharge outlet</b>	1				
<b>Generator dimension</b>	Height	Diameter			
	185mm	84mm			
<b>Self activation temperature of SBK</b>	300° C				
<b>Classes of Fire (NFPA 2010)</b>	A	B	C	D	K
	✓	✓	✓	NO	NO
<b>Minimum height and Maximum area coverage</b>	0.45m (h)			5.29 m <sup>2</sup>	
<b>Maximum height of installation</b>	2 m				
<b>Minimum clearance (mm)</b>	From persons	From combustible material		From Generator Casing	
	550	300		6.4	
<b>Environmental parameters</b>	ODP <sup>1</sup>	GWP <sup>2</sup>		ALT <sup>3</sup>	
	Zero	Zero		Negligible <sup>4</sup>	
<b>Technical Parameters</b>	Electrical conductivity	Corrosion		Oxygen depletion After discharge	
	Nil up to 24KV	Negligible <sup>4</sup>		Negligible <sup>4</sup>	
<b>Note</b>	1	ODP: Ozone Depletion Potential		3	ALT: Atmospheric Life Time
	2	GWP: Global Warming Potential		4	Within the parameters for use

FireNET Xtinguish Condensed Aerosol Generators - FNX-500S

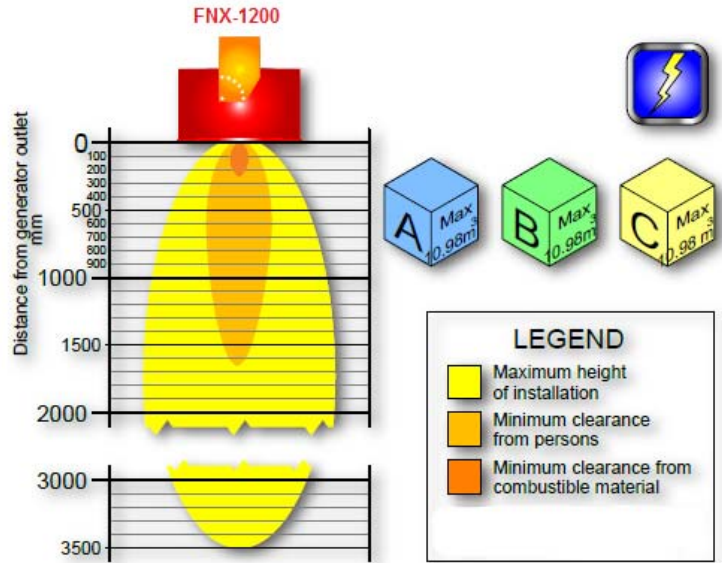


Technical Data

Mass of SBK (Aerosol Generating Solid Compound)	500 g				
Generator gross weight	Weight	Tolerance			
	3340 g	± 5%			
Activation mode/s	Electrically				
Value of activation	6/12/24/36 V D/C 0.8 A 3-4 s				
SBK activation device	Heating elements with 1.6-3.6 Ω Resistance				
Activation line supervision current (Max)	5 mA				
Aerosol discharge time	Min.	Max			
	5 seconds	10 seconds			
Number of discharge outlet	1				
Generator dimension	Height	Diameter			
	295 mm	84 mm			
Self activation temperature of SBK	300° C				
Classes of Fire (NFPA 2010)	A	B	C	D	K
	✓	✓	✓	NO	NO
Minimum height and Maximum area coverage	0.45m (h)			5.29 m <sup>2</sup>	
Maximum height of installation	2.0 m				
Minimum clearance (mm)	From persons	From combustible material		From Generator Casing	
	800	400		6.4	
Environmental parameters	ODP <sup>1</sup>	GWP <sup>2</sup>		ALT <sup>3</sup>	
	Zero	Zero		Negligible <sup>4</sup>	
Technical Parameters	Electrical conductivity	Corrosion		Oxygen depletion After discharge	
	Nil up to 24KV	Negligible <sup>4</sup>		Negligible <sup>4</sup>	
Note	1	ODP: Ozone Depletion Potential		3	ALT: Atmospheric Life Time
	2	GWP: Global Warming Potential		4	Within the parameters for use



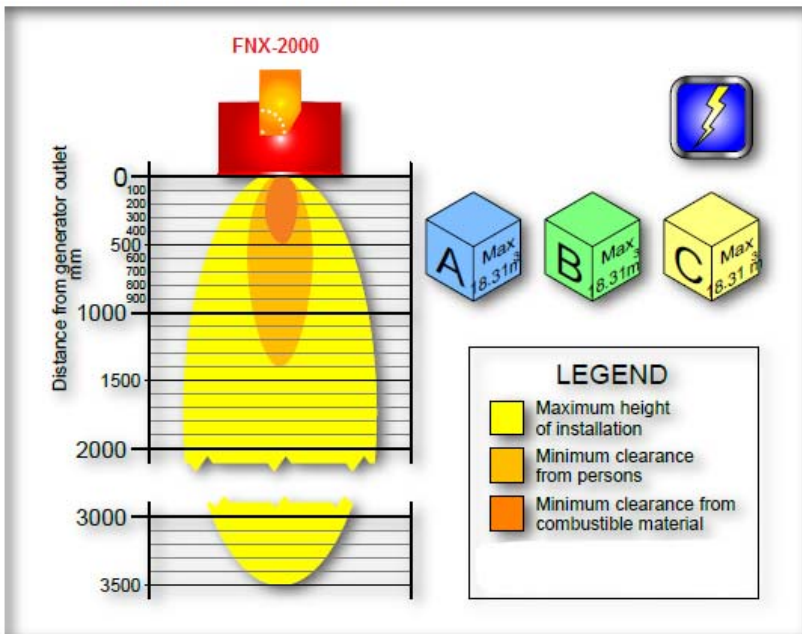
FireNET Xtinguish Condensed Aerosol Generators - FNX-1200



Technical Data

<b>Mass of SBK (Aerosol Generating Solid Compound)</b>	1200 g				
<b>Generator gross weight</b>	Weight	Tolerance			
	10900g	± 5%			
<b>Activation mode/s</b>	Electrically				
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s				
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance				
<b>Activation line supervision current (Max)</b>	5mA				
<b>Aerosol discharge time</b>	Min.	Max			
	15 seconds	20 seconds			
<b>Number of discharge outlet</b>	1				
<b>Generator dimension</b>	Height	Width	Length		
	167	216	300		
<b>Self activation temperature of SBK</b>	300° C				
<b>Classes of Fire (NFPA 2010)</b>	A	B	C	D	K
	✓	✓	✓	NO	NO
<b>Minimum height and Maximum area coverage</b>	0.45m (h)		32.03 m <sup>2</sup>		
<b>Maximum height of installation</b>	3.5 m				
<b>Minimum clearance (mm)</b>	From persons	From combustible material	From Generator Casing		
	1650	250	6.4		
<b>Environmental parameters</b>	ODP <sup>1</sup>	GWP <sup>2</sup>	ALT <sup>3</sup>		
	Zero	Zero	Negligible <sup>4</sup>		
<b>Technical Parameters</b>	Electrical conductivity	Corrosion	Oxygen depletion After discharge		
	Nil up to 24KV	Negligible <sup>4</sup>	Negligible <sup>4</sup>		
<b>Note</b>	1	ODP: Ozone Depletion Potential	3	ALT: Atmospheric Life Time	
	2	GWP: Global Warming Potential	4	Within the parameters for use	

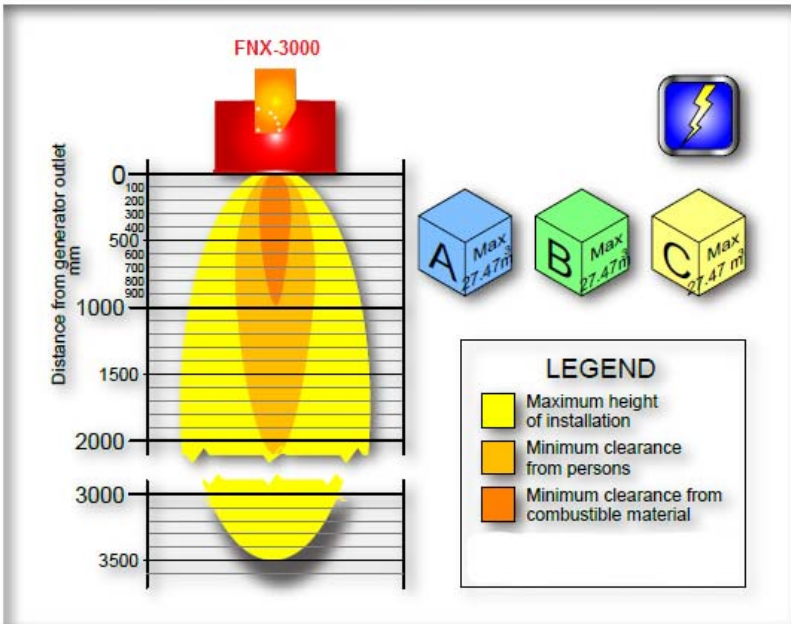
FireNET Xtinguish Condensed Aerosol Generators - FNX-2000



Technical Data

Mass of SBK (Aerosol Generating Solid Compound)	2000 g				
Generator gross weight	Weight	Tolerance			
	15500g	± 5%			
Activation mode/s	Electrically				
Value of activation	6/12/24/36 V D/C 0.8 A 3-4 s				
SBK activation device	Heating elements with 1.6-3.6 Ω Resistance				
Activation line supervision current (Max)	5mA				
Aerosol discharge time	Min.	Max			
	15 seconds	20 seconds			
Number of discharge outlet	1				
Generator dimension	Height	Width	Length		
	185	300	300		
Self activation temperature of SBK	300° C				
Classes of Fire (NFPA 2010)	A	B	C	D	K
	✓	✓	✓	NO	NO
Minimum height and Maximum area coverage	0.45m (h)			32.03 m <sup>2</sup>	
Maximum height of installation	3.5 m				
Minimum clearance (mm)	From persons	From combustible material	From Generator Casing		
	1400	500	6.4		
Environmental parameters	ODP <sup>1</sup>	GWP <sup>2</sup>	ALT <sup>3</sup>		
	Zero	Zero	Negligible <sup>4</sup>		
Technical Parameters	Electrical conductivity	Corrosion	Oxygen depletion After discharge		
	Nil up to 24KV	Negligible <sup>4</sup>	Negligible <sup>4</sup>		
Note	1	ODP: Ozone Depletion Potential	3	ALT: Atmospheric Life Time	
	2	GWP: Global Warming Potential	4	Within the parameters for use	

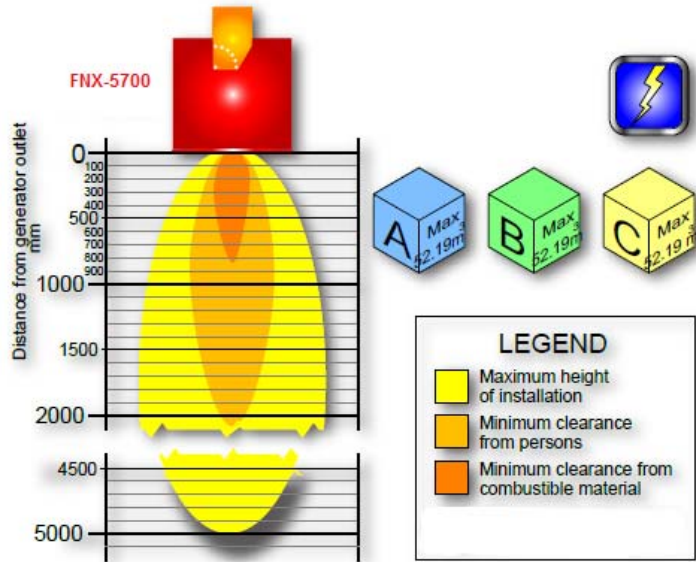
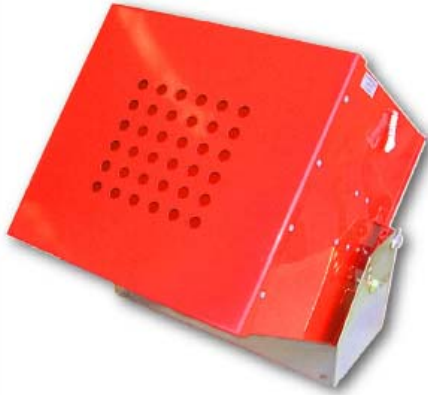
FireNET Xtinguish Condensed Aerosol Generators - FNX-3000



Technical Data

Mass of SBK (Aerosol Generating Solid Compound)	3000 g				
Generator gross weight	Weight	Tolerance			
	16300 g	± 5%			
Activation mode/s	Electrically				
Value of activation	6/12/24/36 V D/C 0.8 A 3-4 s				
SBK activation device	Heating elements with 1.6-3.6 Ω Resistance				
Activation line supervision current (Max)	5mA				
Aerosol discharge time	Min.	Max			
	15 seconds	20 seconds			
Number of discharge outlet	1				
Generator dimension	Height	Width	Length		
	185	300	300		
Self activation temperature of SBK	300° C				
Classes of Fire (NFPA 2010)	A	B	C	D	K
	✓	✓	✓	NO	NO
Minimum height and Maximum area coverage	0.45m (h)		32.03 m <sup>2</sup>		
Maximum height of installation	3.5 m				
Minimum clearance (mm)	From persons	From combustible material		From Generator Casing	
	2200	1000		6.4	
Environmental parameters	ODP <sup>1</sup>	GWP <sup>2</sup>		ALT <sup>3</sup>	
	Zero	Zero		Negligible <sup>4</sup>	
Technical Parameters	Electrical conductivity	Corrosion		Oxygen depletion After discharge	
	Nil up to 24KV	Negligible <sup>4</sup>		Negligible <sup>4</sup>	
Note	1	ODP: Ozone Depletion Potential		3	ALT: Atmospheric Life Time
	2	GWP: Global Warming Potential		4	Within the parameters for use

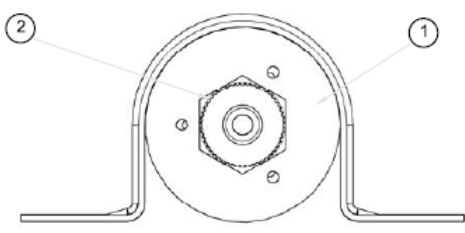
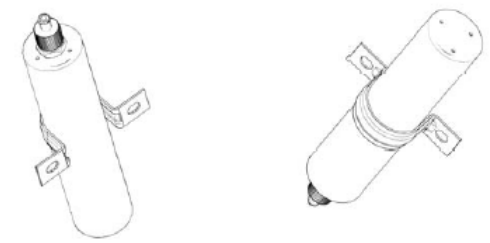
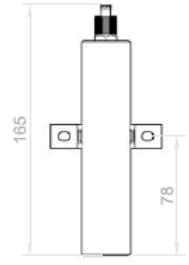
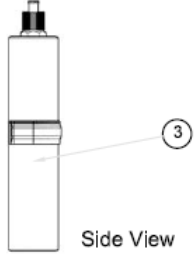
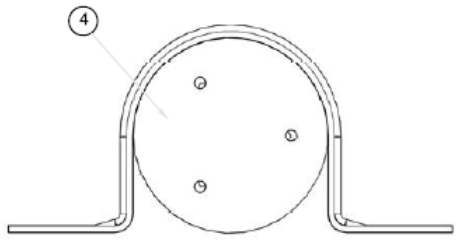
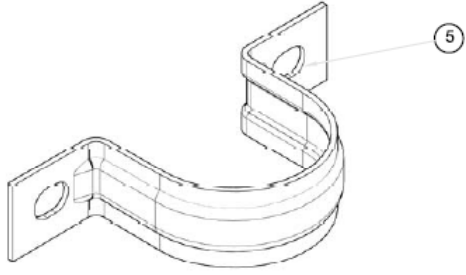
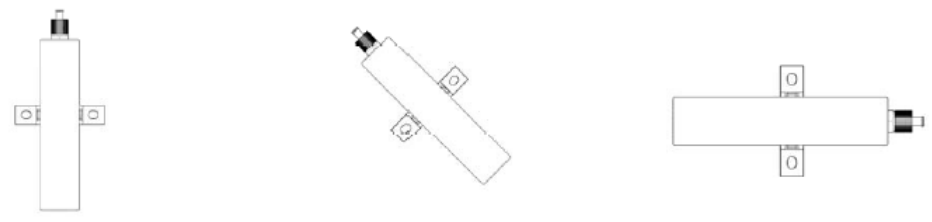
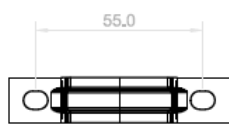
FireNET Xtinguish Condensed Aerosol Generators - FNX-5700

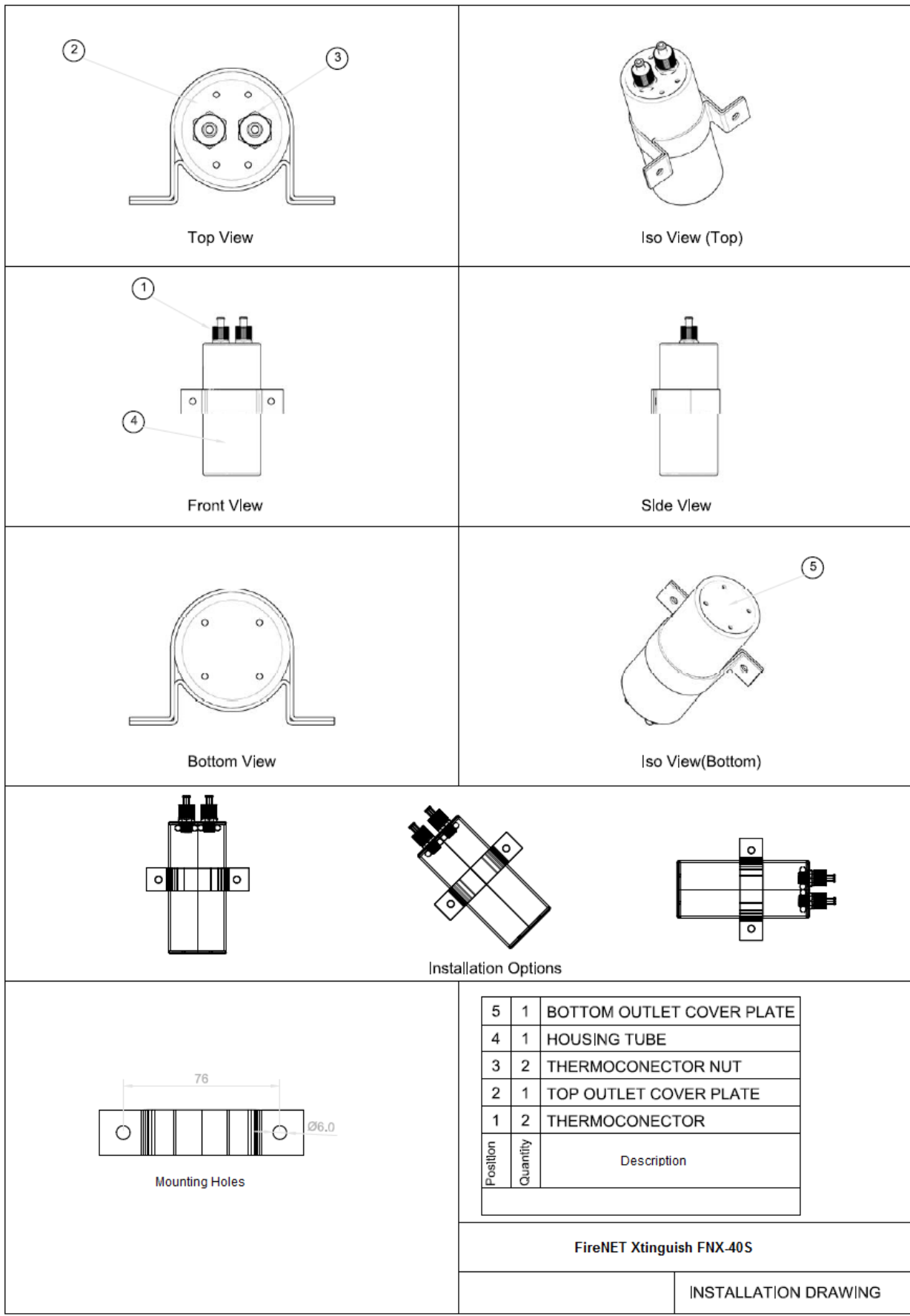


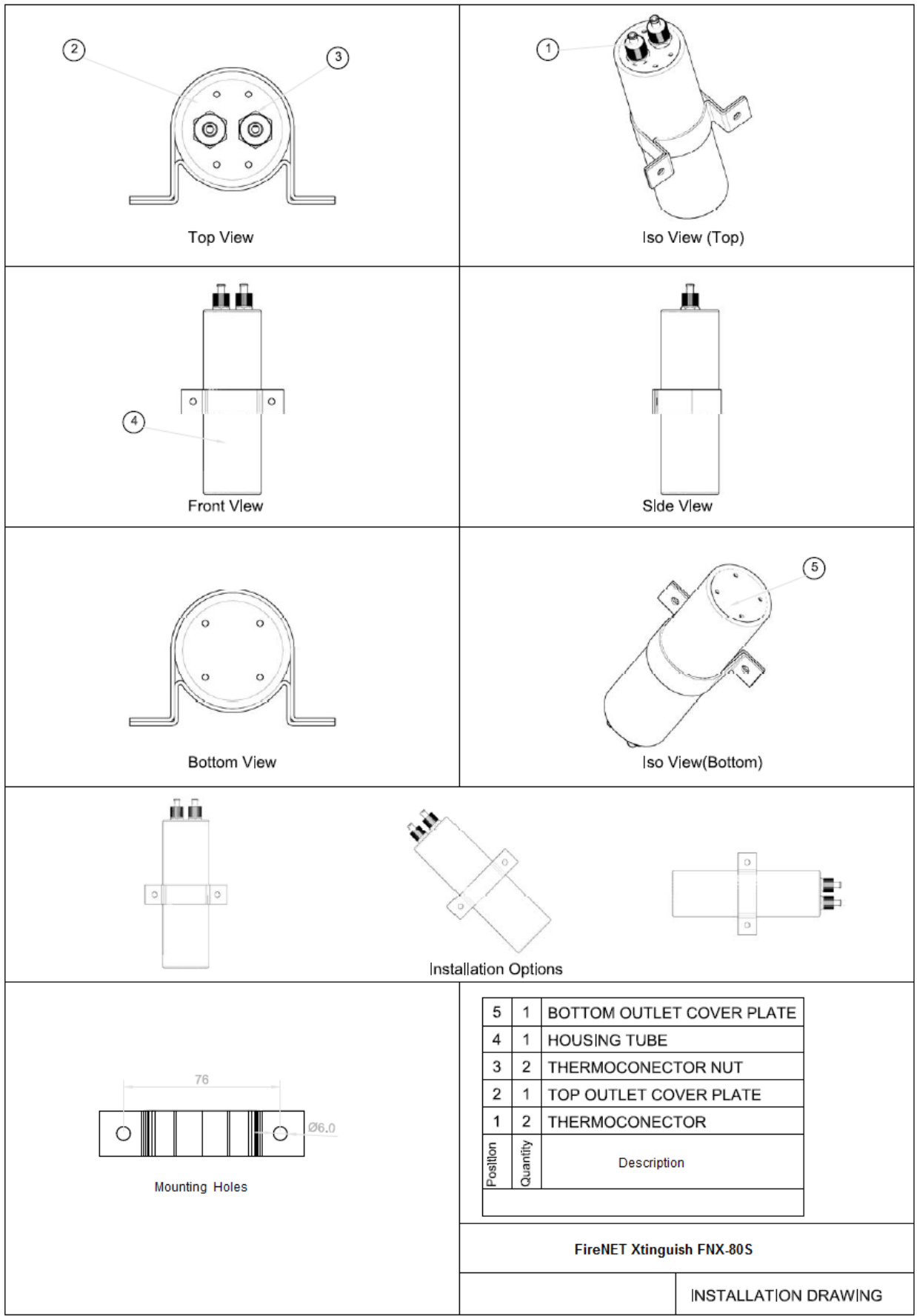
Technical Data

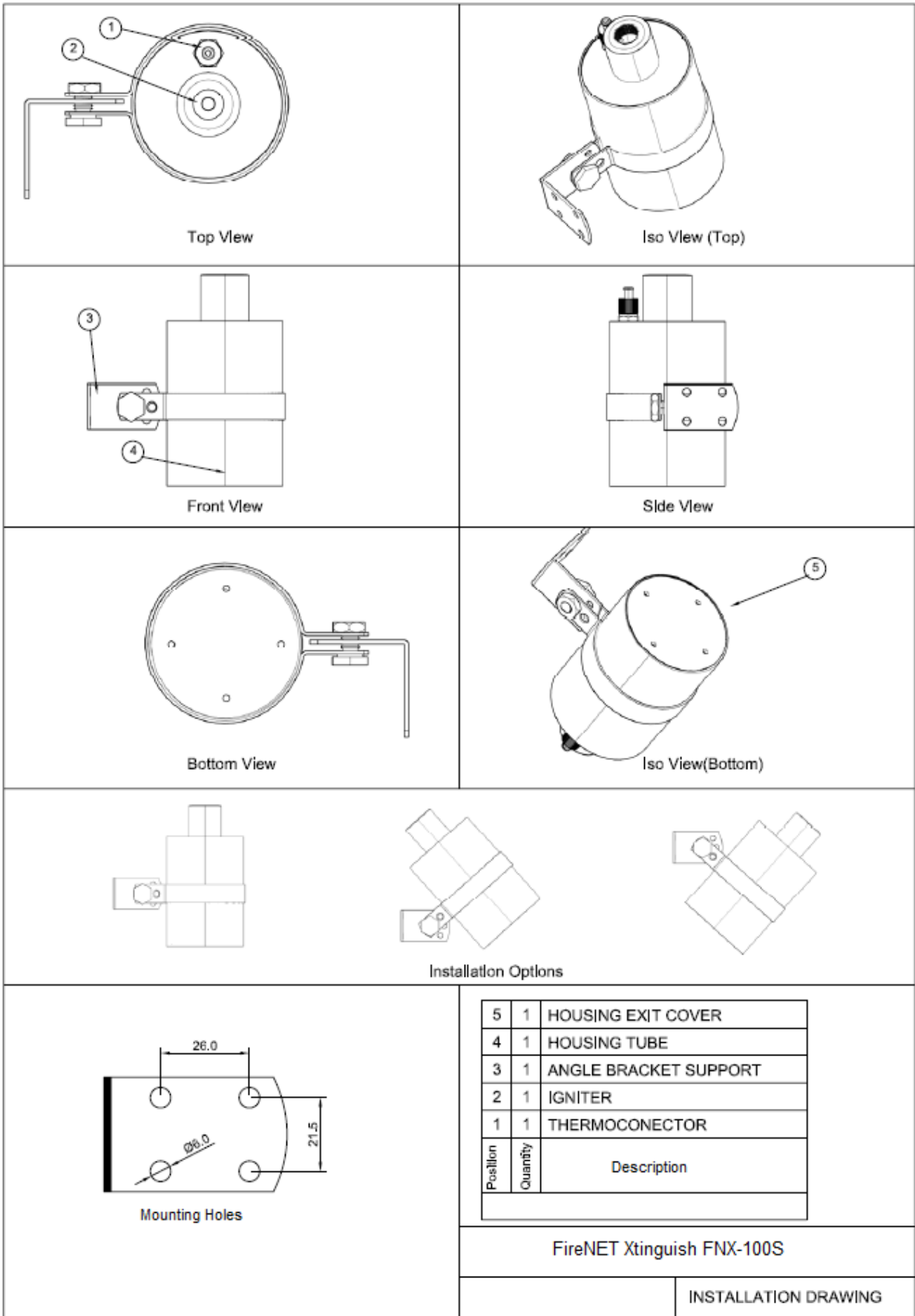
<b>Mass of SBK (Aerosol Generating Solid Compound)</b>	5700 g minimum				
<b>Generator gross weight</b>	Weight	Tolerance			
	26400 g	± 5%			
<b>Activation mode/s</b>	Electrically				
<b>Value of activation</b>	6/12/24/36 V D/C 0.8 A 3-4 s				
<b>SBK activation device</b>	Heating elements with 1.6-3.6 Ω Resistance				
<b>Activation line supervision current (Max)</b>	5 mA				
<b>Aerosol discharge time</b>	Min.	Max			
	15 seconds	20 seconds			
<b>Number of discharge outlet</b>	1				
<b>Generator dimension</b>	Height	Width	Length		
	300	300	300		
<b>Self activation temperature of SBK</b>	300° C				
<b>Classes of Fire (NFPA 2010)</b>	A	B	C	D	K
	✓	✓	✓	NO	NO
<b>Minimum height and Maximum area coverage</b>	0.45m (h)		32.03 m <sup>2</sup>		
<b>Maximum height of installation</b>	5.0 m				
<b>Minimum clearance (mm)</b>	From persons	From combustible material	From Generator Casing		
	2200	850	6.4		
<b>Environmental parameters</b>	ODP <sup>1</sup>	GWP <sup>2</sup>	ALT <sup>3</sup>		
	Zero	Zero	Negligible <sup>4</sup>		
<b>Technical Parameters</b>	Electrical conductivity	Corrosion	Oxygen depletion After discharge		
	Nil up to 24KV	Negligible <sup>4</sup>	Negligible <sup>4</sup>		
<b>Note</b>	1	ODP: Ozone Depletion Potential	3	ALT: Atmospheric Life Time	
	2	GWP: Global Warming Potential	4	Within the parameters for use	

# 19 Appendix D – FireNET Xtinguish Generator Drawings

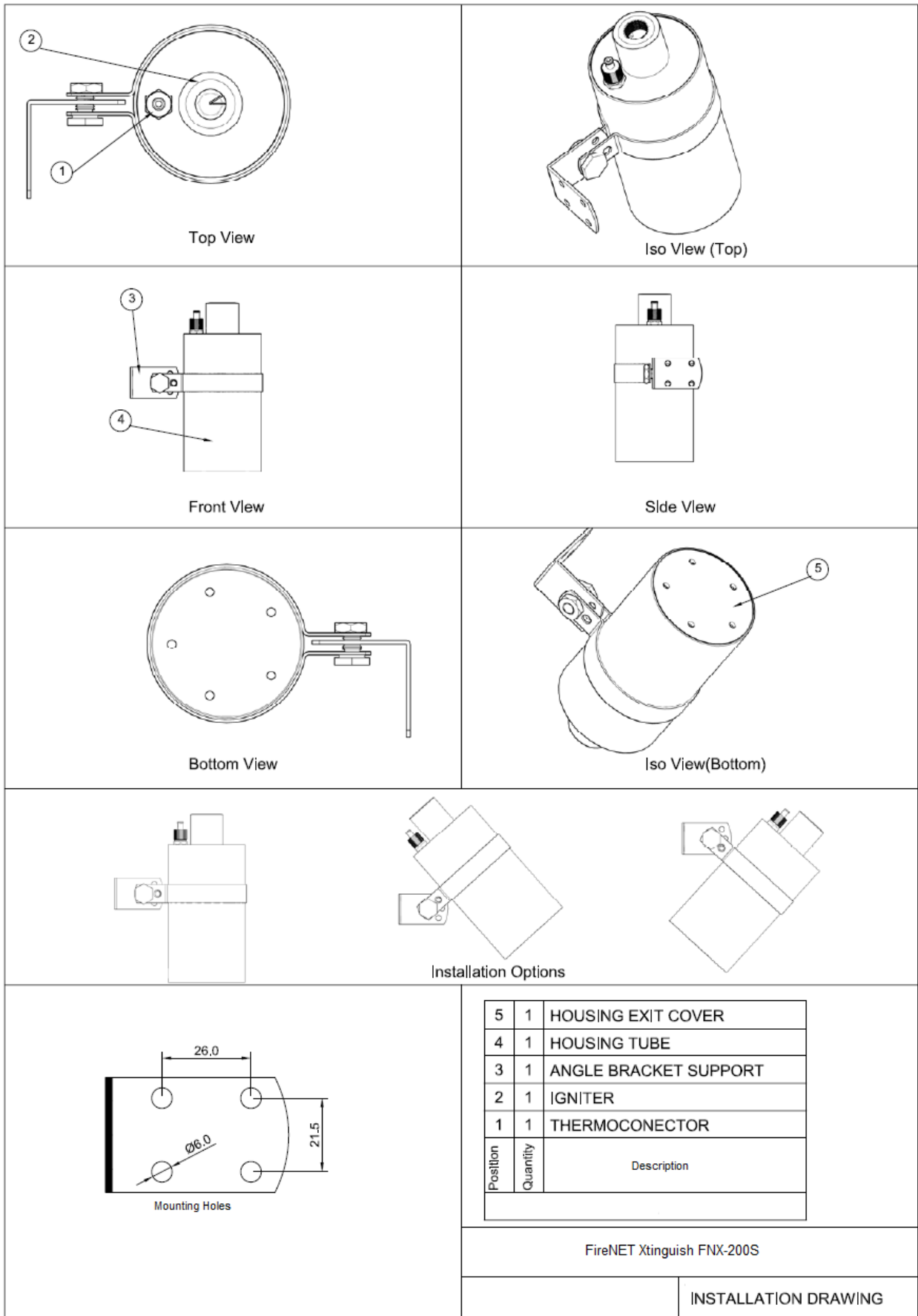
 <p><b>Top View</b></p>	 <p><b>Iso View (Top)</b>      <b>Iso View(Bottom)</b></p>																					
 <p><b>Front View</b></p>	 <p><b>Side View</b></p>																					
 <p><b>Bottom View</b></p>	 <p><b>Isometric View of Bracket</b></p>																					
 <p><b>Installation Options</b></p>																						
 <p><b>Mounting Holes</b></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">5</td> <td style="width: 5%;">1</td> <td>BRACKET</td> </tr> <tr> <td>4</td> <td>1</td> <td>BOTTOM OUTLET COVER PLATE</td> </tr> <tr> <td>3</td> <td>1</td> <td>HOUSING TUBE</td> </tr> <tr> <td>2</td> <td>1</td> <td>THERMOCONNECTOR</td> </tr> <tr> <td>1</td> <td>1</td> <td>TOP OUTLET COVER PLATE</td> </tr> <tr> <td style="text-align: center;">Position</td> <td style="text-align: center;">Quantity</td> <td style="text-align: center;">Description</td> </tr> <tr> <td colspan="3" style="text-align: center;"><b>FireNET Xtinguish FNX-20S</b></td> </tr> </table>	5	1	BRACKET	4	1	BOTTOM OUTLET COVER PLATE	3	1	HOUSING TUBE	2	1	THERMOCONNECTOR	1	1	TOP OUTLET COVER PLATE	Position	Quantity	Description	<b>FireNET Xtinguish FNX-20S</b>		
5	1	BRACKET																				
4	1	BOTTOM OUTLET COVER PLATE																				
3	1	HOUSING TUBE																				
2	1	THERMOCONNECTOR																				
1	1	TOP OUTLET COVER PLATE																				
Position	Quantity	Description																				
<b>FireNET Xtinguish FNX-20S</b>																						
<p><b>INSTALLATION DRAWING</b></p>																						

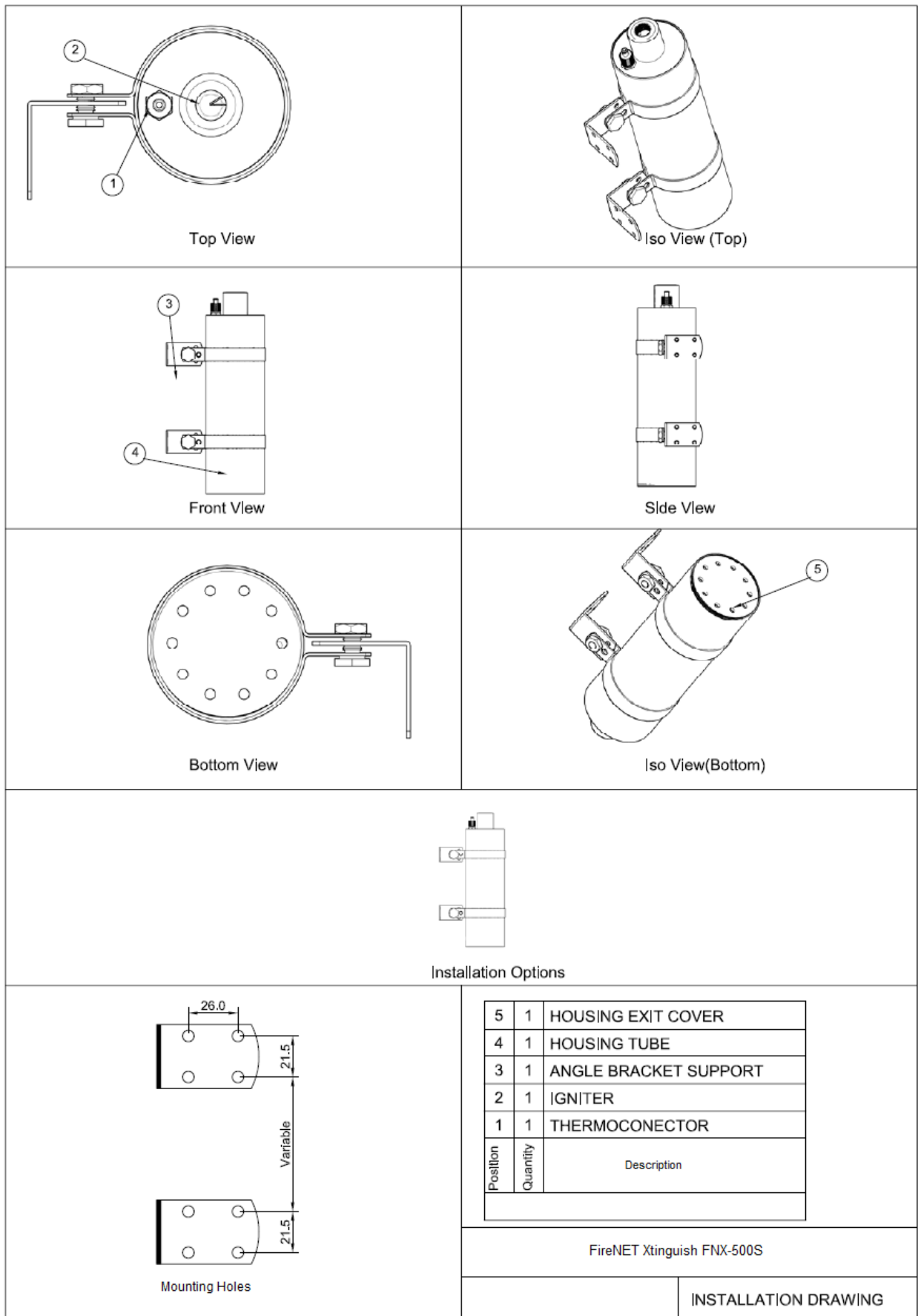


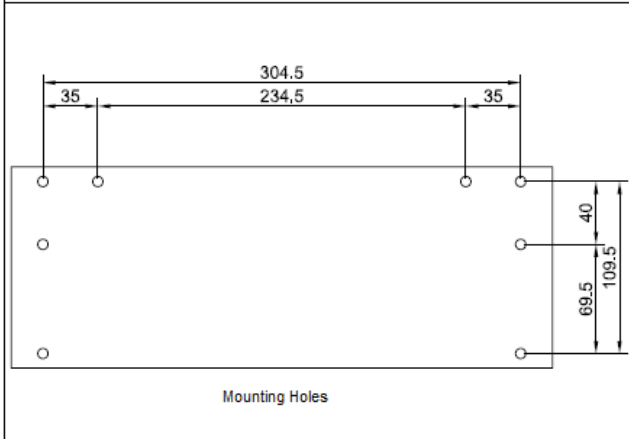
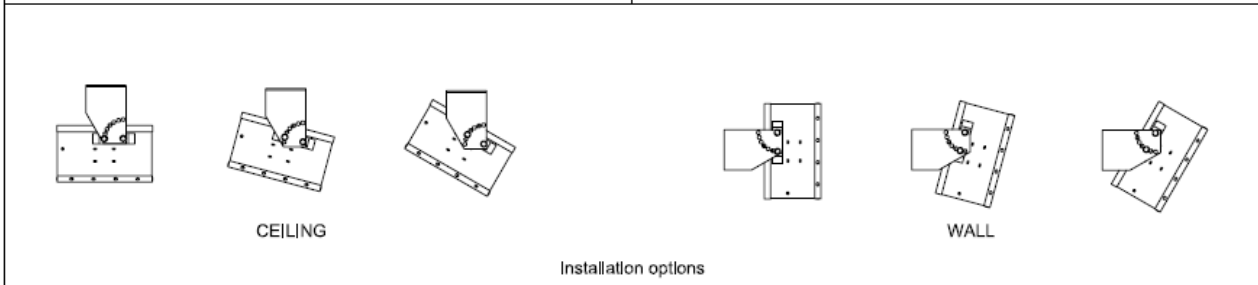
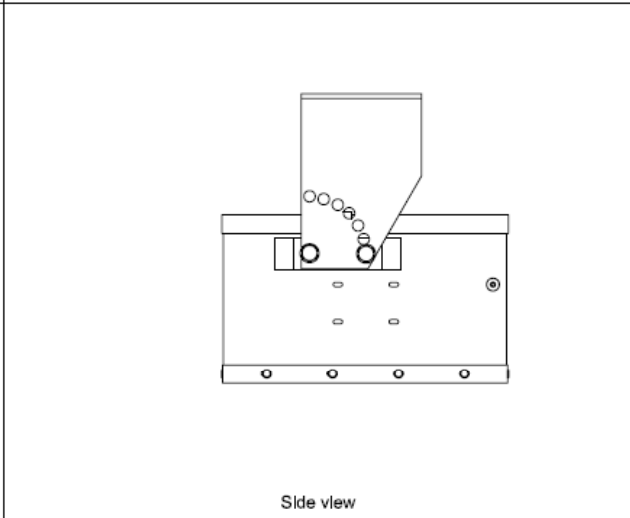
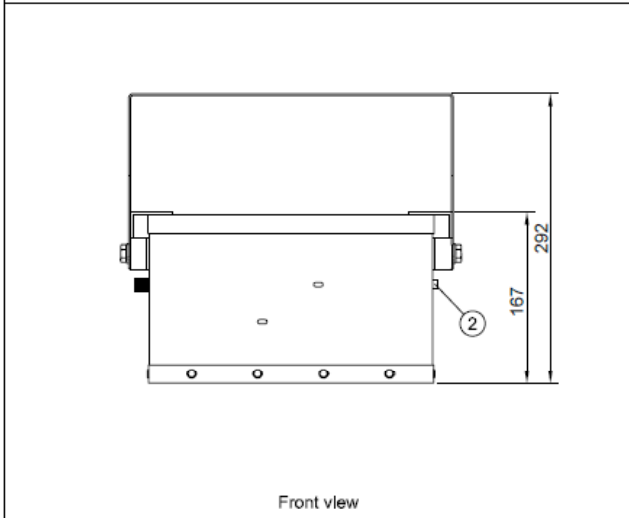
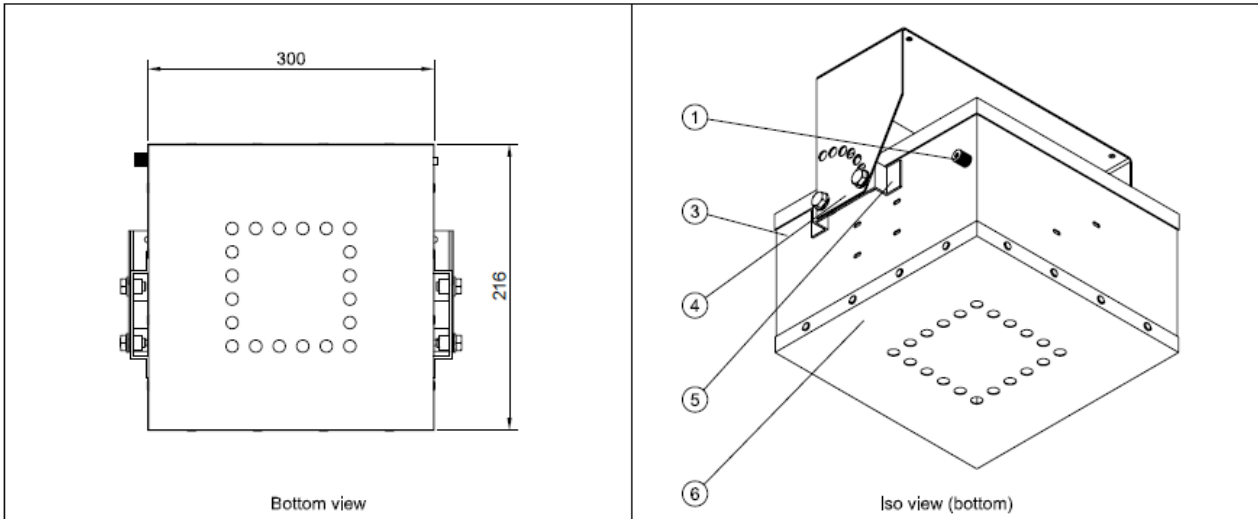








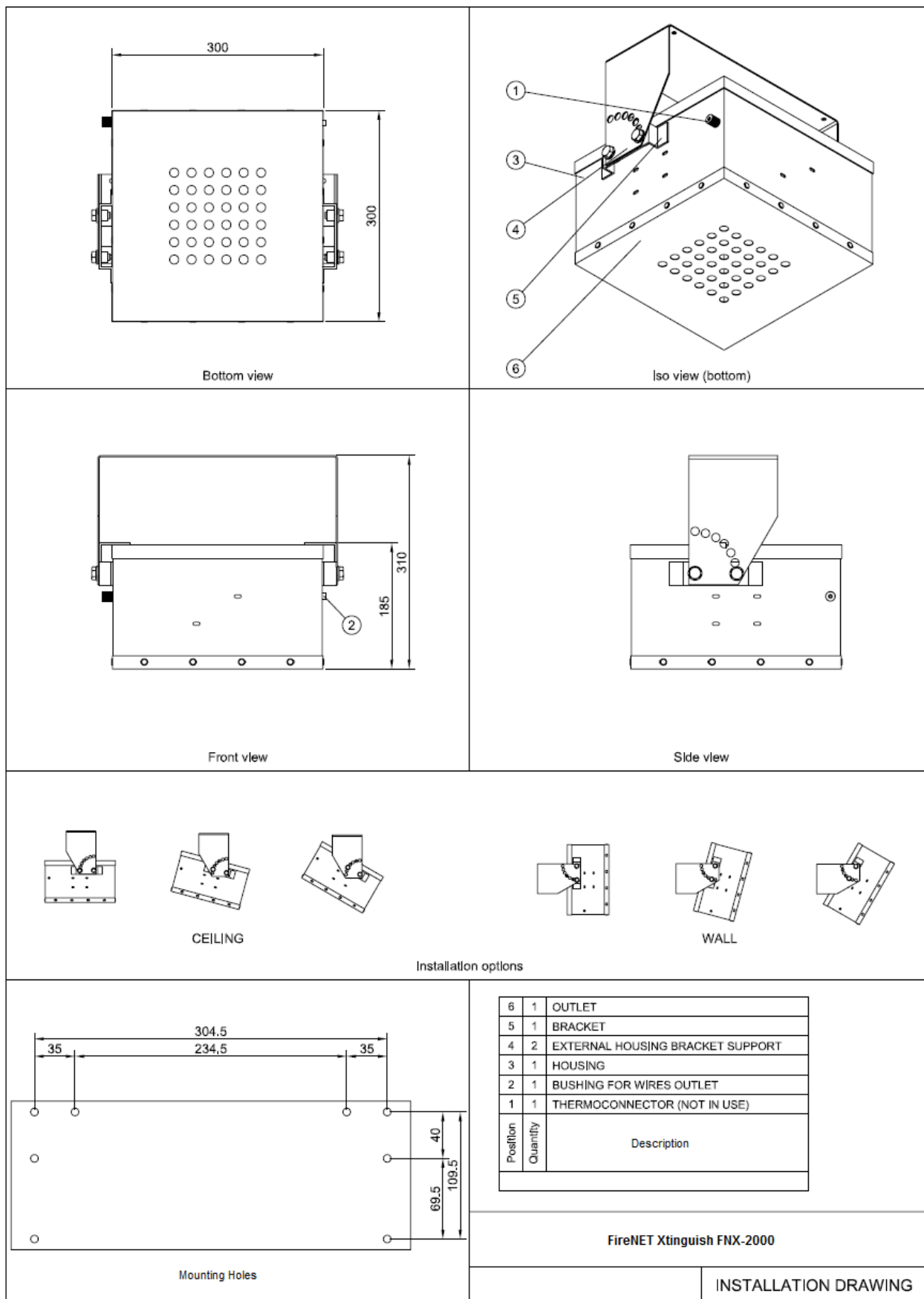


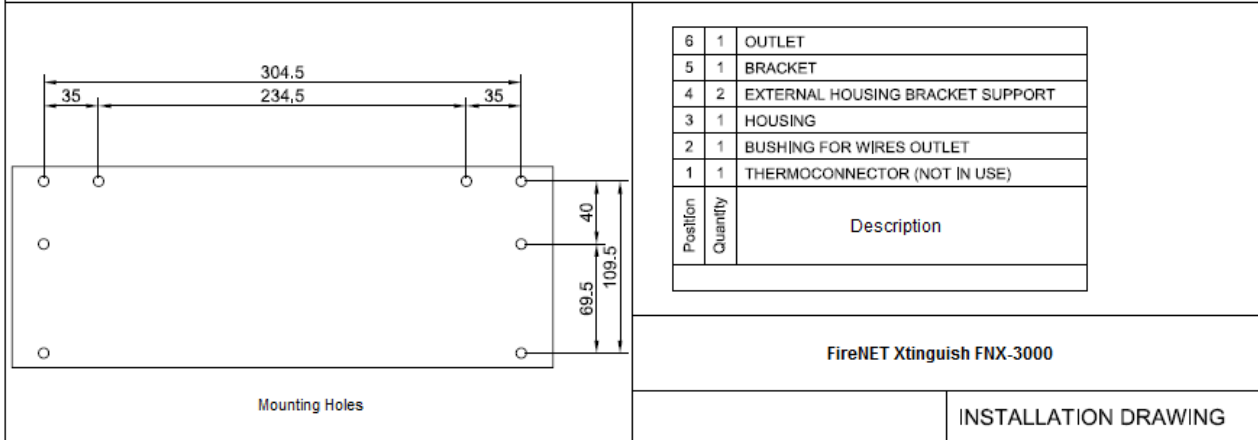
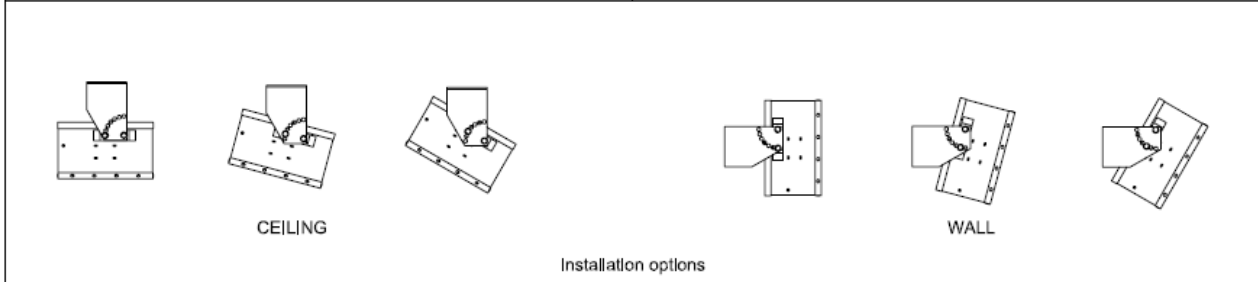
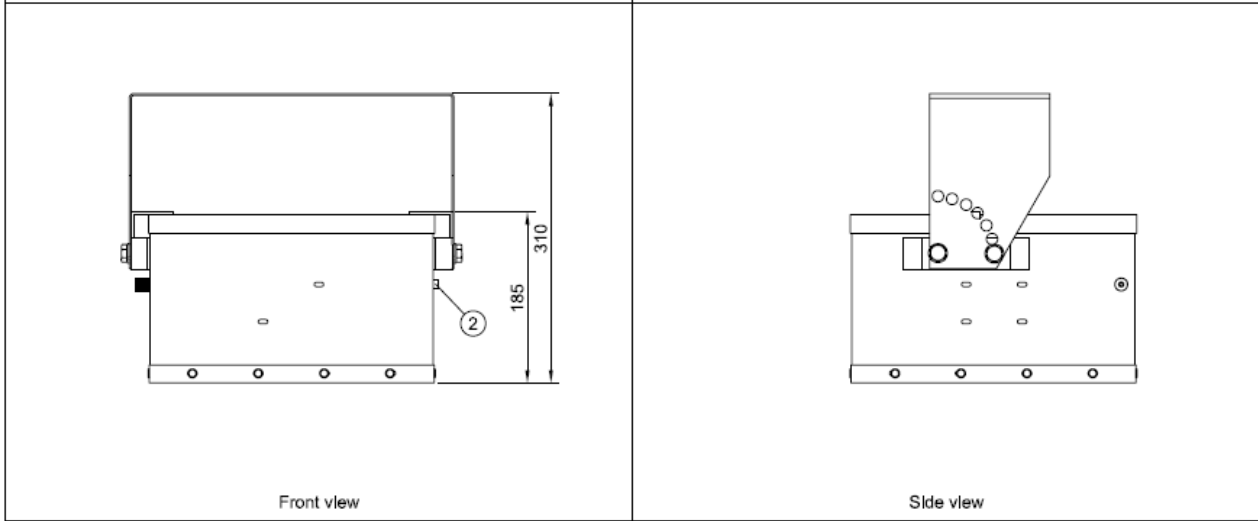
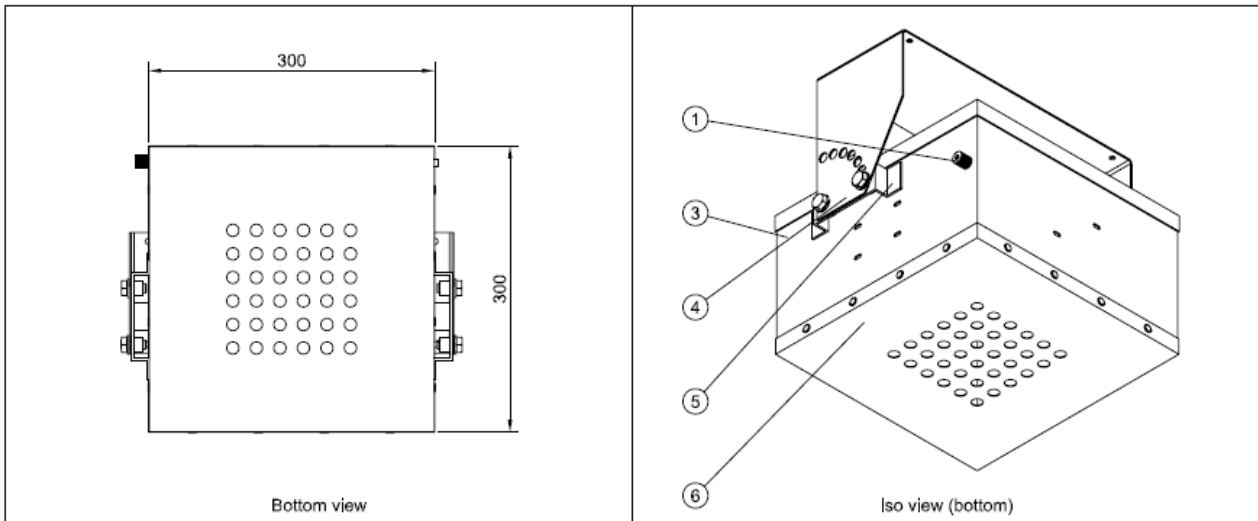


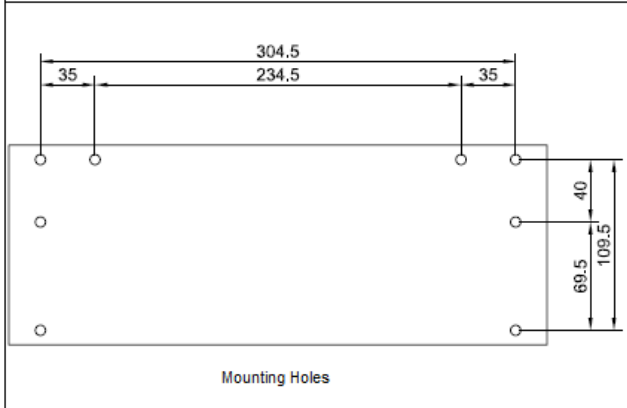
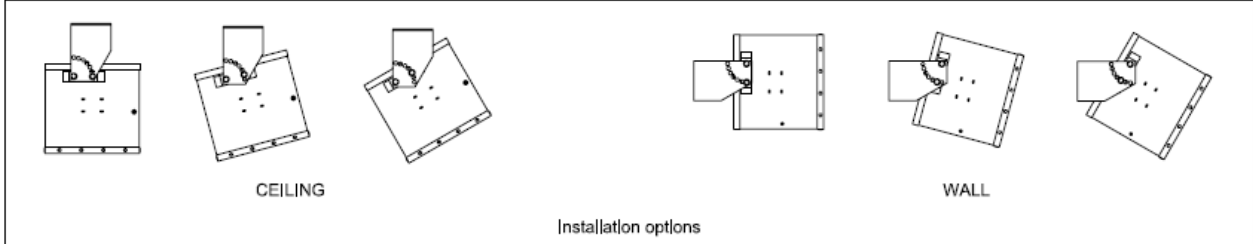
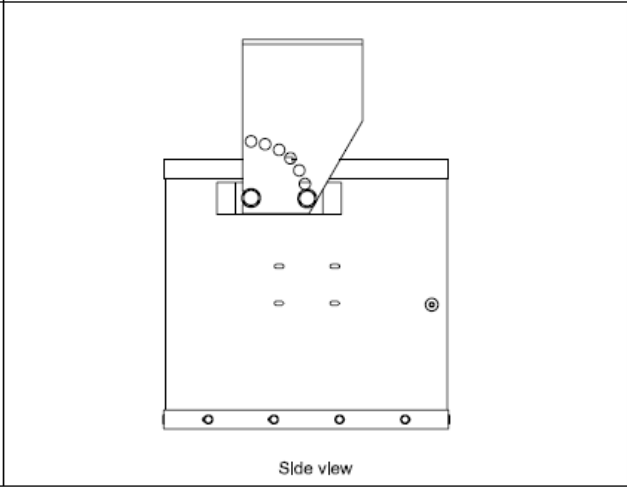
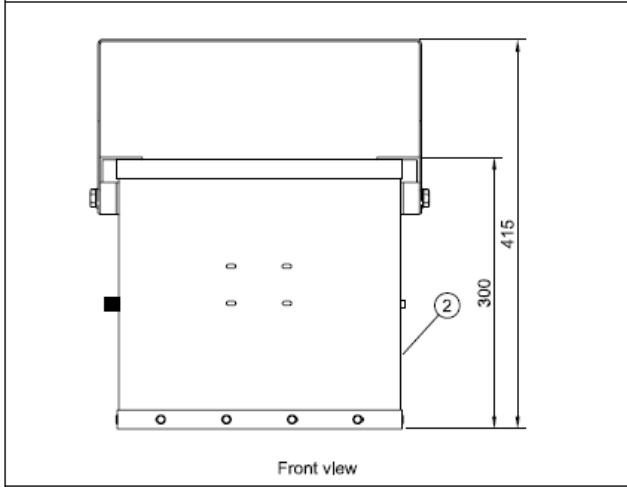
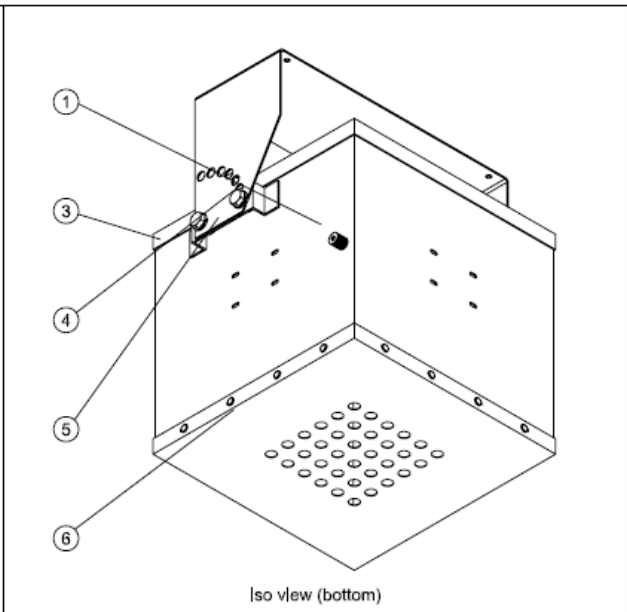
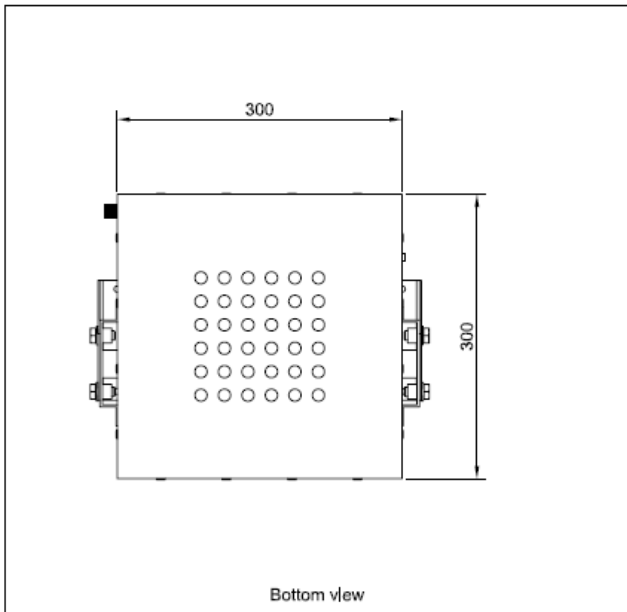
Position	Quantity	Description
6	1	OUTLET
5	1	BRACKET
4	2	EXTERNAL HOUSING BRACKET SUPPORT
3	1	HOUSING
2	1	BUSHING FOR WIRES OUTLET
1	1	THERMOCONNECTOR (NOT IN USE)

FireNET Xtinguish FNX-1200

**INSTALLATION DRAWING**







6	1	OUTLET
5	1	BRACKET
4	2	EXTERNAL HOUSING BRACKET SUPPORT
3	1	HOUSING
2	1	BUSHING FOR WIRES OUTLET
1	1	THERMOCONNECTOR (NOT IN USE)
Position	Quantity	Description
<b>FireNET Xtinguish FNX-5700</b>		
<b>INSTALLATION DRAWING</b>		

## **20 Appendix E – Referenced Publications**

### **NFPA**

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

- ▶ NFPA 2010 *Standard for Fixed Aerosol Fire Extinguishing Systems, 2010 Edition*
- ▶ NFPA 70 *National Electrical Code®*, 2005 Edition
- ▶ NFPA 72 *National Fire Alarm Code®*, 2010 Edition
- ▶ NFPA 2001 *Standard on Clean Agent Fire Extinguishing Systems, 2004 Edition*

### **ANSI**

American National Standard Institute, Inc., 25 West 43<sup>rd</sup> Street, 4<sup>th</sup> Floor; New York, NY10036

- ▶ ANSI C2, National Electrical Safety Code, 2001

### **ISO**

International Organization for Standardization, 1, Rue de Varembe, Case postale 56, CH-1211 Geneve 20, Switzerland

- ▶ ISO /IEC Guide 7, Requirements for Standards Suitable for Use for Conformity Assessment, 1994.

### **IMO**

International Maritime Organization, 4 Albert Embankments, London, SE1 7SR, United Kingdom

- ▶ IMO MSC/Circ.1270, Guidelines for the Approval of Fixed Aerosol Fire-Extinguishing Systems Equivalent to Fixed Gas Fire-Extinguishing Systems, as Referred to in SOLAS 74, for Machinery Spaces; 2008 Edition

### **US Government**

U.S. Government Printing Office, Washington, DC 20402

- ▶ Title 29, Code of Federal Regulations, Part 1910, Subpart S. Title 46, Code of Federal Regulations, Subchapter C, Parts 24-28.
- ▶ Title 46, Code of Federal Regulations, Subchapter J, "Electrical Engineering."
- ▶ Title 49, Code of Federal Regulations, Parts 171-190.
- ▶ Title 49, Code of Federal Regulations, Part 172.101, Subpart B.
- ▶ Title 49, Code of Federal Regulations, Part 173.34(e) (01). Title 49, Code of Federal Regulations, Parts 178.36 and 178.37.

### **Other References**

- ▶ NFPA 10, *Standard for Portable Fire Extinguishers*, 2002 edition.
- ▶ NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition.
- ▶ NFPA 51B, *Standard for Fire Prevention during Welding, Cutting, and Other Hot Work*, 2003 edition.
- ▶ NFPA 101<sup>®</sup>, *Life Safety Code®*, 2006 edition.
- ▶ NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities*, 2003 edition.
- ▶ *Merriam-Webster's Collegiate Dictionary*, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

## 21 Appendix F – Definitions

Except where otherwise noted, the following definitions are taken from NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*, 2010 Edition.

### 20.1 - Actuating mechanism.

A mechanism whose automatic or manual operation leads to the discharge of extinguishing agent.

### 20.2 - Agent Quantity.

Mass of solid aerosol-forming compound required to achieve the design application density within the protected volume within the specified discharge time.

### 20.3 - Approved.

Acceptable to the authority having jurisdiction.

### 20.4 - Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

### 20.5 - Automatic.

That which provides a function without the necessity of human intervention. [101, 2006]

### 20.6 - Automatic/manual switch.

Means of converting the system from automatic to manual actuation.

### 20.7 - Classification for Fires

#### Class A Fire.

Fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics. [10, 2002]

#### Class B Fire.

Fires in flammable liquids, petroleum greases, tars, oil, oil-based paints, solvents, lacquers, alcohols, and flammable gases. [10, 2002]

#### Class C Fire.

Fires that involve energized electrical equipment. [10, 2002]

### 20.8 - Clearance.

#### Electrical Clearance.

The unobstructed air distance between extinguishing system equipment, including piping and nozzles, and unenclosed or un-insulated live electrical components not at ground potential.

#### Thermal Clearance.

The air distance between a condensed aerosol generator and any structure or components sensitive to the temperature developed by the generator.

### 20.9 - Condensed Aerosol.

An extinguishing medium consisting of finely divided solid particles, generally less than 10 microns in diameter, and gaseous matter, generated by a combustion process of a solid aerosol-forming compound.

### 20.10 - Coolant.

A heat-absorbing medium or process.



**20.11 - Density.**

Design Application Density ( $\text{g}/\text{m}^3$ ). Extinguishing application density, including a safety factor, required for system design purposes.

**20.12 - Discharge Port.**

A passage such as nozzles or openings on an aerosol generator where aerosol is released when the generator is actuated.

**20.13 - Disconnect Switch.**

A manually operated switch, electrically supervised and secured from unauthorized use, that prevents the automatic or manual electrical activation of the aerosol generators during maintenance by electrically opening the releasing circuit.

**20.14 - Extinguishing Application Density ( $\text{g}/\text{m}^3$ ).**

Minimum mass of a specific aerosol-forming compound per  $\text{m}^3$  of enclosure volume required to extinguish fire involving particular fuel under defined experimental conditions excluding any safety factor.

**20.15 - Generator.**

A device for creating a fire-extinguishing medium by pyrotechnical means.

**20.16 - Generator Casing.**

The surface of the generator, excluding the surface containing the discharge ports.

**20.17 - Hold Time.**

Period of time during which an extinguishant is required to maintain an even distribution throughout the protected volume in an amount at least at the extinguishing application density.

**20.18 - Hot work.**

Work involving burning, welding, or similar operation that is capable of initiating fire or explosion. [51B, 2003]

**20.19 - Inspection.**

A visual examination of a system or portion thereof to verify that it appears to be in operating condition and free of physical damage. [820, 2003]

**20.20 - Listed.**

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

**20.21 - Maintenance.**

Work performed to ensure that equipment operates as directed by the manufacturer.

**20.22 - Manual.**

Requiring intentional intervention to accomplish a function.

**20.23 - Normally Occupied.**

An area or space where, under normal circumstances, persons are present.

**20.24 - Normally Unoccupied.**

An area or space not normally occupied by people but that can be entered occasionally for brief periods.

**20.25 - Particulate Density.**

The density of solid particulate in  $\text{g/m}^3$  after discharge of the aerosol system at the design application density. This information is used to assess the degrees of visibility obscuration and the potential health effects of accidental exposure to the agent.

**20.26 - Protected Volume.**

Volume enclosed by the building elements around the protected enclosure, minus the volume of any permanent impermeable building elements within the enclosure.

**20.27 - Release.**

The physical discharge or emission of aerosol as a consequence of the condensed aerosol generator's actuation or operation of the dispersed aerosol agent container.

**20.28 - Shall.**

Indicates a mandatory requirement.

**20.29 - Should.**

Indicates a recommendation or that which is advised but not required.

**20.30 - Solid Aerosol-Forming Compound.**

A solid mixture of oxidant, combustible component and technical admixtures that produces a condensed aerosol upon actuation.

**20.31 - Standard.**

A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Non-mandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

**20.32 - Supervisory Signal.**

A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or the maintenance features of related systems. [72, 2002].

**20.33 - Total Flooding Extinguishing System.**

A system arranged to discharge an extinguishant into an enclosed space to achieve a uniform distribution of that extinguishant, at or above the design application density, throughout the space.

**20.34 - Unoccupiable.**

An area or space which cannot be occupied due to dimensional or other physical constraints.

***The following definitions shall be applicable to marine aerosol extinguishing systems:***

**20.35 - A-60 Class Division.**

A bulkhead or deck designed to resist the passage of smoke and flame for 1 hour, including limiting the temperature rise on the unexposed side to 180° C (325° F).

**20.36 - Heat-Sensitive Material.**

A material whose melting point is below 1700°F (926.7°C). [13, 2002]

### **20.37 - Marine System.**

An aerosol system installed on a merchant vessel, ship, barge, boat, pleasure craft, offshore platform or other floating structure.

### **20.38 - Space.**

#### **Cargo Space.**

A space for the carriage or storage of items or products that are transported by the vessel.

#### **Machinery Space.**

A space protected by an aerosol system containing an internal combustion engine or mechanical equipment for handling, pumping, or transferring flammable or combustible liquids as a fuel to internal combustion engine.

### **20.39 - Vessel.**

#### **Inspected vessel.**

A vessel operated on the navigable waterways of the United States that is subject to the regulations in 46 CFR, which require it to be certificated and inspected as a passenger ship, cargo ship, oceanographic ship or a tank vessel.

#### **Uninspected vessel.**

A vessel operated on the navigable waterways of the United States that is subject to the regulations in 46 CFR Subchapter C, Parts 24 - 28, including pleasure craft, tugboats, towing vessels and certain fishing vessels.