DSPA Fixed
extinguishing systems

DESIGN, INSTALLATION, MAINTENANCE AND INSTRUCTION MANUAL

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Document history

Revision	Date	Modification / Change
5.*/2012	01-11-2012	First official document for certification;
6.*/2012 7.*/2014	07-03-2013 01-10-2014 Up to 01-07-2018	Complete revision. Term 'Manual mode switch' instead of lock-off device/isolate switch. Add additional information for use within hazardous area classified as Zone 2 (ATEX 95 directive 94/9/EC). Correction 5.2.7 temperature range DSPA 8-1. Add DSPA 11-7, 3.3.2 part numbers changed, 4 ATEX certified: add DSPA 8-2 and DSPA 11-7. Additions to post fire procedure – item 7.4. Add DSPA 8-1-60. Extended table 4 on page 22 in accordance with product certificate. Information on leakage parameter added on page 24. Add new DSPA units of 12 series, special FE100 and DSPA 17-1, Update ATEX information in accordance with new certification.
8.0/2018	01-08-2018	Changed CEN/TR 15276-[1|2] to prEN-EN 15276-[1|2]:2017. Changed mounting bracket of DSPA 8-1. Reformulate statement to use approved panels. Exchanged MSDS's with one new SDS (Safety Data Sheet). Add appendix with Overview Activation Equipment. General layout changes.
8.1/2018	29-08-2018	Minor grammatical corrections. Rephrase part of chapter 3.1. Add vibration tests for machinery instead of wall mounted devices to DSPA units of 12 series and FE100.
8.2/2019	15-02-2019	Update ATEX information in accordance with new higher maximum ambient temperature. Change of ATEX temperature class from T5 to T3. Change reference to new ATEX Directive 2014/34/EU (ATEX 114).
8.3/2019	21-05-2019	Minor updates to comply with documentation requirements of ATEX and EU regulations.
8.4/2019	01-10-2019	Remove wrong reference to Appendix E instead of Appendix F. Clarification on extended leakage calculation. Restructure Appendix A: EU Declaration of Conformity.
8.5/2020	31-01-2020	Change typo DSPA 8-2-60 into DSPA 8-1-60. Changed CEN/TR 15276-[1|2] and prEN-EN 15276-[1|2]:2017 to new NEN-EN 15276-1:2019 and NEN-EN 15276-2:2019. Introduce System Isolate Switch additional to Manual mode. Adds elementary instructions for automatic detection systems. Use term "density" instead of "factor".
8.6/2021	01-04-2021	Added preparation of relevant working documents. Added awareness of electrical hazards. Update of electrical interface.
8.7/2022	01-03-2022	Restructuring of all referenced standards on latest and/or used harmonized versions. Update of Declaration of Conformity accordingly.
8.8/2023	01-06-2023	Added new DSPA activation systems; DSPA UAS and DSPA SCR.
8.9/2023	01-10-2023	Update ATEX information in accordance with IEC 60079-15:2017 (IECex)

Foreword

This Manual specifies requirements and describes the methods for the design, installation, testing, maintenance and safety of DSPA fixed extinguishing systems and the characteristics of the extinguishant media and types of fire for which it is a suitable extinguishing medium.

This document does not cover all legislative requirements. In certain countries specific national regulations apply and take precedence over this document. Users of this document are advised to inform themselves of the applicability or non-applicability for this document by their national responsible authorities.

This Manual covers the use of DSPA fixed extinguishing systems in normally unoccupied and unoccupied areas, primarily related to buildings, plants and other specific applications, utilizing electrically non-conducting aerosol fire extinguishant and for which there are sufficient data available to enable validation of performance characteristics by an appropriate independent authority.

DSPA aerosol generators comply with the requirements and test methods to the following Standards:

- BRL-K23001/06:2020 Evaluation Guideline for aerosol fire extinguishing for the product certificate for fixed dry aerosol fire extinguishing components;
- EN 15276-1:2019 Fixed firefighting systems - Condensed aerosol extinguishing systems - Part 1: Requirements and test methods for components
- ISO 15779:2011 Condensed aerosol fire extinguishing systems - Requirements and test methods for components and system design, installation and maintenance - General requirements;
- UL 2775: 2019 – Outline of investigation for fixed condensed aerosol extinguishing system units;
- UL864: 2014 - Control Units and Accessories for Fire Alarm Systems;
- IEC 60079-15:2017 Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
- AS 4487-2013 Condensed aerosol fire extinguishing systems: Requirements for system design, installation and commissioning and test methods for components;
- ISO 9094:2015 Small craft — Fire protection

DSPA fixed extinguishing systems are to be designed, installed, inspected and maintained by qualified and trained personnel in accordance with the following Standards:

- EN 15276-2:2019 Fixed firefighting systems - Condensed aerosol extinguishing systems - Part 2: Design, installation and maintenance;
- NFPA 2010:2020 Standard for Fixed Aerosol Fire Extinguishing Systems;
- BRL-K23003/02:2019 KIWA process certificate for design, installation, acceptance and service of fire extinguishing systems based on aerosol;
- ISO 15779:2011 Condensed aerosol fire extinguishing systems - Requirements and test methods for components and system design, installation and maintenance - General requirements;
- AS 4487-2013 Condensed aerosol fire extinguishing systems: Requirements for system design, installation and commissioning and test methods for components

DSPA production and quality processes are certified according ISO 9001 and ISO 14001 and have the BSI KiteMark.

Certification

DSPA B.V. continuously evaluate, improve and extend their collection of aerosol generators. All aerosol generators are designed according above regulations. Based upon geographical markets, DSPA aerosol generators are certified against EN and/or UL regulations. Table below summarizes which generators are EN certified and which generators are UL compliant.

	BRL-K23001/06:2020	EN 15276-1:2019	ISO 15779:2011	EN 1127-1:2011	EN 60079-0:2012	EN 60079-15:2010	UL 2775: 2019	UL 864:2020
DSPA 8-1	√	√	√	√	√	√	C	C
DSPA 11-1	√	√	√	√	√	√	C	C
DSPA 11-2	√	√	√	√	√	√	C	C
DSPA 11-3	√	√	√	√	√	√	C	C
DSPA 11-4	√	√	√	√	√	√	C	C
DSPA 11-5	√	√	√	√	√	√	C	C
DSPA 11-6	√	√	√	√	√	√	C	C
DSPA 11-7	√	√	√	√	√	√	C	C
DSPA 8-1-60	√	√	√	√	√	√	C	C
DSPA 12-1	√	√	√	√	√	√	C	C
DSPA 12-2	√	√	√	√	√	√	C	C
DSPA 12-3	√	√	√	√	√	√	C	C
DSPA 12-4	√	√	√	√	√	√	C	C
DSPA 12-5	√	√	√	√	√	√	C	C
DSPA 17-1	√	√	√	√	√	√	C	C
FE100	√	√	√	√	√	√	C	C
DSPA 0.45-2	√	√	√	√	√	√	C	C
DSPA 0.90-2	√	√	√	√	√	√	C	C
DSPA 2-4-1	√	√	√	√	√	√	C	C

DSPA B.V. assumes no responsibility for the application of any systems other than those addressed in this Manual. The technical data in this Manual is limited strictly for information purposes only. DSPA B.V. believes this data to be accurate, but it is published and presented without any guarantee or warranty whatsoever. DSPA B.V. disclaims any liability for any use made of the data and information contained herein by any and all other parties. If there should be any questions regarding this Manual, please contact your local DSPA representatives.

Content

1. Introduction

It has been assumed in the preparation of this Manual that the execution of its provisions is entrusted to appropriately qualified and experienced people in the specification, design, installation, inspection, operation and maintenance of systems and equipment, for whose guidance it has been prepared, and who can be expected to exercise a duty of care to avoid unnecessary release of extinguishant.

Within this Manual documents are referred to in the text in such a way that some or all of their content constitutes requirements of this Manual. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Present Manual is based on the results that comply with the standards EN 15276-1:2019, UL 2775:2019, ISO 15779:2011, BRL-K23001/06:2020, EN 1127-1:2011, EN 60079-0:2012 and EN 60079-15:2010. Instructions within this manual with regard to design, installation, inspection and maintenance of DSPA systems comply with the standards EN 15276-2:2019, NFPA 2010:2020, BRL-K23003/02:2019 and ISO 15779:2011.

DSPA aerosol generators are devices which, when assembled into a system, are designed to generate and discharge fine potassium based particles and inert gases for the extinguishment of fires. Each system consists of one or more aerosol generators, actuating assemblies for automatic or manual operation, and miscellaneous subsidiary devices. The generators are suitable for use over an ambient temperature range of -40°C to +75°C or as otherwise noted in the individual listings.

The total flooding use of DSPA generators is primarily for protection against hazards that are within an enclosure that will permit to establish and maintain the appropriate design density of condensed aerosol for the required period of time to assure an effective extinguishment.
They are intended for normally unoccupied and unoccupied applications. The temperature of the generated aerosol within the direct surrounding of the generator may cause a potential hazard for personnel and equipment. Installation instructions for save use are given in this manual.

DSPA generators are intended for the protection against fires which fall under the Class A, B and C categories. Aerosol generators in general are less suitable to extinguish deep seated fires and fires involving certain chemicals or mixtures of chemicals that are capable of rapid oxidation in the absence of air.

DSPA B.V. declares on their responsibility that the DSPA aerosol generators mentioned in the statement of Appendix A, are in conformity to the Directives 2014/30/EU and 2014/34/EU of the European Parliament and other normative documents, following the definition of the BRL-K23001/06 made up by KIWA. The conformity of this declaration and other normative documents will be confirmed with the CE-Marking.

DSPA B.V. has the right to revise this publication to review and change the content to make, without the obligation to notify someone prior to the revision or amendments.

2. Terms and definitions

Activation device
A device which is able to ignite the solid aerosol-forming compound at the activation position

Authority
Organization, office or individual responsible for approving equipment, installations or procedures in determining acceptability.

Automatic/Manual mode switch
Means of converting the system from automatic to manual actuation

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

Condensed aerosol
Extinguishing medium consisting of finely divided solid particles and gaseous matter, these being generated by a combustion process of a solid aerosol-forming compound

Condensed aerosol generator
Non-pressurized device which, when activated, generates an aerosol. It includes mounting brackets.

Design density (g/m^3)
The minimum mass of a specific aerosol-forming compound per cubic meter of enclosure volume, including a safety factor.

Discharge time
Time from the generator activation to the end of its discharge

DSPA generator
Device consisting of a rigid steel casing filled with a so-called ‘dry sprinkler powder aerosol’.

Extinguishing application density/ extinguishing density(g/m^3)
Minimum mass of a specific aerosol-forming compound per cubic meter of enclosure volume required to extinguish fire involving a specific fuel under defined experimental conditions, excluding any safety factors.

Family
Group of generators with same solid compound, same kind of cooling device, same kind of discharge outlet, same activation device, same layout and same internal/external architecture

Fire Detection Control Panel
Panel able to control the sequence of events leading to the activation(e.g. LST BC06/2EXT-INT11).

Hold time
Period of time during which the extinguishant is required to maintain at least the extinguishing density throughout the protected area/volume.

Hot work

Grinding, welding, thermal or oxygen cutting or heating and other related heat-producing or spark-producing operations.

Inspection
Visual check to give a reasonable assurance that the extinguishing system is ready to operations

Insulating material
Heat absorbing medium.

Listing authority
Recognized fire protection testing and approval body (notified laboratory)

Location drawing
Plan of the risk clearly indicating the as-installed location of all aerosol generators, controls and isolation switch.

Manual mode
Operating condition of an extinguishing system control in which the activation of manual call points is required for the initiation of the extinguishing process. The manual mode is selected, if an extinction in the flooding zone must not be activated automatically (e.g., because the door to the extinguishing area is open, cleaning activities are carried out in the extinguishing area).

Maintenance
Thorough check to give maximum assurance that the extinguishing system will operate as intended. NOTE It includes a thorough examination and any necessary repair or replacement of system components.

Manufacturer
Legal person that is responsible for the design, manufacturing, packaging and quality assurance of a device before it is placed on the market

Monitoring
Supervision of the operating integrity of an electrical, mechanical, pneumatic or hydraulic control feature of a system

Normally unoccupied area
Area that is not occupied by persons under normal circumstances but may be entered occasionally for brief periods

Normally occupied area
Area that is occupied by persons under normal circumstances.

Pre-discharge-warning time
Starting with the beginning of the activated condition, the activation of the extinguishing output of an extinguishing system control can be delayed by the pre-discharge-warning time

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

Release
Physical discharge or emission of an aerosol as a consequence of the generator actuation

Safety factor
Multiplier of the extinguishing density to determine the design density

Solid aerosol-forming compound
Mixture of oxidant, combustible component and technical admixtures producing fire extinguishing aerosol upon activation

Supplier
Legal person that is responsible for the product and is able to ensure that its quality is ensured

System isolate switch
Key operated or dual mode switch manual device that prevents the electrical actuation of aerosol generators. The activation of this device provides an indication of system isolation. The intent is to prevent the discharge of extinguishant into the hazard area when the system isolation switch device is activated.

Total flooding system
Fire-fighting system arranged to discharge extinguishant into an enclosed space to achieve the appropriate design density

Unoccupied area
Area which cannot be occupied due to dimensional or other physical constraints e.g. shallow voids, cabinets

User
Legal person, whom the system is designed for, and who is responsible for operation and to ensure the consistency of performance as described by the supplier and to follow the legal regulations

3. DSPA fixed extinguishing systems description

3.1 General

DSPA aerosol generators consists of a solid compound in a rigid steel casing which aerosolize finely divided solid particles typically based on potassium based inorganic products and gases typically comprised of nitrogen, carbon dioxide and a neglectable amount of water vapor. It is self-generated by a combustion process of a solid aerosol-forming compound contained in a non-pressurized canister, an aerosol generator. Aerosol generators also contain an activation device designed to ignite the aerosol-forming compound and may have various insulating materials to cool the aerosol prior to its release into a protected area.
The aerosol generating combustion process provides sufficient energy for a rapid discharge and efficient distribution of the aerosol. Aerosol generator has discharge outlets in radial or axial positions and are normally placed inside the protected risk area. No piping is required.

Aerosols are electrically non-conductive gas-like media, which are suspended in the air in the protected volume. Being a suspension of fine solid particles in a gaseous medium, the aerosol is not defined as a "clean agent"[1]. After a period of natural suspension the remaining aerosol, left after extinguishment if not ventilated, will eventually settle down forming a dust-like fire retardant residue, normally in very small quantity. The settled aerosol can easily be removed, see chapter 7.4 for post fire procedures.

The total flooding use of aerosol generators is primarily for protection against hazards that are within an enclosure that will permit to establish and maintain the appropriate design factor of condensed aerosol for the required period of time to assure an effective extinguishment.

Condensed aerosols are recognized by International Standards(See Table 1) as suitable for extinguishing of surface Class A, Class B, and Class C. Europe use the International Standard 'Classification of fires" according EN 2(Table 1), while the United States uses the NFPA system (Table 2) The hazards against which these systems offer protection and any limitations on their use, are described in this Manual.

Fire Class according standard EN 2	Description
Class A	All solid materials, usually organic origin nature(contains compounds of carbon) and generally produce glowing embers – i.e. wood, textiles, curtains furniture and plastics
Class B	All flammable liquids and solids
Class C	Natural mains gas, liquid petroleum gases (e.g. LPG – Butane& propane etc.) and medical or industrial gases.

Table 1 Classification for fires according to International Standard EN 2.

[1] The term "clean agent" has traditionally referred to gases.

Fires Class according Standard NFPA 2010	Description
Class A	Ordinary combustible materials, such as wood, cloth, paper, rubber and may plastics
Class B	Flammable liquids, combustible liquids, petroleum, tars, oils, oil-based paints, solvents, lacquers, alcohol and flammable gasses
Class C	Energized electrical equipment

Table 2 Classification for fires according to Standard NFPA 2010

Total flooding fire-extinguishing systems are used primarily for protection against hazards that are in enclosures or equipment that, in itself, includes an enclosure to contain the extinguishant. Condensed aerosol generators can be used as a part of firefighting systems in buildings, plants or other structures. It covers total flooding systems primarily related to buildings, plant and other specific applications, utilizing electrically non-conducting condensed aerosol fire extinguishants.

DSPA aerosol generators are intended to be used in unoccupied and normally unoccupied areas like, industrial units and buildings, energetic objects, storages, garages, other spaces not intended for residential occupancy, etc.

The condensed aerosol extinguishing components should not be used on fires involving the following unless relevant testing by accredited testing laboratories has been carried out to the satisfaction of the Authority:

a. Deep seated fires in Class A materials;
b. Certain chemicals or mixtures of chemicals, such as cellulose nitrate, that are capable of rapid oxidation in the absence of air;
c. Local applications[2] of condensed aerosol extinguishing systems are not covered by this product declaration.
    - Local applications require a pre-engineered and pre-designed system which has been tested and approved for a specific application by an authority such as Kiwa or by an accredited testing laboratory.

The above list may not be exhaustive.

Temperatures for use of aerosol extinguishing agents shall be within the supplier's listed limits.

Under certain conditions the potential for explosive atmospheres may exist. Areas where such potential may exist are classified as hazardous. Condensed aerosols may be used in hazardous areas subject to the manufacturer obtaining the specific listings and approvals for such areas from the appropriate authorities. Chapter 4: "ATEX certified EX DSPA aerosol generators" describes the compatibility of the DSPA aerosol generators to potentially explosive atmospheres.

3.2 Extinguishing mechanism

"Fire propagation" radicals (OH, H, and O) are essential elements in the propagation of the fire. Aerosol agents suppresses the fire (primarily) by chemical interference with these free radicals within the fire zone, thus interrupting the on-going fire reaction.

[2] a local application is used for the extinguishment of surface fires in flammable liquids, gasses, and shallow solids, where the enclosure does not conform to the requirements for total flooding.

The DSPA generator is discharged as solid particles, mainly potassium radicals as components, with a typically diameter less than 5 microns. When introduced into the flaming region of a fire, the aerosol reacts with the fire radicals produced during combustion (hydrogen, oxygen, and hydroxyls) resulting in extinguishment of the fire. The small aerosol particles provide a large surface area for capturing these radicals making them effective extinguishing agents.

Condensed aerosols are generated through the combustion of a solid compound in a generator, hereby called DSPA generator. The agent is released or formed in the exhaust of the burning compound and propelled throughout the protected enclosure with the combustion by-products of the solid compound, generally a combination of nitrogen, carbon dioxide and a minor amount of water vapor. The solid compound is converted into solid aerosol particles and gasses. The agent utilized is generally a combination of potassium based inorganic products.
In order to effectively extinguish the fire and preventing re-ignition after extinguishment, an effective design application density in the space not only has to be achieved, it also has to be maintained. The loss of aerosol density is due to both leakage from the space and due to fall out of the aerosol particles.

When activated the aerosol, itself, consists of solid and gas combustion products. The solid phase is composed of highly dispersed particles. The gas phase may contain carbon dioxide CO_2, nitrogen N_2 and neglectable amounts of water vapor H_2O.

The chemical reaction of a DSPA generator can schematically be represented as follows (only main components without quantities

$$\text{DSPA}_{\text{Generator}} \xrightarrow{\uparrow \Delta T} NH_4HCO_{3(S)} + K_2CO_{3(S)} + CO_{2(g)} + N_{2(g)} + H_2O_{(g)}$$

Actual concentrations of the aerosol depend on the chemical compositions of the solid aerosol-forming compound and engineering design of the aerosol generators and conditions of the enclosure under protection.

3.3 Compatibility with other extinguishants

Mixing of extinguishants in the same container shall be permitted only if the system is approved for use with such a mixture. Systems employing the simultaneous discharge of aerosols and other extinguishants to protect the same enclosed space shall not be permitted.

3.4 Hot work

As open flame or prolonged exposure to temperatures exceeding 350°C may cause activation of the condensed aerosol generators, they shall be removed from a protected area prior to any hot work being carried out within their vicinity.

3.5 Components

The DSPA generator typically consists of the following main components:

- Outer body; Rigid steel casing protecting the inner parts to mechanical and environmental effects.
- Insulating material; The insulating material shall provide an adequate cooling of the hot aerosol prior to its discharge into the enclosure.
- Activation position; The activation position is arranged to initiate the aerosol-forming compound at the activation position.
  - ❖ An electrical activation device “build-in type” shall be capable of operating via an electrical input and arranged to activate the aerosol-forming compound at this position (See Figure 1 and Figure 2). This applies to DSPA generator types 2-4-1, 11-1, 11-2, 11-3, 11-4, 11-7, 12-1, 12-2, 12-3, 12-4, 12-5, FE100, 0.90-2 and 0.45-2.
  - ❖ An electrical activation device “screw-in type” shall be capable of operating via an electrical input and arranged to activate the aerosol-forming compound at this position (See Figure 3 and Figure 4.). This applies to DSPA generator types 11-5, 11-6, 8-1, 8-1-60 and 17-1.
- Protective layer; Creates spaces between mutual solid aerosol forming compounds.
- Solid aerosol forming compound; Upon actuation of the DSPA generator, the solid aerosol forming compound shall undergo the combustion reaction producing a fire extinguishing aerosol.
- Discharge outlet, mounting brackets (DSPA 8-1, 8-1-60, 2-4-1, 11-5, 11-6, 17-1, 0.90-2 and 0.45-2) or fixed mounting positions (all other types).

The generator is a non-pressurized canister, because aerosol is generated and distributed by the combustion process of the solid aerosol-forming compound.

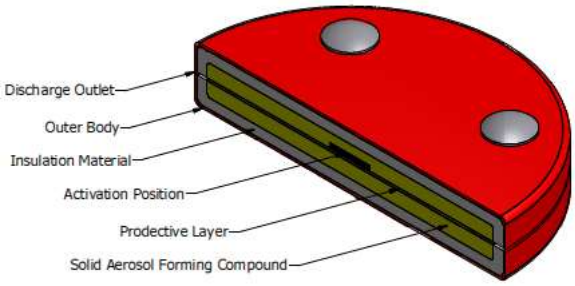


Figure 1. Cross-section of DSPA 11-1 (Comparable to DSPA 11-2 and DSPA 11-3)

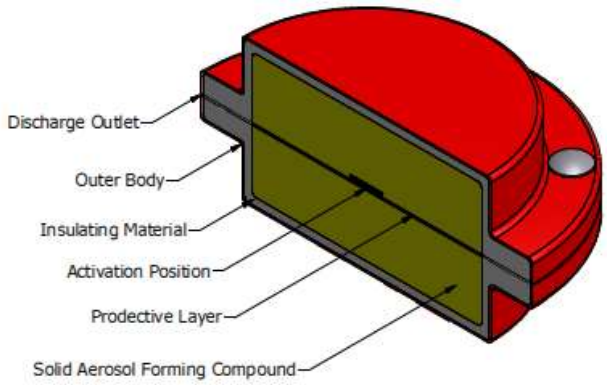


Figure 2. Cross-section of DSPA 11-4

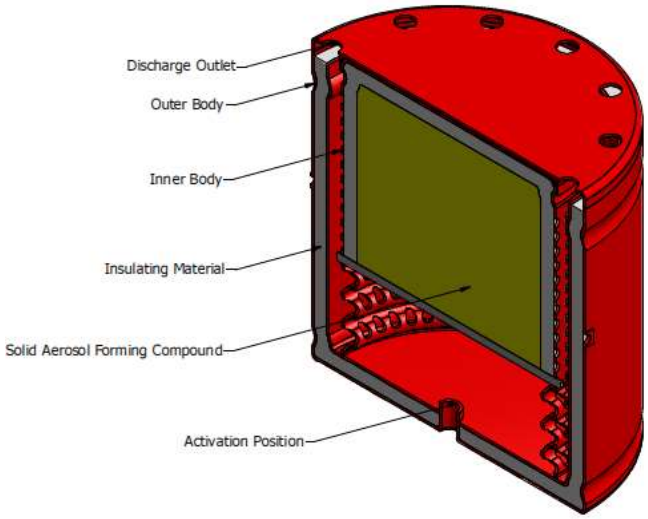


Figure 3. Cross-section of DSPA 8-1/8-1-60.

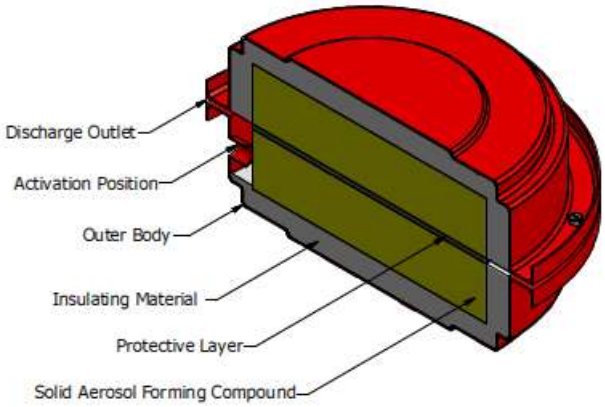


Figure 4. Cross-section of DSPA 11-6.(Comparable to DSPA 11-5)

3.5.1 Overview of the DSPA Fixed System range

		
DSPA 11-1	DSPA 11-2	DSPA 11-3
		
DSPA 11-4	DSPA 11-5	DSPA 11-6
		
DSPA 11-7	DSPA 8-1	DSPA 8-1-60
		
DSPA 12 Series	DSPA 17-1	
		
FE100	DSPA 0.90-2 and DSPA 0.45-2	DSPA 2-4-1

Figure 5. Overview of the DSPA fixed system generators

3.5.2 Part numbers DSPA aerosol generators

DSPA B.V. has numbered all product items according table 3.

Part No	Description	Aerosol mass
100009	DSPA 8-1	3250 gram
100011	DSPA 11-1	110 gram
100012	DSPA 11-2	170 gram
100013	DSPA 11-3	300 gram
100014	DSPA 11-4	900 gram
100015	DSPA 11-5	1400 gram
100016	DSPA 11-6	2300 gram
100017	DSPA 11-7	520 gram
100140	DSPA 8-1-60	3250 gram
100020	DSPA 12-1	15 gram
100021	DSPA 12-2	30 gram
100022	DSPA 12-3	55 gram
100023	DSPA 12-4	110 gram
100217	DSPA 12-5	5 gram
100033	DSPA 17-1	2300 gram
100157	FE100	100 gram
100901	DSPA 0.45-2	45 gram
100903	DSPA 0.90-2	90 gram
100002	DSPA 2-4-1	1600 gram

Table 3 Part numbers of DSPA aerosol generators

3.5.3 Electrical Activation device

The electrical activation device consists of two fire retardant wires connected to a fuse head. The fuse head consist of two separated contact fins which are fixed together by special crimping. The bridge wire at the ends of the tinned brass contact fins is embedded in a spherical composition of combustion compound. A special coating protects the composition against mechanical damages and against environmental influences.

Unless used with DSPA activation interfaces like DSPA UAS or DSPA SCR (see Appendix F) , the electrical interface for DSPA aerosol generators is defined as:

Minimum operation voltage: 12 Vdc
Maximum operation voltage: 30 Vdc
Minimum current rating: 800 mA

Maximum line resistant (incl. DSPA aerosol generator): 25 Ω at 24 Vdc (1.6 Ω at 1.5 Vdc)
Value depends on the actual operating voltage according U (V) = I (A) * R_{line} (Ω)

Average resistance of the activation device: 0.8 Ω
Maximum safe current (no activation): 150 mA

See Chapter 6.2 “Aerosol generator installation.” For more detailed connection instructions.

3.6 Safety

Any hazard to personnel created by the actuation and discharge of the DSPA aerosol generators should be considered in the design of the system in particular with reference to the hazards associated with particular extinguishant.
Adherence to this document does not remove the user's statutory responsibility to comply with the appropriate safety regulations.

Reduced visibility:
DSPA aerosol generators are intended to be used in unoccupied and normally unoccupied areas. Once a DSPA generator is activated, a combustion process occurs within the generator that expels a white smoke (products of combustion and very fine particles) throughout the space. The particle sizes are small (< 5 micron) allowing the agent/particulate to remain suspended in the air for a long period of time. Without ventilation up to 60 minutes. These suspended particles significantly reduce the visibility in the space. The visibility is reduced to about 0.3 m assuming an illuminated source/target.

Potential toxicity:
The DSPA compound consist of 70-76% oxidizing agent, mainly inorganic potassium based products, 13-20% of a fuel/combustible additive like dicyandiamide and 7-14% of a novolac resin. These components are pressed in a solid block that are not friable and are contained in a rigid steel casing.

When activated, condensed aerosol generators may produce solid particles like potassium carbonate and gases such as nitrogen carbon dioxide and nitrogen dioxide, which are typical by-products of the aerosol generating reaction. At normal extinguishing concentration the solid particles as well as the gasses present no health hazards to personnel. The unknown, and potentially harmful, by-products of an actual fire pose the biggest risk to personnel.

While the components of the aerosol are not considered toxic at normal concentration levels (TNO[3] and Breglobal[4]), ingestion of the ultra-fine particulate may cause short-term discomfort and unnecessary exposure should be avoided. Tests have shown no long-term negative effects from exposure to the aerosol. The aerosol has a high obscuration factor when discharged. DSPA aerosol generators are designed only be used in unoccupied and normally unoccupied areas (area that is not occupied by persons under normal circumstances but may be entered occasionally for brief periods).

DSPA aerosol generators shall only be applied in areas where personnel may be present in conjunction with a 30 second time delay and (Pre-discharge-warning time)to ensure evacuation of personnel prior to discharge.

Environmental conditions
DSPA aerosol generators are listed under the United States Environmental Protection Agency (EPA) Significant New Alternatives Program (SNAP) as substitute for ozone depleting substances (ODS) for specific application.
The listing regulates the use of DSPA Aerosol Fixed Generators by finding them acceptable subject to use under specific conditions as substitutes for Halon 1301 for use in total flooding fire suppression systems in normally unoccupied spaces.

[3] TNO Quality Services BV, TQS-BRF-08-5028/nw, Product certificate of DSPA as fire extinguishing agent
[4] Breglobal, Tests with DSPA BV aerosol suppression system for prison cell fire protection, august 4th, 2008, client report number 246190

The pre-activation constituents of DSPA Aerosol are solids before use and therefore have zero ODP and zero GWP. Further, the ODP of each of the post-activation constituents of DSPA Aerosol is zero, and the GWPs of post-activation constituents are 1 or less.
Potential emissions of VOCs from the use of DSPA Aerosol in the fire extinguishing and explosion prevention sector relating to the environmental impacts of these VOCs are not considered a significant risk to local air quality.

For more information at http://www.gpo.gov/fdsys/pkg/FR-2012-09-19/pdf/2012-23138.pdf

Corrosivity
Due to the ultra-fine particles size and unique generator construction the particulate suspends in a gas/air mixture for an extended period.
DSPA B.V. recommends a hold time of minimal 10 minutes on common Class A and B fires. Depending on the situation, after minimal 10 minutes, a dehumidifier an axial fans must be placed in the enclosure. This prevents the settled particles to attract moisture and form an electrolyte.

Thermal hazard:
A condensed aerosol discharges at elevated temperatures. Depending on the intended application(s) of the aerosol system, the temperature at the minimum clearance from the discharge outlet, as specified by the manufacturer of the aerosol generators, should not exceed 75 °C for persons, 200 °C for combustible material and 400 °C for construction structures respectively. Immediately after discharge the aerosol generators can be hot, therefore, protective gloves shall be worn before handling generators up to 30 minutes after discharge.

Positioning
In rare cases, positioning of the DSPA generators may have been altered improperly or equipment may have been re-oriented within the protected enclosure resulting in an improper discharge directly onto a wall or equipment surface. This could result in the deposit of small, localized areas of highly concentrated agglomerated particulate on that surface. If left untended, an agglomerated mass may take on moisture and may cause non-progressive surface discoloration of unprotected metal surfaces. High-velocity discharge from the nozzle may be enough to dislodge substantial objects directly in its path, such as ceiling tiles and light fittings. Therefore, tiles and light fittings should be properly secured. Aerosol discharge may also cause enough general turbulence to move unsecured paper and light objects.

Oxygen levels
DSPA aerosol generators extinguish fires by means of interrupting the flame chain reaction chemically and do not extinguish fires by oxygen depletion. Tests have shown that the oxygen levels, after discharge of a DSPA generator remain at normal levels.

Clean up method
After a generator has been activated it is necessary to remove the products of burning and the settled aerosol from the surfaces as soon as possible, by a recognized salvage or disaster recovery company(e.g. Polygon[5]). Aerosol is hygroscopic sensitive material and has a week alkaline reaction after moisture absorption. This can cause the oxidation of nonferrous metals. See chapter 7.4 for post fire procedures. Contact DSPA B.V. for more information about clean-up methods.

[5] www.polygongroup.com

When replacing DSPA aerosol generators, be aware that immediately after discharge the canisters outer surface may exceed 150°C. Therefore, protective gloves should be worn before handling generators until at least 30 minutes after discharge.

Storage and Transportation

Based on test results as well as a desk study of TNO Defense, Security and Safety, Rijswijk, The Netherlands it is concluded that for transport purposes this generator need not be classified as a dangerous article[6].

[6] TNO-DV 2009 C660 Transport safety of a Dry Sprinkler Powder Aerosol Generator.

4. ATEX certified EX DSPA aerosol generators

Unless otherwise stated, all DSPA aerosol generators are also available in a version for use in hazardous area classified as Zone 2.

II3 G EX ec IIC T3 Gc

4.1 Labeling

DSPA aerosol generators that have the following label attached have been certified in compliance with the Directive 2014/34/EU of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 96/309 on 26 February 2014.

DEKRA Certification BV official label from DSPA B.V.

The following information is provided as part of the labeling of the DSPA aerosol generator:

- Name and address of the manufacturer:
  DSPA B.V., Hogelandseweg 30, 6545 AC Nijmegen, The Netherlands.
- The serial number of the device
- Year of production
- Model number
- CE Mark
- Marking for explosion protection: II3 G EX ec IIC T3 Gc
- DEKRA ATEX certificate number: 15ATEX0062 issue 3

4.2 Type approval standards

The DSPA Ex approved aerosol generators have an a type examination certificate issued by DEKRA Certification BV and have been approved to the following harmonized standards:

- IEC 60079-15:2010 Explosive atmospheres – Part 15: Equipment protection by type of protection “n”.

4.3 Zone, Gas Group, Category and Temperature class

The DSPA aerosol generators have been certified ATEX II3 G EX ec IIC T3 Gc (Tamb. -40°C to +75°C). This means that the units can be installed in locations with the following conditions:

4.3.1 Area Classification

Zone 2	Area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur, is likely to do so only infrequently and will exist for a short period only

4.3.2 Gas grouping

Group IIA	Propane
Group IIB	Ethylene
Group IIC	Hydrogen and Acetylene

4.3.3 Equipment category

3G (Zone 2 suitable for gasses explosive environments)

4.3.4 Temperature classification

Temperature Class	Maximum Surface Temperature (°C)
T3	200

4.3.5 Ambient Temperature Range

Ambient temperature range -40°C to +75°C.

4.4 Safe use of ATEX approved equipment

4.4.1 Mounting, Commissioning, and Operation

The DSPA aerosol generators has been designed to operate safely in accordance with the current technical and safety regulations of the EU. If installed incorrectly or used for applications for which it is not intended, it is possible that application related changes may arise. For this reason, the instrument must be installed, connected, operated, and maintained according to the instructions in this manual.

Persons handling/installing or commissioning this equipment must be authorized and suitably qualified. The manual must be read, understood, and the instructions must be followed. Modifications and repairs to the device are only permissible when they are expressly approved in this manual.

4.4.2 Explosive Hazardous Area

If the DSPA aerosol generator is to be installed in an explosive hazardous area, then the specifications in the certificate as well as all national and local regulations must be observed.

In case of a conflict between the general specifications elsewhere in this manual and the specifications given by the certificate (and/or this chapter), the specifications of the certificate must be followed.

4.5 Remote electronics and maintenance

In case the DSPA aerosol generator is installed in conjunction with a fire detection and release panel, e.g. the LST BC06 panel, the generator is connected with remote electronics like the so called EOL circuit (LST part no: AKPZ1-1 or AKPZ2-1). It is the installers responsibility to install this (small) circuit into an appropriate ATEX approved housing.

The generators are electrically energized only if the sensors connected to the Fire Detection and Release panel provide an alarm signal to the panel and the panel activates the generators. Under normal day-to-day operation the generators are not electrically energized (no current).

Please observe the following during (preventive) maintenance: Ensure that the power to the DSPA aerosol generator has been disconnected before you open any ATEX approved housing.

4.6 Earthing

The DSPA aerosol generators must be connected to a good quality earth. It is the installers responsibility to connect a cable shoe/crimp to one of the mounting bolds on the generators enclosure suited for a minimal 4 mm^2 ground cable connection. The cable must be secured against loosening and twisting.

4.7 Mounting the electrical screw in type activation device

To mount the screw in type activation device to the DSPA aerosol generator a sealant like PTFE pipefitter's tape must be applied to provide a reliable sealing on the metal threads. Two or three revolutions around the male thread of the activation device is enough. Tape should never extend beyond or overhang the first thread. If tape does not lie flat, firmly press the tape into the threads. Now tighten the male end connection of the activation device into the mating female thread.

5. Application design and limitations

5.1 General

Test methods are described in the EN 15276-1:2019 , UL 2775:2019:, ISO 15779:2011 and BRL-K23001/06:2020 and must meet the requirements according to EN 15276-2:2019, NFPA 2010:2020, ISO 15779:2011 and BRL-K23003/02:2019.

The following extinguishing densities(table 4) were determined according to International Standards accomplished by DSPA B.V.

Fires Class EN2	Description	DSPA minimum extinguishing density(g/m^3)	Fires Class NFPA 2010	Description	DSPA minimum extinguishing density(g/m^3)
Class A	Compatible wood crib test	79	Class A	Ordinary combustibles	79
Class A	Wood crib	116			
Class A	Polymethyl-acrylate	97	Class A	Ordinary combustibles	97
Class A	Polypropylene	58	Class A	Ordinary combustibles	58
Class A	ABS	87	Class A	Ordinary combustibles	87
Class A	Reformed wood (chops)	29			
Class A	MDF	59			
Class A	Multilayers plywood	87			
Class B	Flammable liquids	33.5	Class B	Flammable liquids	45
Class C	Flammable gases	32.7	Class C	Electrical	Determined by class A or B involvement

Table 4 Extinguishing density for DSPA aerosol generators according EN and UL

The minimum extinguishing density should be multiplied by a safety factor of 1,3 according to International Standards.

The safety factor of 1,3 relates to the increase of 30 % from the extinguishing density to the design density, which results in additional quantity of extinguishant. Circumstances which may not be adequately covered by this density and which may need allowance for additional extinguishant (i.e. more than 30 %) are included but not limited to the following:

a) Where leakage occurs from a non-tight enclosure.
b) Where leakage occurs due to doors being opened during or immediately after discharge.

According to the hold time tests of EN 15276-1:2019 and ISO 15779:2011 no additional mass of aerosol is needed as long as above density of 79 g/m3 is applicable and the leakage factor is smaller than 0.1%.

5.2 Application

The following steps must be taken to design and calculate usage for a DSPA system:

- Determine how the area is used and if floor, ceiling, and walls are fire-proof.
- Determine the hazard classification of materials and substrates inside of the area.
- Determine the appropriate extinguishing density for materials and substances inside the protected area.
- Determine the leakage potential of the hazard enclosure.
- Determine the geometrical dimensions of protected area (volume, total area, length, width and height; Protected equipment size is not deducted from the total volume).
- Determine if any large obstructions exist in the hazard.
- Determine if additional agent will be required to compensate for leakage..
- Include the safety factor of 30% and correction coefficients(when applicable) to obtain the correct design density.

5.2.1 Calculate the total mass of aerosol required to protect a certain volume

In case multiple fuels/heat sources exist in the protected volume, the highest of the extinguishing densities shall be used. In addition to these calculated total flooding quantities, additional quantities of extinguishant may be required (e.g. by national standards) to compensate for any special conditions that would adversely affect the extinguishing efficiency.

The design density, required mass of aerosol required for a specific volume, is calculated according to the following formula:

$$m = K_1 * K_2 * K_3 * K_x * V * c * S$$

Where:

m	=	the design density, total mass of aerosol required to protect the hazard in grams.
K_1	=	additional design factor based on the non-uniformity of aerosol distribution according to the height of the protected enclosure.
K_2	=	additional design factor based on the calculated leakage rate and leakage distribution for the protected volume.
K_3	=	additional design factor based on specific parameters for cable tunnels.
K_x	=	additional design factor based on specific parameters for altitude or temperature.
V	=	the total volume of the protected area in cubic meters.
C	=	extinguishing density of aerosol required to extinguish the hazard class, in grams per cubic meter.
S	=	Safety factor of 1.3 according to International Standards

5.2.2 Additional design factors

For the following (extraordinarily) situations additional design factors (K) must be used to correct to following effects:

- Leakage through enclosure openings
- Effects of altitude
- Effects of temperature
- Effects of ventilation

5.2.2.1 Additional design factors to compensate leakage through unclonable openings

Aerosol discharged into an enclosure for total flooding will result in an air and extinguishant mixture that has a lower specific gravity than the air surrounding the enclosure. Therefore, any openings especially in the ceiling and higher portions of the enclosure will allow condensed aerosol to flow out.
Most openings to enclosures, even difficult to close ones, can be closed just before extinguishing by using suitable devices. In case one or more openings cannot be closed (e.g. a conveyor belt penetrating the wall), corrections must be made to the calculated mass of required aerosol.

Leakage rate(ν) is calculated according to the formula:

$$\nu = \frac{\sum A_{open}}{A_{Total}} * 100\%$$

Where:
ν = leakage rate %
Σ Aopen = sum of the area of unclosed openings [m^2].
Atotal = total surface area of the bounding structure, including floor and ceiling[m^2].

Coefficient K1
The ratio based on the non-uniformity of aerosol distribution according to the height of the protected enclosure(K1) can be determined as follows:

	K1 when ν ≥ 1%[7]
Enclosure ≤3.5 m	1.00
Enclosure 3.51 – 5.0 m	1.15
Enclosure 5.01 – 8.0 m	1.25
Enclosure ≤ 10.0	1.40

Table 5 Coefficient K1 correction factor to compensate for the non-uniformity of aerosol distribution according to the height in enclosed spaces.

Coefficient K2
Coefficient K2 is determined by the relationship between the leaking parameter(δ) and the distribution of leakage in the protected enclosure (ψ).

Leakage parameter, delta(δ) is calculated according to the formula:

$$\delta = \frac{\sum A_{open}}{V_{Total}}$$

Where:
δ = Leakage parameter [m^{-1}] is a value, which characterizes the leakage of the protected enclosure as a ratio of the sum of the area of unclosed openings to the volume of the enclosure; the leakage parameter is limited to 0.001 m^{-1} per m3 volume for DSPA Aerosol generators, if the leakage parameter is greater and there are more unclosed openings more

[7] Leakage rate is allowed < 1.0% in enclosed spaces up to 5000 m^3; and is allowed <0.5% in enclosed spaces between 5000-10.000 m^3

or less equally divided over the enclosure, the leakage parameter is used to determine the correct value of K2.

Σ Aopen = sum of the area of unclosed openings [m^2].

Vtotal = total protected volume [m^3].

Leakage distribution, psi (ψ) is calculated according to the formula:

$$\psi = \frac{A_{upper}}{\sum A_{open}} * 100\%$$

Where:

ψ = Leakage distribution is the ratio of the area of constantly unclosed openings in the upper half of the protected enclosure(A_{upper}) to the sum of the area of constantly unclosed openings[%].

Σ Aopen = sum of the area of unclosed openings [m^2].

Aupper = surface area of constantly unclosed openings in the upper half of the protected enclosure[m^2].

Values of K2 are already been calculated and described in Appendix E.

Coefficient K3

The following values for coefficient K3 can be used to compensate the location, orientation and function defects of cables:

	K3
Building with cable installations	1.50
Cable structures where the longitudinal axis of the cable structure is situated at an angle > 45 degrees to the horizon (vertical, inclined cable collectors, tunnels and passages).	1.15
For all other structures	1.0

Table 6 Coefficient K3 correction factor to compensate the location, orientation and function defects of cables.

5.2.2.2 Additional design factors to compensate effects of altitude

The design calculations of DSPA aerosol generators should be adjusted to compensate for ambient pressures that vary more than 11 % (equivalent to approximately 1 000 m of elevation change) from standard sea level pressure (1,013 bar absolute). The ambient pressure is affected by changes in altitude, pressurization or depressurization of the protected enclosure, and weather-related barometric pressure changes.

At elevations above sea level, condensed aerosol expands to a greater specific volume because of the reduced atmospheric pressure. Hence, a system designed for sea level conditions will provide, at the same design density, a higher coverage at elevations above sea level. A reduction in extinguishant quantity is however not recommended as it may result in lower extinguishant performance.
For elevations below sea level, condensed aerosol may compress to a lower specific volume because of increased atmospheric pressure. This may result in lower coverage compared to that achieved under

sea level conditions, but the likelihood of this occurring should be low, due to a high velocity and elevated temperature of aerosol being released.
At elevations below sea level, the quantity indicated at sea level conditions should be increased to compensate for a lower coverage. Design density determined at sea level should be multiplied by correction coefficient(K_x) to obtain correct values. For the correction coefficient below sea level(mines and quarries), values can be obtained by your local distributor.

5.2.2.3 Additional design factor to compensate effects of temperature

Temperature, as with altitude, has no effect on condensed aerosol design density calculations, but it affects the extinguishant spatial distribution.
At elevated temperatures aerosol expands to a greater specific volume. A system designed for standard conditions will therefore develop, at the same design density, a higher distribution at elevated temperatures. Reduction in quantity of extinguishant is, however, not recommended, as it may result in lower extinguishant performance.
At lower temperatures aerosol may compress to a lesser specific volume. This may result in lower coverage compared to that achieved under standard temperature conditions. The likelihood of this should be low due to a high velocity and the elevated temperature of aerosol being released.
At temperatures below zero, the quantity indicated at room temperature should be increased to compensate for a lower coverage. Design density determined at room temperature should be multiplied by a correction coefficient(K_x). For information about correction coefficient below zero contact DSPA B.V.

5.2.2.4 Additional design factor to compensate effects of ventilation

All ventilation systems should be shut down prior to the actuation of DSPA system. However, the possibility of aerosol discharge into an enclosure that is ventilated should also be considered. In such enclosures some extinguishant will be lost with the ventilating air. Assuming that ventilation continues during and after discharge, a greater amount of extinguishant is required to develop a given design density.
Also, to maintain the design density at a given level requires continuous extinguishant discharge for the duration of the holding period. If an enclosure initially contains pure air, the DSPA discharge rate required to develop a given design density for extinguishant at any given time after the start of discharge. For information about calculations with ventilation systems contact the manufacturer.

5.2.3 System discharge time

The combination of selected DSPA aerosol generators, the selected control system and the selected extinguishing interface(s) shall not result into a discharge time which exceed 90 s from the actuation for extinguishing systems according EN 15276-2:2019 and 60 seconds for extinguishing systems designed according UL 2775:2019.

Where an extended discharge is necessary, the duration shall be sufficient to maintain the application density for the required hold time. For information about calculations with extended discharge contact the manufacturer.

5.2.4 Aerosol generator selection

As each DSPA generator contains a distinct amount of the solid aerosol-forming compound, there may be a few options in regards to the unit size and number of the aerosol generators that would be adequate to achieve the required design quantity.

$$Number\ of\ DSPA's\ = \frac{Total\ mass\ of\ aersol\ required(g)}{\text{Effective Mass}\ of\ individual\ aerosol}$$

The number of DSPA aerosol generators required is rounded up to a whole number.

The type of DSPA generator selected is typically based on several considerations as follows:

- The selected unit sizes should conform to the maximum distance and area coverage and maximum protected height limitations as specified for each unit.
- The selected unit sizes should be appropriate for the protected area in terms of the minimum thermal clearance from the discharge outlets. If the protected area is congested or contains temperature sensitive equipment, it would be appropriate to select several smaller units that require less minimum clearance although one large unit may be adequate in terms of achieving the required design quantity. In some applications such as cable ducts and trenches several smaller units of the same family evenly spread along the protected enclosure would provide better distribution and faster achievement of the minimum design density throughout the area although one large unit may fulfill the agent quantity requirement.
- Certain protected enclosures may have very specific permissible mounting locations. This may influence the quantity and size of the units selected.

5.2.4.1 Area coverage review

Each DSPA generator has been tested and listed with a unique "footprint" for area coverage and maximum height of protected area (See Table 7). Once the number of aerosol generators required to provide the necessary mass of aerosol has been determined, the area coverage of each unit selected must be evaluated to ensure the system falls within listed parameters. If not, additional units or a different mix of generator types shall be selected to ensure the final system configuration conforms to the DSPA listing.

Model	Housing Type and Discharge method	Agent distribution			
		Maximum area coverage (in m) (with tested height)		Maximum height (with tested area)	
		Height	Area	Height	Area
DSPA 11-1	Disk, radial	0.5	3.66 x 1.22	1.83	1.22 x 1.22
DSPA 11-2	Disk, radial	0.5	3.66 x 2.44	2.44	1.22 x 1.22
DSPA 11-3	Disk, radial	0.5	3.66 x 2.44	2.44	1.22 x 1.22
DSPA 11-4	Disk, radial	1.22	3.66 x 3.66	3.05	1.83 x 1.83
DSPA 11-5	Disk, radial	1.22	4.88 x 3.66	3.66	2.44 x 2.44
DSPA 11-6	Disk, radial	1.22	7.32 x 3.66	3.66	2.44 x 2.44
DSPA 11-7	Disk, axial	1.00	4.88 x 2.44	4.00	2.44 x 1.22
DSPA 8-1	Cylinder, axial	2.44	9.76 x 3.66	4.88	4.88 x 3.66
DSPA 8-1-60	Cylinder, axial	2.44	7.32 x 4.00	6.10	4,88 x 2.44
DSPA 12-1	Disk, radial	0.50	0,81 x 0,73	n.a.	n.a.
DSPA 12-2	Disk, radial	0.50	1,60 x 0,81	0,80	0,81 x 0,74
DSPA 12-3	Disk. Radial	0.80	1,49 x 0,81	1,99	0,86 x 0,81
DSPA 12-4	Disk, radial	1.60	1,99 x 0,81	1,99	1,60 x 0,81
DSPA 12-5	Disk, radial	-	-	0,53	0,59 x 0,25
DSPA 17-1	Disk, radial	1.22	7.32 x 3.66	3.66	2.44 x 2.44
FE100	Cylinder, axial	0.80	2.00 x 1.60	2.00	1.60 x 0.80
DSPA 0.90-2	Cylinder, outlet	0.50	2.00 x 2.00	2.00	0.50 x 2.00
DSPA 0.45-2	Cylinder, outlet	0.50	2.00 x 1.00	1.00	0.50 x 2.00
DSPA 2-4-1	Cylinder, axial	2.44	3.66 x 4.00	6.10	2.44 x 2.44

Table 7 Installation and coverage limitations

5.3 Other Facility Considerations

In cases where there is a large ratio of fixed equipment to total volume, or where the protected equipment is located in such a way as to present a barrier to the free flow and distribution of agent throughout the hazard area a strategic placement of the systems is required to improve distribution characteristics throughout the area.

5.3.1 Total flooding in areas where personnel may be present

Note: In total flooding installations where personnel may be present, a 30 second time delay shall be installed to ensure evacuation time prior to system discharge. In occupied and normally unoccupied areas, a system isolate switch shall be installed outside the hazard area to ensure that activation of the system is inhibited when personnel are present.

5.4 Placement of the DSPA generator

5.4.1 Mounting

Position mounting brackets and securely fasten to wall, ceiling, or other support in a location and manner which ensures the generators will not be subjected to accidental damage or movement.
Make sure mounting brackets are located in a manner to ensure a circular flow pattern and maximum mixing of aerosol during discharge.
Securely attach generators to the mounting brackets or fixed mounting position to ensure free of the activator mechanism and that all bolts are securely tightened in place.
Verify that generator mounting brackets and clamps are properly installed and that all fittings are tight.

DSPA 8-1, DSPA 11-5, DSPA 11-6, DSPA 2-4-1 and DSPA 17-1 aerosol generators are regular equipped with mounting brackets like Figure 6. The brackets are based on 1 mm stainless steel plate material and have been coated with a polyurethane/polyester protective coating system.

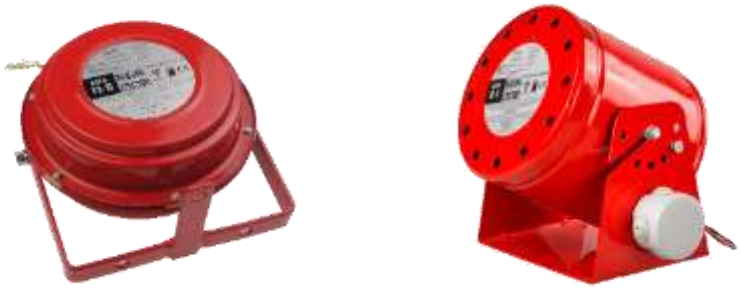


Figure 6. Some DSPA aerosol generators and their mounting brackets

The DSPA 11-1, 11-2, 11-3, 11-4, 11-7, 12-1, 12-2, 12-3, 12-4, 12-5 and FE100 aerosol generators can be mounted using the mounting positions fixed on the generators.

The DSPA 0.90-2 and DSPA 0.45-2 are default equipped with magnets. A separate mounting bracket can also be ordered.

The DSPA generators must be fixed with bolts with appropriate length and size. Use always approved materials so that all bolts are securely tightened.

DSPA aerosol generators are listed for both sidewall and center locations and may be mounted on walls, beams, constructions and columns as long as the unit is securely fastened and is mounted in a position where it has an unobstructed discharge path and where it will not impact on personnel, equipment and combustible materials located within the protected area.

5.4.2 Mounting Height

In general, the aerosol generators should be mounted in rooms at or near ceiling height and angled to discharge down toward the floor at an angle to ensure three-dimensional distribution of aerosol. Normal orientation from vertical is 5-25° for sidewall mounting and vertical for center mounting. In larger volumes (=100m3) utilizing the DSPA 8-1 the rotational angles should ensure as long an unobstructed discharge path as possible(see Figure 7). The aerosol generators must be mounted in such a way as to

have a clear discharge path and must not discharge onto walls or equipment as this will result in agglomeration and decreased effectiveness.

Distribution tests shows that at larger volumes generators can best be installed at lower heights than the height of the protected volume. In order to ensure maximum distribution of aerosol throughout the hazard area, the maximum height of generator placement must be limited as indicated in Table 8.

Model	Type	Aerosol mass(g)	Installation height limitation	Min. distance of persons(75°C)	Min. distance of combustible material(200°C)	Min. distance of construction structures(400°C)
DSPA 11-1	Radial	110	1.83 m	0,50 m	0,25 m	0,05 m
DSPA 11-2	Radial	170	2.44 m	0,50 m	0,25 m	0,05 m
DSPA 11-3	Radial	300	2.44 m	0,50 m	0,25 m	0,05 m
DSPA 11-4	Radial	900	3.05 m	1,0 m	0,50 m	0,15 m
DSPA 11-5	Radial	1400	3.66 m	1,0 m	0,50 m	0,15 m
DSPA 11-6	Radial	2300	3.66 m	1,5 m	0,75 m	0,15 m
DSPA 11-7	Axial	520	3.00 m	1,5 m	0,50 m	0,10 m
DSPA 8-1	Axial	3250	3.00 m	1,5 m	0,75 m	0,15 m
DSPA 8-1-60	Axial	3250	3.00 m	3,0 m	1,00 m	0,10 m
DSPA 12-1	Radial	15	-	0,08 m	0,03 m	0,01 m
DSPA 12-2	Radial	30	0.81 m	0,15	0,08	0,02
DSPA 12-3	Radial	55	1.99 m	0,25	0,10	0,03
DSPA 12-4	Radial	110	1.99 m	0,30	0,15	0,05
DSPA 12-5	Radial	5	0.53 m	0,08	0,03	0,01
DSPA 17-1	Radial	2300	3.66 m	1,5 m	0,75 m	0,15 m
FE100	Axial	100	2.00 m	0,30	0,15	0,05
DSPA 0.90-2	Outlet	90	2.00 m	0.50 m	0.25 m	0.05 m
DSPA 0.45-2	Outlet	45	1.00 m	0.50 m	0.25 m	0.05 m
DSPA 2-4-1	Axial	1600	3.00 m	1.5 m	0.50 m	0.15 m

Table 8 Installation height limitations and minimal safe distance

In facilities with walls higher than the heights given in Table 7 aerosol generator systems for total flooding must be designed to place generators on multiple levels. Nominal 50% of the generators must be mounted on the first tier at a height according to the maximum installation height listed in Table 8 for the model utilized. Nominal 50% of the generators must be mounted in a second tier located above the first tier near the ceiling or at a relative installation height within the second tier according Table 8. This will ensure complete and even distribution of aerosol throughout the hazard area.

Generators used in suspended ceiling applications should be mounted to discharge radial due the limited height of the volume. For the same reason, suspended ceiling applications should generally utilize smaller units (DSPA 11-1, 11-2, 11-3 and DSPA 12 Series).
Although the minimal height tested indicates that a minimal height of 0.50 m must be used, DSPA B.V. suggests using the minimal safe distance of combustible material, 0.15 m as minimum height in similar

applications. Likewise, depending on the application enclosure, other DSPA aerosol generator type must be interpreted.

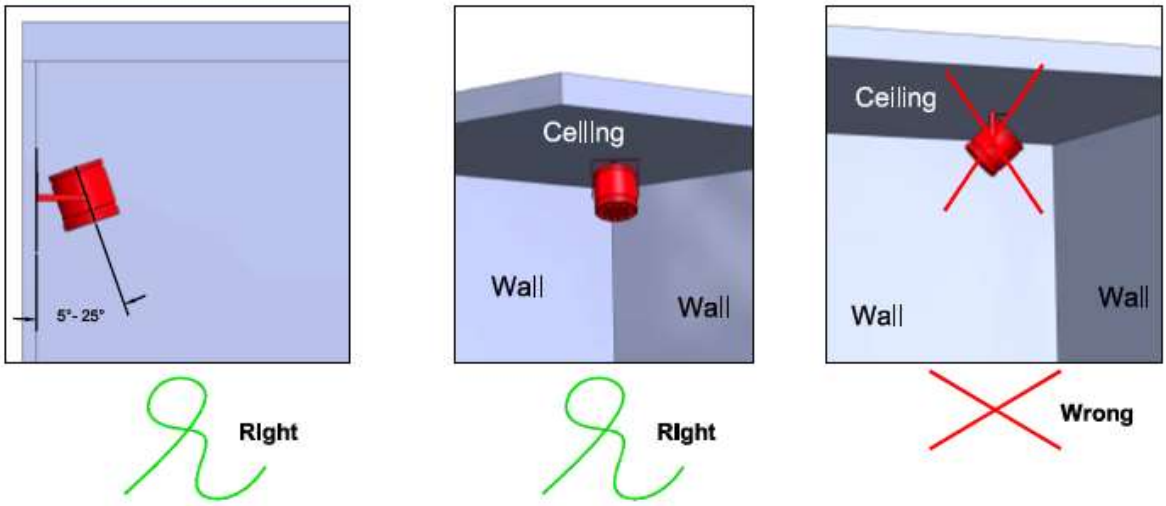


Figure 7. Positioning of DSPA aerosol generators with axial discharge

Aerosol generators must never be positioned to discharge directly at each other! Aerosol generators must be mounted in such a way as to have an unobstructed discharge path and must not discharge at close range onto walls, ceiling, or equipment(Figure 8). Always check for obstructions in the path of the aerosol discharge stream. Generators must be installed in such way that they cannot cause personnel injury upon activation.
Aerosol generators should not be positioned direct above equipment or other materials, even when the minimum distance to the objects is taken into account. After discharge, disposable residue could drop and may damage the equipment.

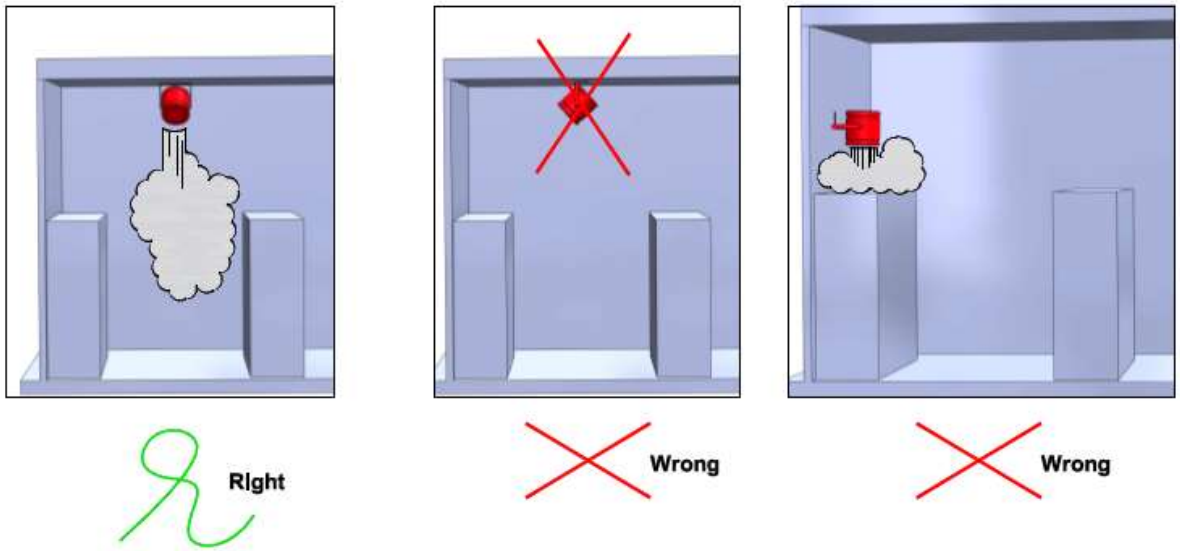


Figure 8 Aerosol generators mounted in such way as to have an unobstructed discharge path and not discharge at close range onto walls, ceiling, or equipment.

5.4.3 Electrical hazards

Where exposed electrical conductors are present, electrical clearances no smaller than those given in the Table below shall be provided, where practicable, between the electrical conductors and all parts of the system that may be approached during maintenance. Where these clearances cannot be achieved, warning notices shall be provided and a safe system of maintenance work shall be adopted.

The system should be so arranged that all normal operations can be carried out safely by the operator.

Maximum rated voltage (KV)	Minimum clearance from any point on or around the permanent equipment where a person may be required to stand. (m)	
	To the nearest unscreened live conductor in air (section clearance)	To the nearest part not at earth potential of an insulator b supporting a live conductor (ground clearance)
15	2,6	2,5
33	2,75	2,5
44	2,90	2,5
66	3,10	2,5
88	3,20	2,5
110	3,35	2,5
132	3,50	2,5
165	3,80	2,5
220	4,30	2,5
275	4,60	2,5

- Minimum clearance measured from position of the feet.
- The term “insulator” includes all forms of insulating supports, such as pedestal and suspension insulators, bushings, cable sealing ends and the insulating supports of certain types of circuit breaker.
- Always check the clearances against local regulations!

Systems within electrical substations or switch rooms shall be efficiently bonded and earthed to prevent the metalwork from becoming electrically charged. At least the system shall be adequately bonded and earthed to minimize the risk of electrostatic discharge.

5.4.4 Flow

Placement of the aerosol generators to ensure proper aerosol flow and distribution is extremely important. Generators should be spaced as evenly as possible around the hazard area and directionally positioned to promote a circular, 3-dimesional flow pattern. Aerosol generators must never be positioned to discharge directly at each other! This will cause agglomeration of the aerosol particulate, reducing the aerosol's extinguishing effectiveness. For the same reason, aerosol generators in total flood applications should also be positioned to ensure that the aerosol stream does not impinge directly on walls or the sides of equipment being protected. There should be no flammable or highly combustible materials or equipment within a specified minimum clearance from the generator’s nozzle(See Figure 9)

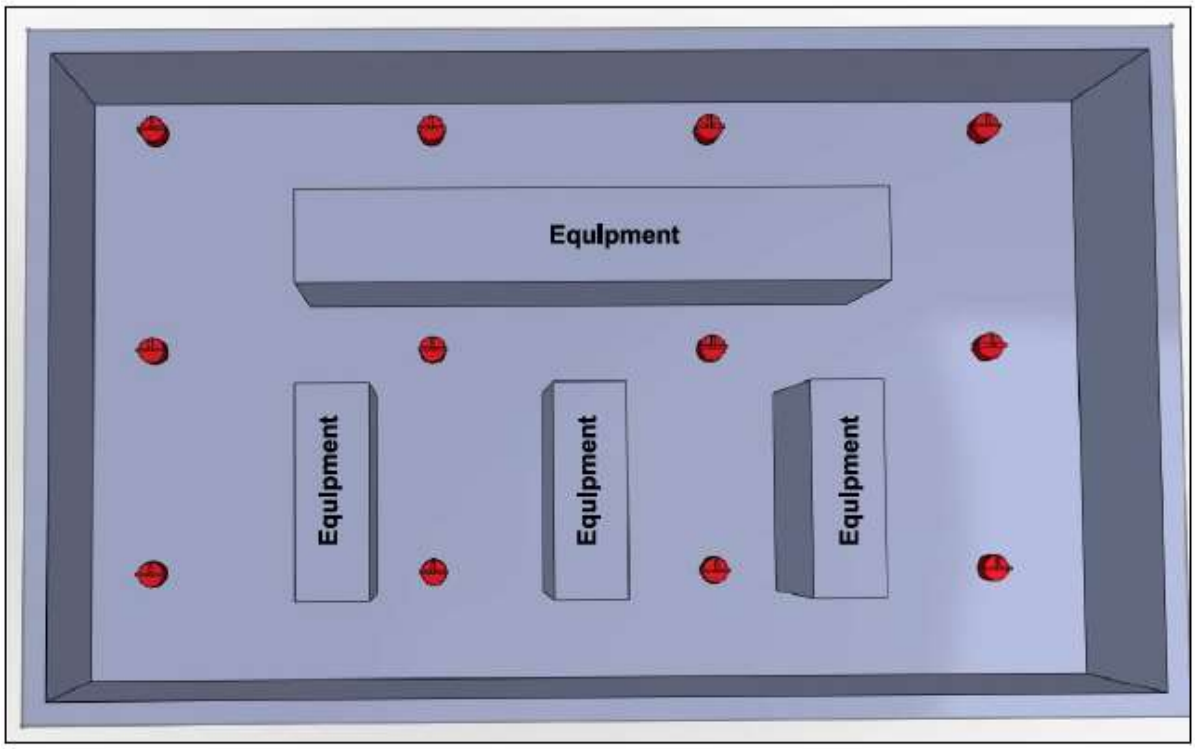


Figure 9 Evenly distribution to achieve an unhindered distribution by center mounting

Note:

- Generators should be located in such a way as not to orient the aerosol discharge across any route of exit(See Figure 10).
- If there are any enclosable openings such as exits, doors and apertures, aerosol discharge should be directed across the likely fire zone and not towards those openings;
- If there are any obstacles which could obstruct the free flow of the aerosol, it is preferable to install several small generators instead of one large one, should design limitations for smaller units allow such a replacement. If it is not possible, the distance from the nozzle to the obstacle should be not less than the minimum distance given in the Technical Specifications. In case of multiple obstacles the design density should be increased;
- The aerosol generator should be mounted in a way that a free outflow of aerosol is possible. The minimum distance from the generator outlet to the first obstacle is given in the Technical Specifications.

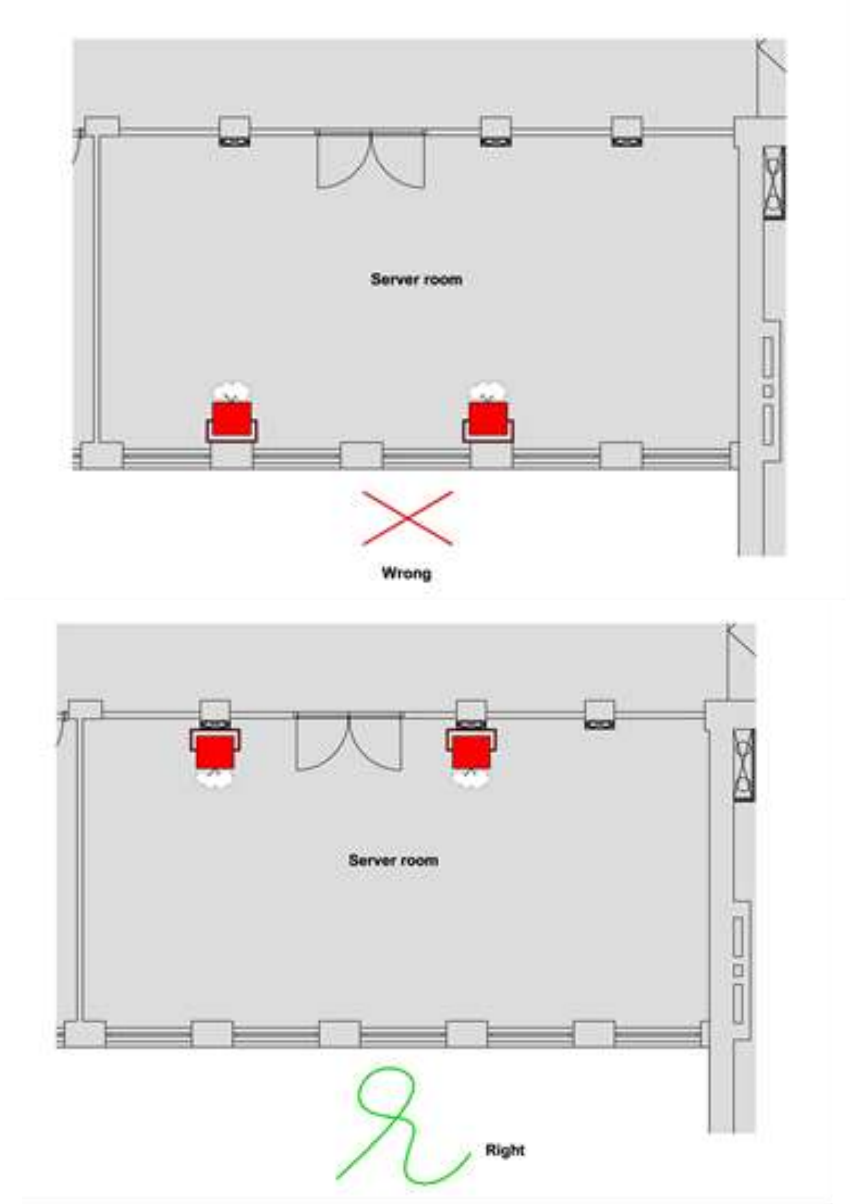


Figure 10 Location of the DSPA aerosol generators must be placed in such a way as to orient the aerosol discharge not across any route of exit

6. System installation

6.1 General

All DSPA equipment must be installed to facilitate proper operation, inspection, testing, and any other maintenance as may be necessary. Equipment must not be subject to mechanical, chemical, or other damage, which could render the equipment inoperative. Equipment must be installed in accordance with all applicable standards and the contents of this section of the Manual.

Applicable standards:

- EN 15276-2:2019 Fixed firefighting systems - Condensed aerosol extinguishing systems - Part 2: Design, installation and maintenance
- NFPA 2010:2020 Standard for Fixed Aerosol Fire Extinguishing Systems
- BRL-K23003/02:2019 KIWA process certificate for design, installation, acceptance and service of fire extinguishing systems based on aerosol.
- ISO 15779:2011 Condensed aerosol fire extinguishing systems - Requirements and test methods for components and system design, installation and maintenance - General requirements

All persons who can be expected to inspect, test, maintain or operate fire-extinguishing systems shall be trained and kept adequately trained in the functions they are expected to perform.

DSPA B.V. strongly advises to design and implement fire protection and extinguishing systems according local regulations and/or international standards. As result of the design process a number of working documents shall be prepared by persons fully experienced in the design of extinguishing systems.

Working documents shall include at least the following items:

- Location drawings;
- Name of owner and occupant;
- Location of the building in which hazard is located;
- Location and construction of protected enclosure walls and partitions;
- Enclosure cross-section, full height or schematic diagram, including raised access floor and suspended ceiling;
- Type of aerosol generators being used;
- Design application density;
- Description of occupancies and hazard to be protected against;
- Specification of aerosol generators used;
- Equipment schedule or list of materials for each piece of equipment or device, showing device name;
- Manufacturer, model or part number, quantity and description;
- System calculation;
- Enclosure pressurization and venting calculations;
- Description of fire detection, actuation and control systems.

Deviation from the above documents shall require permission from the relevant authority.

DSPA B.V. invests continuously into Fire Detection and Control Equipment to be compatible with DSPA aerosol generators and the compliance of the equipment with above standards. Appendix F gives an overview of equipment approved by DSPA B.V. to be compatible with DSPA aerosol generators. The appendix also indicates if the equipment has a formal declaration of a Notified Body to be compliance with the applicable standards. On request DSPA can investigate other equipment on their compatibility with DSPA aerosol generators.

WARNING!
DSPA AEROSOL GENERATORS MUST ONLY BE HANDLED, INSTALLED, AND SERVICED ACCORDING THE INSTRUCTIONS CONTAINED IN THIS SECTION. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD CAUSE A PREMATURE DISCHARGE RESULTING IN POTENTIAL INJURY.

6.2 Aerosol generator installation.

DSPA aerosol generators should normally be located within the protected hazard area.
The following installation instructions must be followed in the exact sequence outlined below to prevent accidental discharge, bodily injury, or property damage.

It is important that prior to the installation of DSPA aerosol generators the integrity and resistance of the electric activation circuit for each generator be checked with the use of a digital multi-meter. The maximum test current shall not exceed 150 mA. The resistance of the electric activation circuit depends on the length of the connection wires and is typical within 0.4 – 0.8 Ω for the activation device and about 0,07 Ω/m for a 2-wire cable (0.8 mm / AWG 20).

WARNING!
TO PREVENT PERSONNEL INJURY, DE-ENERGIZE ALL ELECTRICAL CONNECTIONS PRIOR TO GENERATOR INSTALLATION.

6.2.1 Single Generator System:

1. Position DSPA generator and securely fasten to wall, ceiling, or other support in a location and manner, which ensures the generator will not be subjected to accidental damage or movement.
2. Check electrical activation device integrity with Ohmmeter. Do not install if reading is outside range of 0.4 - 0.8 Ω.
3. Position generator to allow for an unimpeded discharge upon activation. Care must be taken so that the generator does not directly discharge at close range at the wall, ceiling, or vertical surfaces of the equipment within the hazard area.
4. Taking care to ensure that power is off, connect electrical lines to the activator of the generator.

WARNING!
TO PREVENT PERSONNEL INJURY, DE-ENERGIZE ALL ELECTRICAL CONNECTIONS PRIOR TO GENERATOR INSTALLATION. BE CAREFUL TO ENSURE THAT NO BODY PART IS PLACED DIRECTLY IN FRONT OF THE GENERATOR EXIT PORTS DURING INSTALLATION.

6.2.2 Multiple Generator System:

1. Position DSPA generator and securely fasten to wall, ceiling, or other support in a location and manner which ensures the generators will not be subjected to accidental damage or movement.
2. Check igniter integrity with Ohmmeter. Do not install if reading is outside range of 0.4 - 0.8 Ω.
3. Position generator to allow for an unimpeded discharge upon activation. Care must be taken so that the generator does not directly discharge at close range at the wall, ceiling, or vertical surfaces of the equipment within the hazard area. Generators must be positioned to promote circular flow and mixing of aerosol from multiple generators. Aerosol generators must never be positioned to discharge directly at each other! This will cause agglomeration of the aerosol particulate, reducing the aerosol's extinguishing effectiveness.
4. Make sure that the power is off, connect electrical lines to the activator of the generator.
5. DSPA strongly advises to use a proper, by DSPA listed, interface between the used fire detection and release panel and the DSPA aerosol generators. The maximum number of DSPA aerosol generators which can be connected to the system depends on the used fire detection and release panel and the applied interface (see Appendix F).
   Where such an interface is not used, to following guide lines should be used:

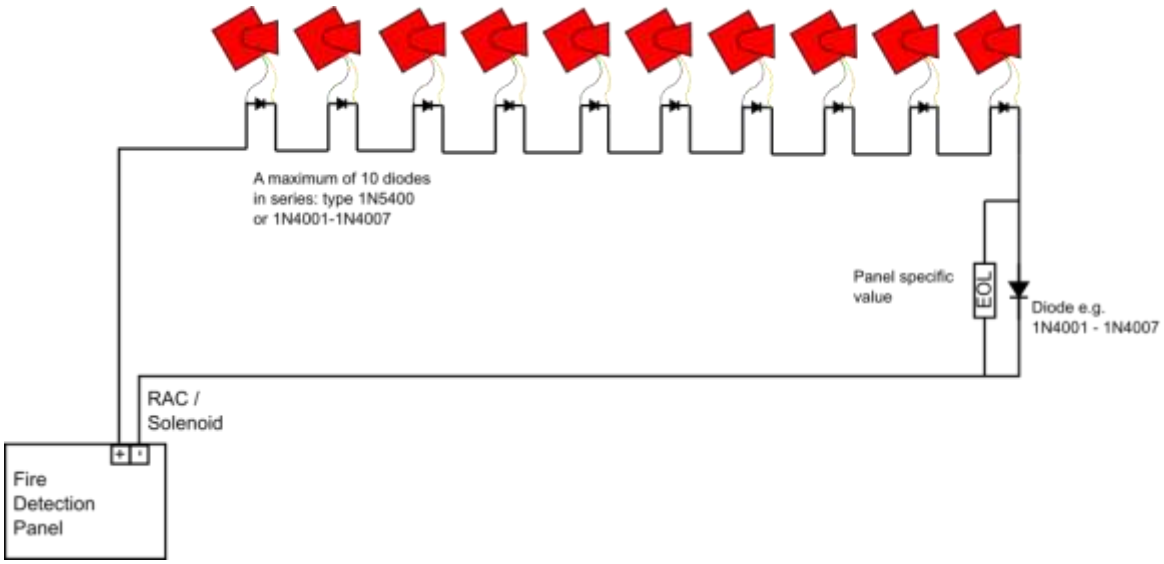


Figure 11 Serial connection of up to 10 DSPA aerosol generators (at 24Vdc)

Voltage Nr of DSPA generators	12 Vdc		24 Vdc	
	Rmax (incl. DSPA)	Length AWG 20 (Ø 0,8 mm)	Rmax (incl. DSPA)	Length AWG 20 (Ø 0,8 mm)
1	11 Ω	160 m	25 Ω	330 m
2	11 Ω	140 m	25 Ω	310 m
3	11 Ω	120 m	25 Ω	290 m
4	11 Ω	100 m	25 Ω	270 m
5	-		25 Ω	250 m
6	-		25 Ω	230 m
7	-		25 Ω	210 m
8	-		25 Ω	190 m
9	-		25 Ω	170 m
10	-		25 Ω	150 m

6.2.3 Post Installation

After the DSPA aerosol generators have been installed and connected to the appropriate detection and/or control system perform the following inspection and tests.

1. Verify that generators of the correct size are installed per the installation drawings.
2. Verify that the DSPA generators are properly installed and that all fittings are tight.
3. Verify that all electrical connections have been made and test for electrical continuity using an Ohmmeter (electrical only).
4. Verify that all generators are positioned properly. Check for obstructions in the path of the aerosol discharge stream. Generators must be installed such that they cannot cause personnel injury upon activation. The aerosol discharge stream must not impinge at close range on walls, ceiling, or vertical surfaces of equipment!
5. Manual/Electrical pull stations must be properly installed, readily accessible, and clearly identified.
6. Verify Time Delay functionality and integrity.
7. All acceptance testing shall be in accordance with this Manual, any applicable standards, and the authority having jurisdiction.
8. Last but not least, document the aerosol extinguishing system together with daily maintenance instructions and post fire instructions (see chapter 7) into the logbook.

6.3 DSPA Installation and Expiry Date Label

An example of a label of the DSPA 11-1 is displayed in figure 12. The label is 'filled in' and affixed to every generator used in the system. The batch number and production date are 'filled in' by the manufacturer, while the installation and expiry date are 'filled in' by the distributer in a logbook.

The batch number is set up as follows:
The first 3 digits are based on the article number of the DSPA generator type(see also table 3), followed by a letter(N) and ending at 4 digits as serial number
Example:

0	1	1	N	0	1	5	1

011 = 100011 = DSPA 11-1
N0151 = Number 151 out of the serial number(max 9999)

Generators produced after April 2018 have a production date in readable format (Year and Month).
Generators before April 2018 have a production date based on a code:
The date code appears as follows, where the alphabetic character represents the year and the numeric the month of shipment from the factory:
A = 2012 B = 2013 C = 2014 etc.
01= January 02= February 03 = March etc.
A generator marked with A10, for example, would have shipped in October of 2012.

Figure 12 Example of a label of the DSPA 11-1.

For systems with electrical operation only (no thermal automatic operation) the installed date is the current date and the expiry date is normally 15 years later, except when installed in an aggressive environment where the service life is likely to be less, in which case please refer to an Approved Representative for an assessment of the expected service life.

6.4 DSPA Warning & Instruction Signs

The following Warning and Instruction Signs shall be firmly attached to specified locations by the installer on completion of the installation in normally unoccupied areas, where people may enter the enclosure for brief periods:

a) Label to be displayed at entrance to enclosure:

THIS AREA IS PROTECTED WITH A DSPA AEROSOL FIRE EXTINGUISHING SYSTEM DO NOT ENTER UNLESS THE SYSTEM IS ISOLATED AFTER AEROSOL DISCHARGE DO NOT ENTER UNTIL AREA HAS BEEN VENTILATED

b) Label to be displayed inside enclosure

THIS AREA IS PROTECTED WITH A DSPA AEROSOL FIRE EXTINGUISHING SYSTEM EVACUATE AREA ON SOUND OF ALARM AFTER AEROSOL DISCHARGE DO NOT ENTER UNTIL AREA HAS BEEN VENTILATED

c) Label to be displayed at System Isolate Switch

DSPA SYSTEM ISOLATE SWITCH WARNING CHECK THAT THE AREA IS CLEAR OF PERSONNEL BEFORE REACTIVATING THE SYSTEM

d) Label to be displayed at Manual Release Point

DSPA AEROSOL FIRE EXTINGUISHING SYSTEM MANUAL RELEASE POINT ENSURE AREA IS EVACUATED BEFORE RELEASE OF DSPA AEROSOL

7. Operation requirements

Personnel working in an enclosure protected by an aerosol extinguishant shall receive training in the operation and use of the system, in particular regarding safety issues and the operation requirements as described in this chapter.

7.1 General

The DSPA generator consists of a solid blocks of aerosol compound, is not friable and is contained in a rigid steel casing. Upon activation the charge begins a controlled burn producing an ultra-fine aerosol of N_2, CO_2 and a minor amount of water vapor. The aerosol passes through an insulating material where the temperature of the aerosol is rapidly reduced before it escapes through the discharge outlet of the generator at low pressure. Generator placement within the hazard area provides proper flow and distribution of the highly effective aerosol within the protected area.

7.2 Operating procedure

7.2.1 Electrical Automatic Operation schema

Electrical automatic operation occurs upon activation of the detection circuit, initiating a current source from the Fire Detection Control Panel to the generators. In areas where personnel may be present, a 30 second time delay shall be installed to ensure egress time prior to system discharge. In occupied and normally unoccupied areas, a system isolate switch shall be installed outside the hazard area to ensure that activation of the system is inhibited when personnel are present. Personnel must evacuate the hazard area promptly upon hearing the pre-discharge alarm. Ensure no one enters the hazard area after discharge and call the fire department promptly.

Automatic detection shall be by any method or device acceptable to the authority and shall be capable of early detection and indication of heat, flame, smoke, combustible vapors, or any abnormal condition in de hazard that is likely to produce fire.
The detection system shall be based on EN 54-14 or EN 12094, whichever applies. In case a standard requires a higher level of criteria's these shall be implemented in the basic design.
The detection method shall be based on the principles given in table 9.

Type of application	Type of protection	Number of criteria	Detection of	Activation criteria
Room	Total flooding	3	CO, heat and smoke	2 detectors or 2 groups
Object/cabinet	Total flooding	2	CO and heat	
Specific	See protocol	See protocol	See protocol	
Specific applications shall be based on a test protocol and according as described at chapter 8.2.2 of EN 15276-2:2019				

Table 9 Detection principle

Be aware that detectors installed at the maximum spacing for fire alarm use can result in excessive delay in extinguishing release, especially where more than one detection device is required to be in alarm before automatic actuation results.
Smoke detectors can be activated by aerosol extinguishing media, release of the aerosol can cause unwanted activation of smoke detectors in adjacent areas. When two or more detectors are used, such

as those for detecting smoke or flame, it is preferable for the system to operate only after signals from two detectors have been received.

7.2.2 Remote electrical manual operation

Manual electrical operation is performed by manual release from a releasing device located (manual call point) outside the protected enclosure.
Operate as follows:

1. Upon fire notification, leave the hazard area quickly.
2. Proceed to the appropriate remote manual/electrical pull station for the hazard.
3. Ensure all personnel have exited the protected enclosure
4. Operate manual pull station.
5. Allow no one to enter the hazard area. Call the fire department promptly.

7.2.3 System Isolate switch

The automatic operation of the system shall be prevented by means of a system isolate switch (located outside the protected area) when personnel are present in the hazard area. While the system isolate switch is active the automatic activation of the system is inhibited but the fire detection and alarm system shall continue to function. The system shall return to full automatic control when the switch is reactivated. The operation of the system isolate switch shall electrically isolate and earth each conductor of the wiring to the generators and initiate a visual indicator of status at the Control Station.

NOTE
THE ABOVE INSTRUCTION MUST BE POSTED ON DISPLAY IN THE PROTECTED AREA.

7.3 Post Fire Operation

After discharge of a DSPA aerosol generator, qualified fire suppression system maintenance personnel must perform post fire maintenance and system installation procedures outlined in this Manual. Observe all warnings, especially those pertaining to the length of elapsed time before entering the hazard area.

WARNING!
DO NOT ENTER A HAZARD AREA WITH AN OPEN FLAME OR LIGHTED CIGARETTE. THE POSSIBLE PRESENCE OF FLAMMABLE VAPORS MAY CAUSE RE-IGNITION OR EXPLOSION.

WARNING!
ENSURE FIRE IS COMPLETELY EXTINGUISHED BEFORE VENTILATING AREA. BEFORE PERMITTING ANYONE TO ENTER THE HAZARD AREA, VENTILATE AREA THOROUGHLY OR USE SELF-CONTAINED BREATHING APPARATUS

7.4 Post fire procedure

The following procedures must be followed in the exact sequence to maintain and re-commission a DSPA aerosol generator system:

1. After discharge, allow a minimum hold time of 10 minutes.
2. Do not enter the enclosure, secure enclosure for unauthorized personnel.

3. Switch off electronic apparatus; only keep the internal air conditioning switched on .[8]
4. In case of high air humidity, place dehumidifiers in the room.
5. Keep windows and doors closed.
6. After the hold time, 10-15 minutes, switch on external ventilation.[9]
7. If the enclosure is safe you may enter the enclosure.
8. Use high pressure air to blow settled aerosol away.
9. Clean surfaces with a clamp cloth to remove the last aerosol.
10. Contact e.g. Polygon or your local salvage company within 12 hours after discharge[10]
11. Dispose of spent generators according to applicable federal, state, and local regulations.
12. Contact your DSPA distributor immediately for replacement generators.

WARNING!
BEFORE PERFORMING POST FIRE MAINTENANCE PROCEDURES, REFER TO THE MATERIAL SAFETY DATA SHEETS AND INFOSHEETS IN THIS MANUAL.

NOTE
DSPA aerosol generators have been tested as cold discharge on a wide range of materials including structural, composites and materials commonly used in electronic equipment. In all cases it has been shown that DSPA aerosol generators have no deleterious effect on the operating capability of equipment.
Due to the ultra-fine particle size and the method of generation, the particulate is quite buoyant[11] and suspends in the gas/air mixture within the protected enclosure. Because of this “buoyant” effect the aerosol does not begin to “settle” for an extended period (up to an hour). Only very minor amounts of particulate may be deposited on equipment. Any particulate deposited on horizontal surfaces will be $\leq$5µm and will not form a continuous layer
As a precautionary measure, however, it is always important to inspect and clean the site thoroughly following a cold discharge. While the aerosol itself is quite “clean”, environmental factors are also a consideration. It is important to decrease the relative humidity below 40% to ensure reduced damage on electronic equipment.

After a fire, the unknown and potentially harmful, by-products of an actual fire pose the biggest risk to sensitive equipment. Because unknown products from the fire itself may be present or because of unwanted environmental conditions, it is always recommended that the area is thoroughly cleaned to insure that no unwanted products are present. During discharge, any dirt within the enclosure will be blown around and then deposited as unwanted residue throughout the area. Also, in rare cases, unit orientation may have been altered improperly or equipment may have been re-oriented within the protected enclosure resulting in an improper discharge directly onto a wall or equipment surface. This could result in the deposit of small, localized areas of highly concentrated agglomerated particulate on that surface. If left untended, an agglomerated mass may take on moisture and may cause non progressive surface discoloration (copper, bronze) of unprotected metal surfaces. It is therefore, very important that any agglomerated particulate be cleaned up by a recognized salvage company.

[8] Diverse situations are conceivable in which it is in the interest of the customer not to switch off electronic apparatuses.
[9] By ventilation all not settled aerosol is removed. Caution in case of high humidity outdoor air.
[10] A clean-up flow-chart is available at info@dspa.nl
[11] Buoyant means upward force, opposite of gravity

7.5 Inspection and Maintenance

Before performing maintenance procedures, refer to the technical instruction of this Manual and the material safety data sheets in the appendix of this Manual. The installer of the DSPA aerosol extinguishing system should take care that those instructions are part of the logbook and explained to the person responsible for daily maintenance of the system.

7.6 General

While DSPA suppression systems require significantly less maintenance than other fire suppression systems which operate at pressure, a regular program of systematic maintenance must be established to ensure continuous, proper operation of any fire suppression system. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. At a minimum, the log must record: (1) inspection interval, (2) inspection procedure performed, (3) maintenance performed, if any, as a result of inspection, and (4) the name of the responsible person performing the operation.

7.7 Preventive maintenance

Preventive maintenance must be performed as per Table 10.

Schedule	Requirements	Paragraph
Weekly	Check all electrical connections Visually inspect components	7.8.1
Semi-annual	Inspect and test all system components; Inspect mounting and position of generators; Generator casing and actuators; Generators are securely mounted; Generators are free from corrosion; Service life of the generator.	7.8.2
15 years	Replace DSPA Generator after 15 years.	

Table 10. Preventative Maintenance/Replacement Schedule

7.8 Inspection Procedures

7.8.1 Weekly

1. Check all electrical connections to ensure operation of the DSPA suppression system in the event of a fire.
2. Make a general visual inspection of all aerosol generators for damaged or missing parts.
3. Make sure that the generators are not obstructed and that the required clearances have been met.

7.8.2 Semi-Annual

1. Make a general visual inspection of all aerosol generators for damaged or missing parts.
2. Ensure access to hazard areas, lines of egress, and manual pull stations are unobstructed and that there are no obstacles inhibiting the proper operation of the aerosol generators or distribution of the aerosol in the event of a fire.
3. Inspect DSPA aerosol generators for physical damage, such as cracks, dents, distortion, or corrosion. If damage is found, replace generator as instructed in this Manual. If minor corrosion is found generator may be cleaned up and appropriate touch-up paint applied.

4. Inspect mounting brackets, straps, and associated hardware for loose, damaged, or broken parts. Replace damaged parts and tighten all loose hardware.
5. Inspect all manual pull stations for cracks, broken or cracked glass plate, dirt or distortion. Inspect station for signs of physical damage, replacing if necessary.
6. Inspect all electrical connections and run electrical continuity tests using an Ohmmeter. Repair and replace as necessary.
7. Make sure that the generators are not obstructed and that the required clearances have been met.

7.8.3 Replacement/Removal from Service

The following procedures shall be performed for replacing or removing a system from service:

The DSPA Generators are to be replaced 15 years from the date of production. There is a grace period of one year as the generators are certified for a period longer than 15 years to ensure a full 15 years in actual service.

8. Responsibility and warranty

8.1 Limited liability

DSPA B.V. excludes warranties or guarantees regarding the content of this document. Due to continuing research and experience there are regular updates for DSPA products. It is therefore possible that certain instructions, specifications and illustrations in this documentation will be revised. DSPA B.V. has the right to revise this publication to review and change the content to make, without the obligation to notify anyone prior to the revision or amendments. DSPA B.V. can under no circumstances be liable for incidental or consequential damages, including but not limited to loss of revenue or other business losses resulting from the use of these products.
DSPA B.V. cannot be held responsible for modifications made by the User and the consequences.

In no case DSPA B.V. and its distributors be liable for damages (including, without limitation, damages for lost profits, business interruption, loss of business information or other pecuniary loss) arising from the use of or any inability to use these products, even if DSPA B.V. and its distributors informed of the risk of such damage.

The original version of this document was written in English. DSPA B.V. cannot be held responsible for any translation errors or changes to its content. A copy of the original in English is available through your local DSPA distributor or upon request at info@dspa.nl.

8.2 Limited warranty

DSPA B.V. ensures that the DSPA products mainly operate in accordance with the accompanying documentation.
DSPA B.V. and its distributors provide no warranty, either expressed or implied, including but not limited to, the implied warranty of merchantability or fitness for a particular purpose, with respect to the DSPA products and the accompanying documentation.

Appendix A1 – EU Declaration of conformity

We, undersigned, DSPA B.V., Hulzenseweg 20, 6534 AN Nijmegen, The Netherlands, manufacturer of the below mentioned products, declare under their sole responsibility that the mentioned products are according to requirements of the EEC directive 2014/30/EU regarding EMC, and the directive 2014/34/EU regarding ATEX.

Product:	DSPA Aerosol generator for fixed Installations
Model(s):	DSPA 11-1, DSPA 11-2, DSPA 11-3, DSPA 11-4, DSPA 11-5, DSPA 11-6, DSPA 11-7, DSPA 2-4-1, DSPA 8-1, DSPA 8-1-60, DSPA 8-2, DSPA 12-1, DSPA 12-2, DSPA 12-3, DSPA 12-4, DSPA 12-5, DSPA 17-1, DSPA 0.45-2, DSPA 0.90-2 and FE100.
EMC test report number:	9505 331 739XX 001
Issued by:	Thales Nederland BV Department SR TBU RADAR Mech Des ECC Haaksbergerstraat 42 7554 PA Hengelo The Netherlands
CE Marking:	CE
ATEX Marking:	Ex **II 3 G Ex nA IIC T3 Gc**

Samples of the aforementioned products have been tested and found in compliance with the directives according to below harmonized standards:

Regarding EMC:

- DSPA Aerosol generators comply to 2014/30/EU Article 2 paragraph 2 point (d): equipment which is excluded from the directive. However, most applicable tests are performed to prove EMC immunity and disturbance according to:
  - EN 55011:2009, Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and and methods of measurement.
  - EN 61000-4-3:2007, Electromagnetic compatibility (EMC) – Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test.

Regarding ATEX:

- EN 1127-1:2011 Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology;
- EN 60079-0:2012 Explosive atmospheres - Part 0: Equipment - General requirements;
- EN 60079-15:2010 Explosive atmospheres - Part 15: Equipment protection by type of protection "n".

The technical documentation required regarding the relevant conformity procedures in Directives for proving the presumption of agreement with the directives mentioned has been composed under undersigned's responsibility and will be placed at the disposal of the relevant authorities by request.

Nijmegen, March 1, 2022
Place/Date

Frans Vogelzangs, DSPA B.V., Managing Director

Appendix B2 – EU Declaration of performance

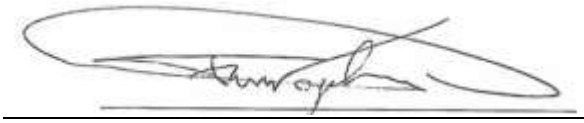
We, undersigned, DSPA B.V., Hulzenseweg 20, 6534 AN Nijmegen, The Netherlands, manufacturer of the below mentioned products, declare under their sole responsibility that the mentioned products are according to requirements of the EEC regulation (EU) 305/2011 (CPR); Area 10: Fixed Fire Fighting Equipment.

Product:	DSPA Aerosol generator for fixed Installations
Model(s):	DSPA 11-1, DSPA 11-2, DSPA 11-3, DSPA 11-4, DSPA 11-5, DSPA 11-6, DSPA 11-7, DSPA 2-4-1, DSPA 8-1, DSPA 8-1-60, DSPA 8-2, DSPA 12-1, DSPA 12-2, DSPA 12-3, DSPA 12-4, DSPA 12-5, DSPA 17-1, DSPA 0.45-2, DSPA 0.90-2 and FE100.

Samples of the aforementioned products have been tested and found in compliance with the directives according to below standards and assessments:

- EN 15276-1:2019 Fixed firefighting systems - Condensed aerosol extinguishing systems - Part 1: Requirements and test methods for components;
- ISO 15779:2011 Condensed aerosol fire extinguishing systems — Requirements and test methods for components and system design, installation and maintenance — General requirements
- BRL K23001/6 Fixed Dry Aerosol Fire Extinguishing Components

The technical documentation required regarding the relevant conformity procedures in Directives for proving the presumption of agreement with the directives mentioned has been composed under undersigned's responsibility and will be placed at the disposal of the relevant authorities by request.



Nijmegen, March 1, 2022
Place/Date

Frans Vogelzangs, DSPA B.V., Managing Director

Appendix C – Safety Data Sheet

in accordance with 1907/2006/EC, Article 31

Version: 5.5
Page: 1/107
Date of issue: 10.04.2018
Revision of version 5.4

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name: **DSPA Aerosol Compound**
Synonym(s): -
Article number: -

1.2. Relevant identified uses of the substance or mixture and uses advised against use

Can be used for operational application during localization and extinguishing fire of class A, B and C, localization of fire of class A in closed spaces up, and electrical fires (voltage < 40 kV) e.g. blind floor/ceilings, cable ducts and other small volume applications.

1.3. Details of the supplier of the safety data sheet

Manufacturer/supplier: DSPA B.V.
Hulzenseweg 20
6534 AN Nijmegen
The Netherlands

P.O. Box: 6572
6503 GB Nijmegen
The Netherlands

Tel.: +31(0)24 35 22 573
Fax: +31(0)24 37 87 583
Email: info@dspa.nl
Website: www.dspa.nl

Further information obtainable from:

Contact person: F. Vogelzangs
Tel.: +31 (0) 591 693 570
Email: f.vogelzangs@dspa.nl
Working hours (business days): 09h00 -17h00

1.4. Emergency telephone number (for the doctor)

The Netherlands:	National Poison Information Centre:	+31 (0) 30 247 88 88
Belgium:	Belgian Poison Centre:	+32 (0) 70 245 245
United Kingdom:	UWIC:	+44 (0) 29 204 16388

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification in accordance with Regulation (EC) no 1272/2008

Skin Sens. 1	H317
Eye Irrit. 2	H319

2.2. Label elements

Hazard pictograms:

Signal word: Warning.

Hazard statements:

H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.

Precautions:

P101	If medical advice is needed, have product container or label at hand.
P102	Keep out of reach of children.
P280	Wear protective gloves/eye protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313	If eye irritation persists: Get medical advice/attention.

Hazard-determining components for labelling: Formaldehyde, oligomeric reaction products with phenol.

2.3. Other hazards

Void.

Results of PBT and vPvB assessment

PBT: No.

vPvB: No.

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable.

3.2. Mixtures

Chemical characterization: Preparation comprising the following component(s).

Hazardous ingredients (or substances with exposure limits)

Potassium nitrate

CAS#: 7757-79-1

EC#:	231-818-8
REACH reg.#:	01-2119488224-35
Content (W/W):	> 50 %
Danger, 1272/2008/EC:	-
Note:	Prills or granules (not classified in this form according to the ECHA REACH registration dossier, see section 16).

Cyanoguanidine

CAS#:	461-58-5
EC#:	207-312-8
REACH reg.#:	01-2119474914-28
Content (W/W):	10 - 30 %
Danger, 1272/2008/EC:	-

Formaldehyde, oligomeric reaction products with phenol

CAS#:	9003-35-4
EC#:	(500-005-2)
REACH reg.#:	01-2120735197-51
Content (W/W):	5 - 15 %
Danger, 1272/2008/EC:	Eye Irrit. 2; H319 - Skin Sens. 1; H317 - Aquatic Chronic 3; H412

Full text of H- and EUH-phrase(s): see section 16.

SECTION 4: First aid measures

4.1. Description of first aid measures

General information:
Remove victim from danger zone and place in lying position.
In case of irregular breathing or respiratory arrest provide artificial respiration.
Remove immediately all contaminated clothing.
Substance is harmful to tissue after continuous contact. Rinsing immediately following exposure can limit injury.

Inhalation:
Remove to fresh air.
If the victim is not breathing, apply artificial respiration.

Skin contact:
Wash immediately with plenty of water and soap.

Eye contact:
Remove contact lenses, if present, and immediately rinse eyes while holding eyelids open for a sufficient period of time (at least 15 minutes) with lukewarm water.
Help the victim with the rinsing process.
Then immediately consult a physician/ophthalmologist.

Ingestion:
Rinse mouth immediately with water (if conscious). Do not induce vomiting. If the person feels unwell consult a physician or take victim to hospital (show packaging, label or SDS to physician). If the person needs to vomit, keep their head low to prevent vomit from entering the lungs. Place unconscious person on the side in the recovery position. Loosen tight clothing such as a shirt collar, tie, belt or waistband. Rest.

4.2. Most important symptoms and effects, both acute and delayed

After inhalation:
Exposure to vapour concentrations of component dusts higher than the MAC value can be harmful to the health. Potential health effects include: slight irritation of the airways, sore throat and coughing.
The product may cause effects on the blood, resulting in formation of methaemoglobin when ingested. The effects may be delayed.
Smoke and gases released during intended use is harmful upon inhalation.
After skin contact:
Slightly irritating to the skin. Redness.
Contact with the preparation may result in contact eczema, sensitisation, skin cracking and swelling.
Prolonged or repeated exposure may damage the skin and may cause irritation eczema.
After eye contact:
May cause irreversible damage to the eyes. Redness. Pain.
Particle matter may cause physical injury to the eye.
After ingestion:
Nausea, abdominal pain, blue skin.
Product can act on the thyroid gland.
Exposure can lead to blood disorders (mild methemoglobinemia). Methemoglobinemia is characterized by dizziness, drowsiness, headache, shortness of breath, cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood), rapid heart rate and chocolate-brown coloured blood.

4.3. Indication of any immediate medical attention and special treatment needed

Symptomatic treatment and supportive therapy as prescribed.
Special first-aid is required in the event of exposure to potassium nitrate. Admission to hospital is required for this. For methemoglobinemia, administer oxygen alone or with Methylene Blue depending on the methaemoglobin concentration in the blood. Cleansing of the entire contaminated area of the body is of utmost importance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:
NONE – THIS IS AN EXTINGUISHING AGENT.
Unsuitable extinguishing media for safety reasons:
None.

5.2. Special hazards arising from the substance or mixture

During heating or in case of fire, poisonous gases may be produced.
May be released in event of fire:
Nitrogen oxides (NOx).
Ammonia.
Above 900 °C.
Carbon oxides.
Potassium peroxide.
Hydrogen cyanide.

5.3. Advice for firefighters

Special protective clothing:
Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.
Special precautions:
Wear self-contained breathing apparatus.
Other information:
No specific requirements.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Eliminate all sources of heat and ignition.
Prevent dust formation.
People dealing with major spillages should wear personal protective clothing (suitable gloves and filter mask FFP-P2 if dust is formed).

6.2. Environmental precautions
Do not allow large quantities of product to reach sewage/surface water/groundwater in concentrated form.
Notify competent authorities in case of release of large quantities into the environment.

6.3. Methods and material for containment and cleaning up
Improper discharge could result in the deposit of small, localized areas of highly concentrated agglomerated particulate on that surface. If left untended, an agglomerated mass may take on moisture and may cause non-progressive surface discoloration of unprotected metal surfaces. Any agglomerated particulate must be cleaned up with a water/alcohol solution no later than 12 hours following a discharge.
Collect spilled material by hand, e.g. with a dustpan and duster or a vacuum cleaner.
Use of a blower for cleaning is not permitted.
Collect the waste product in suitable drums for disposal.
Wash the spillage area clean with plenty of water.

6.4. Reference to other sections
Information regarding safe handling - see section 7.
Information regarding personal protective equipment - see section 8.
Information regarding disposal - see section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Handling:

When handling observe the usual precautionary measures for chemicals.
Prevent dust formation and inhalation of dust.
If intense aerosol is released from a dry sprinkler powder system, respiratory protection is required.
Wear suitable protective clothing.
Eye-wash fountain, particularly with the danger of dust formation.
Avoid contact with eyes and prolonged skin contact.
Do not smoke, eat or drink during use of the unpacked product.

Information about fire - and explosion protection:

Avoid contact with heat, sparks, flames and other ignition sources - do not smoke.
Do not use equipment producing an open flame or electrical equipment which may cause sparks.

7.2. Conditions for safe storage, including any incompatibilities

Storage:

Store in accordance with local regulations.
Keep away from heat sources.
Store the product dry.

Requirements to be met by storerooms and receptacles:

Store in original DSPA packaging at room temperature.
Suitable packaging material: Original DSPA packaging.
Suitable material for tanks and pipelines: Not applicable.

Information about storage in one common storage facility:

Product is hydroscopic; prevent contact with other liquids.

Further information about storage conditions:

Keep tanks / packing hermetically closed.
Prevent product temperatures above 75 °C and below -50 °C.

7.3. Specific end use

Extinguishing material in case of a fire.
Only use in combination with the ignition device of DSPA.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Dangerous ingredients with DN(M)EL - reference Dutch SER database (“grenswaarden”)				
Product information: CAS# 7757-79-1 Potassium nitrate	Exposure	Value	Unit	Population / Effects
DN(M)EL	Short-term dermal	-	mg/kg bw/day	Workers Local
DN(M)EL	Short-term inhalation	-	mg/m^3	Workers Local
DN(M)EL	Long-term dermal	-	mg/kg bw/day	Workers Systemic

DN(M)EL	Long-term inhalation	36.7	mg/m³	Workers Systemic
DN(M)EL	Long-term dermal	-	mg/kg bw/day	Workers Local
DN(M)EL	Long-term inhalation	-	mg/m³	Workers Local
DN(M)EL	Short-term dermal	-	mg/kg bw/day	Consumer Local
DN(M)EL	Short-term inhalation	-	mg/m³	Consumer Local
DN(M)EL	Short-term inhalation	-	mg/m³	Consumer Systemic
DN(M)EL	Short-term oral	-	mg/kg bw/day	Consumer Systemic
DN(M)EL	Long-term dermal	-	mg/kg bw/day	Consumer Systemic
DN(M)EL	Long-term inhalation	-	mg/m³	Consumer Systemic
DN(M)EL	Long-term oral	-	mg/kg bw/day	Consumer Systemic
DN(M)EL	Long-term dermal	-	mg/kg bw/day	Consumer Local
DN(M)EL	Long-term inhalation	-	mg/m³	Consumer Local

Dangerous ingredients with DN(M)EL - reference ECHA registration database				
Product information: CAS# 461-58-5 Cyanoguanidine	Exposure	Value	Unit	Population / Effects
DN(M)EL	Short-term dermal	-	mg/kg bw/day	Workers Systemic
DN(M)EL	Short-term inhalation	76.5	mg/m³	Workers Systemic
DN(M)EL	Long-term dermal	30.1	mg/kg bw/day	Workers Systemic
DN(M)EL	Long-term inhalation	15.3	mg/m³	Workers Systemic
DN(M)EL	Long-term dermal	-	mg/kg bw/day	Workers Local
DN(M)EL	Long-term inhalation	-	mg/m³	Workers Local
DN(M)EL	Short-term dermal	-	mg/kg bw/day	Consumer Local
DN(M)EL	Short-term inhalation	-	mg/m³	Consumer Local
DN(M)EL	Short-term inhalation	56	mg/m³	Consumer Systemic
DN(M)EL	Short-term oral	-	mg/kg bw/day	Consumer Systemic
DN(M)EL	Long-term dermal	6.5	mg/kg bw/day	Consumer Systemic
DN(M)EL	Long-term inhalation	11.2	mg/m³	Consumer Systemic
DN(M)EL	Long-term oral	6.5	mg/kg bw/day	Consumer Systemic
DN(M)EL	Long-term dermal	-	mg/kg bw/day	Consumer Local
DN(M)EL	Long-term inhalation	-	mg/m³	Consumer Local

Dangerous ingredients with PNEC - reference ECHA registration database			
Product information: CAS# 7757-79-1 Potassium nitrate	Value	Unit	Compartment
PNEC	-	mg/l	Fresh water
PNEC	-	mg/l	Intermittent releases
PNEC	-	mg/l	Marine water
PNEC	18	mg/l	STP (sewage treatment plant)
PNEC	-	mg/kg dwt	Sediment fresh water
PNEC	-	mg/kg dwt	Sediment marine water
PNEC	-	-	Air
PNEC	-	mg/kg wwt	Soil
PNEC	No potential for bioaccumulation	mg/l	Oral (foodstuffs)

Dangerous ingredients with PNEC - reference ECHA registration database			
Product information: CAS# 461-58-5 Cyanoguanidine	Value	Unit	Compartment
PNEC	2.5	mg/l	Fresh water
PNEC	10	mg/l	Intermittent releases
PNEC	0.25	mg/l	Marine water
PNEC	34	mg/l	STP (sewage treatment plant)
PNEC	5.83	mg/kg dwt	Sediment fresh water
PNEC	0.58	mg/kg dwt	Sediment marine water
PNEC	No hazard identified	-	Air
PNEC	3.16	mg/kg wwt	Soil
PNEC	No potential for bioaccumulation	mg/l	Oral (foodstuffs)

8.2. Exposure controls

Personal protective equipment:

After activating the DSPA, as dense aerosol or dust is formed.
Remove all contaminated clothing.
Avoid contact with eyes and prolonged skin contact.
Wash hands thoroughly after handling.

General protective and hygienic measures:

Keep away from foodstuffs and beverages.
Do not eat, drink when using this product.
The usual precautionary measures are to be adhered to when handling chemicals.

Respiratory protection:

Required at inadequately ventilated workplaces or in case of dust formation.
In case of handling the unpacked product (the chemicals) use respiratory protection (FFP-P2 mask EN149).

Hand protection:

Safety gloves.

The glove material (EN374) has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and degradation (e.g. for penetration time > 480 minutes, level 6, e.g. nitrile rubber (0.4 mm)).

Material of gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality
and varies from manufacturer to manufacturer.

Penetration time of glove material

The exact break through time can be obtained from the manufacturer of the protective gloves and has to be observed.

Eye protection:

Tight fitting acid resistant safety glasses (EN 166). Full face mask with safety glasses if dust formation may occur.

Body protection:

Wear appropriate chemical protective clothing (preferably thick cotton or in case of dust risk EN ISO 13982-1 [type 5]).
Wash contaminated clothing before using it again.

Measuring procedures:

In order to establish compliance with an exposure limit and to establish that exposure is properly controlled, it may be necessary to determine the concentration of the substances in the inhalation zone or in the general workspace.

Environmental exposure controls:

Unintended leakage of the material must be stopped.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

General information	
Appearance:	
Form:	Solid (pressed compound in rigid steel casing).
Colour:	Beige / light red.
Odour:	None specific.
Odour threshold:	Not determined.
pH-value:	Not determined.
Change in condition	
Melting point/freezing point:	Not determined.
Initial boiling point and boiling range:	Not determined.
Flash Point:	Not determined.
Flammability (solid, gas):	Not determined.
Auto-ignition temperature:	Not determined.
Explosion hazard:	Not determined.
Oxidising properties:	Not determined.
Explosive limits	
Lower:	Not determined.
Upper:	Not determined.
Vapour pressure:	Not determined.

Relative density:	1.9 (water = 1).
Vapour density:	Not determined.
Evaporation rate:	Not determined.
Solubility in/miscibility with water:	Slight (< 1 %).
Partition coefficient (n-octanol/water):	Not determined.
Viscosity;	
Dynamic:	Not determined.
Kinematic:	Not determined.
9.2. Other information	
Auto activation temperature:	> 270°C.

SECTION 10: Stability and reactivity

10.1. Reactivity
Stable at intended use.

10.2. Chemical stability
The product is stable if stored and handled as prescribed.
Thermal decomposition/Conditions to avoid:
No decomposition if used as prescribed. Not self-reactive substance. Avoid storing at high temperatures (> 75 °C) or low temperatures (< -50 °C).

10.3. Possibility of hazardous reactions
Avoid high temperatures, heating, open fire and ignition sources, and prevent the effects of a grinding motion and impact forces that may result in ignition.

10.4. Conditions to avoid
Substance is non-combustible, but can have in specific conditions an oxidizing effect.
Heating causes a rise in pressure, risk of bursting and explosion.
Upon dismantling an intact generator, the contents shall be treated as an oxidizing material.

10.5. Incompatible materials
Organic compounds, metal powders, strong acids.

10.6. Hazardous decomposition products
No hazardous decomposition products are formed if stored under normal conditions. In case of heating or fire, irritating and/or toxic vapours may be released. See section 5.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity from the components:

LD/LC50 values relevant for classification - reference ECHA registration database		
Product information: CAS# 7757-79-1	Potassium nitrate	
Oral Inhalation Dermal	LD50 LC50 (4 h) LD50	> 2000 mg/kg (rat, OECD 425, read across) > 0.527 mg/l air (rat, OECD 403) > 5000 mg/kg (rat, OECD 402)

LD/LC50 values relevant for classification - reference ECHA registration database		
Product information: CAS# 461-58-5	Cyanoguanidine	
Oral Inhalation Dermal	LD50 LC0 (4 h) LD50	> 7000 mg/kg (rat, OECD 401) > 259 mg/m³ air (rat, OECD 403) > 2000 mg/kg (rabbit, OECD 402)

LD/LC50 values relevant for classification - reference ECHA registration database		
Product information: CAS# 9003-35-4	Formaldehyde, oligomeric reaction products with phenol	
Oral Inhalation Dermal	LD50 LC50 LD50	> 5000 mg/kg (rat) - > 2000 mg/kg (rat)

The following health hazard assessment is based on an assessment of the various ingredients in the product.

Primary irritant effect:
on the skin:
Slightly irritates the skin and the mucous membranes.
to the eye:
Irritant effect.

Germ cell mutagenicity:
Not classified.
Reproductive and developmental toxicity:
Not classified.
Sensitisation:
Contains formaldehyde, oligomeric reaction products with phenol which may cause sensitisation by skin contact. **CMR effects (carcinogenicity, mutagenicity and toxicity for reproduction):**
Not classified.
Other information:
When using and handling in accordance with the regulations the undamaged generator does not present any health dangers. After activating the generator, slightly irritations to skin due to increase of the pH value and slightly irritation of respiratory due to an increase of smoke (aerosol).

SECTION 12: Ecological information

12.1. Toxicity

Ecotoxicity from the components:

Aquatic toxicity - reference ECHA registration database		
Product information: CAS# 7757-79-1	Potassium nitrate	
Fish Water flea Algae Bacteria	LC50 (96 h) EC50 (24 h) EC50 (10 d) EC50 (3 h)	> 100 mg/l (oncorhynchus mykiss, OECD 203, read across) 490 mg/l (daphnia magna) > 1700 mg/l (benthic diatoms) > 180 mg/l (activated sludge, OECD 209)

Aquatic toxicity - reference ECHA registration database		
Product information: CAS# 461-58-5	Cyanoguanidine	
Fish Water flea Algae Bacteria	NOEC (96 h) EC50 (48 h) EC50 (4 d) TT (18 h)	> 1000 mg/l (lepomis macrochirus) 3177 mg/l (daphnia magna, OECD 202) 2.04 mg/l (pseudokirchneriella subcapitata, OECD 201) 130.6 mg/l (pseudomonas putida)

Aquatic toxicity - reference ECHA registration database		
Product information: CAS# 9003-35-4	Formaldehyde, oligomeric reaction products with phenol	
Fish Water flea Algae Bacteria	LC50 (96 h) EC50 (48 h) EC50 (96 h) EC50	17 mg/l (pimephales promelas) 18 mg/l (daphnia magna) 57.66 mg/l (green algae, QSAR) -

The following ecological risk assessment is based on an assessment of the various ingredients in the product.

12.2. Persistence and degradability

Partially inorganic and presumed to be partially biodegradable over the long-term.

12.3. Bioaccumulative potential

Bioaccumulation in organisms is not expected.

12.4. Mobility in soil

Low solubility in water.

Further ecological information

General information:

Water hazard class 1 (German regulation) (Self-assessment): slightly hazardous to water.

Do not discharge undiluted product into groundwater, surface water or sewage system.

12.5. Results of PBT and vPvB assessment

The mixture does not meet all of the assessment criteria for persistence, bioaccumulation and toxicity and hence is not considered to be PBT or vPvB.

12.6. Other adverse effects

When released in an aquatic environment damage can be caused by an increased pH.

The material can give off hydrogen sulphide with high hazard potential to animals.

Ozone Depletion Potential (ODP) = 0.
Global Warming Potential (GWP) = 0.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Recommendation:

May be brought to a supervised incineration plant in compliance with local regulations.
The generation of waste should be avoided or minimised wherever possible.
Waste, even small quantities, should never be poured down watercourses.

EC Regulation for Disposal of Waste (EWC):

06 03 99. WASTES FROM INORGANIC CHEMICAL PROCESSES. Waste salts and their solutions, wastes from the manufacture, formulation, supply and use (MFSU) of salts and their solutions and metallic oxides; wastes not otherwise specified.

Uncleaned packaging

Recommendation:

Disposal must be made according to official regulations. Empty the packaging with care. Do not contaminate soil, water or environment with the waste container. Comply with local regulations with regard to the recovery or disposal of waste.

SECTION 14: Transport information

Land transport ADR/RID (cross-border)	
ADR/GGVSEB class:	Not a dangerous good according to the transport regulations.
Hazard identification number:	-
UN number:	-
Packing group:	-
Label:	-
Special marking:	-
UN proper shipping name:	-
Tunnel restriction code:	-
Inland shipping ADN/ADR	
ADN/R-class:	-
UN number:	-
Subsidiary risk	
Environmental hazards:	-
CMR properties:	-
Buoyancy:	-
Maritime transport IMDG	
IMDG-class:	-
UN number:	-
Label:	-
Packing group:	-
EMS number:	-

Marine pollutant:	-
Proper shipping name:	-

Air transport ICAO-TI and IATA-DGR	
ICAO/IATA class:	-
UN number:	-
Label:	-
Packing group:	-
Proper shipping name:	-

14.1. UN number
-

14.2. UN proper shipping name
-

14.3. Transport hazard class(es)
-

14.4. Packing group
-

14.5. Environmental hazards
No.

14.6. Special precautions for user
None.

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code
No further relevant information available.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
National regulations:

Tactile warning: Void.

Child-resistant fastening: Void.

EU regulations and directives which affect this mixture (not yet directly or indirectly mentioned):

Directive 89/686/EEC	Personal protective equipment (is to be replaced from 21 April 2018 by regulation (EU) 2016/425).
Directive 98/24/EC	Risks related to chemical agents at work.
Decision 2000/532/EC	List of waste.
Regulation 1272/2008/EC	On classification, labelling and packaging of substances and mixtures.

Regulation (EC) 2015/830	Commission regulation of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

15.2. Chemical safety assessment

A chemical safety assessment has not been carried out.

SECTION 16: Other information

This information is based on the current state of our knowledge. It should not be construed as any guarantee of
product characteristics, nor does it establish a legally valid contractual relationship.

List of relevant H- and EUH-phrases from sections 2 and 3

H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H412	Harmful to aquatic life with long lasting effects.
Aquatic Chronic	Hazardous to the aquatic environment, chronic.
Eye Irrit.	Serious eye irritation.
Skin Sens.	Skin sensitization.

Classification according to Regulation (EC) No 1272/2008:	Classification of the mixture based on the standard calculation method.
Note:	The standard classification for CAS# 7757-79-1 as crystals is Oxid. Solid 3.

Document history

Printed on:	20 September 2023.
Previous edition:	17.09.2015, version 5.4.
Version:	5.5.
Change:	Product name and update of legislation and classification.

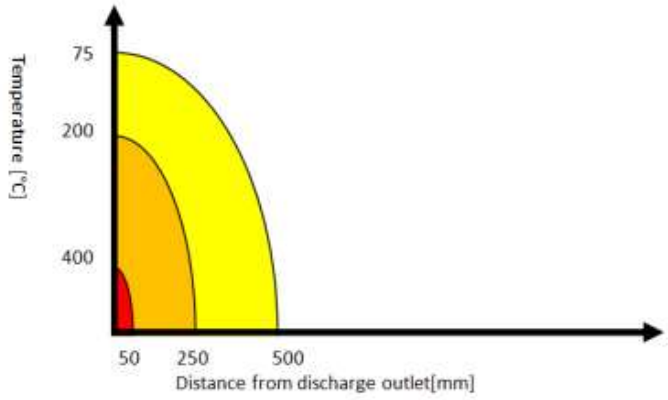
Abbreviations and acronyms:

ADR:	Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
RID:	Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
IMDG:	International Maritime Code for Dangerous Goods
IATA:	International Air Transport Association
IATA-DGR:	Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO:	International Civil Aviation Organization

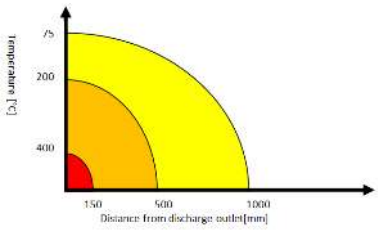
ICAO-TI:	Technical Instructions by the "International Civil Aviation Organization" (ICAO)
P:	Marine Pollutant
GHS:	Globally Harmonized System of Classification and Labelling of Chemicals
CAS:	Chemical Abstracts Service (division of the American Chemical Society)
EC50:	Half maximal effective concentration
LC50:	Lethal concentration, 50 percent
LD50:	Lethal dose, 50 percent
OEL:	Occupational Exposure Limit
NOEC:	No Observed Effect Concentration
vPvB:	Very Persistent and Very Bioaccumulative
PBT	Persistent, Bioaccumulative and Toxic substance
EWC:	European Waste Catalogue
TWA:	Time-Weighted Average, limit value associated with the MAC value
DNEL:	Derived No-Effect Level
DMEL:	Derived Minimal Effect Level
PNEC:	Predicted No-Effect Concentration

Appendix D – TECHNICAL SPECIFICATIONS

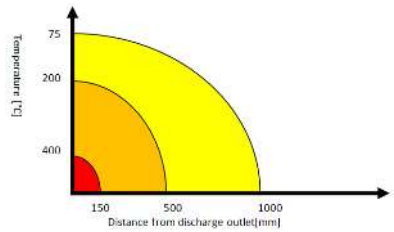
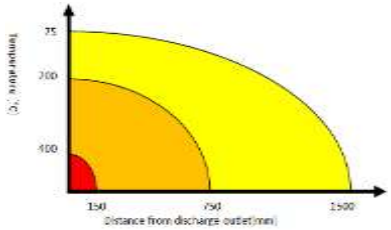
C.1 Technical specifications of DSPA 11-1, 11-2 and 11-3

Technical specifications				
Model		**DSPA 11-1**	**DSPA 11-2**	**DSPA 11-3**
Type of discharge outlet		Radial		
Diameter		122 mm	124 mm	133 mm
Height		22 mm	34 mm	54 mm
Total weight		0.55±0.10 kg	0.85±0.15 kg	1.25±0.25 kg
Aerosol mass		0.11kg	0.17kg	0.3kg
Discharge time		6-10 sec	9-15 sec	14-26 sec
Activation		Built-in		
Temperature range		From -40°C to +75°C		
Relative humidity		Up to 95% at 54°C		
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)		
Activation		Built-in		
Min. distance for persons(75°C) from discharge outlet Min. distance for combustible material(200°C) from discharge outlet Min. distance for construction structures(400°C) from discharge outlet				
Maximum temperature of body		≤ 150°C		
Heat quantity(KJ)		378	538	1029
Tested mounting positions		Side	Side	Center
Minimum height		0.50 m	0.50 m	0.50 m
Maximum coverage		3.66 x 1.22 m	3.66 x 2.44 m	3.66 x 2.44 m
Maximum height		1.83 m	2.44 m	2.44 m
Maximum coverage		1.22 x 1.22 m	1.22 x 1.22 m	1.22 x 1.22 m
Corrosion test	Moist H_2S air mixture	Pass		
	Moist CO_2/SO_2 air mixture	Pass		
	Salt spray	Pass		
	Moist NH_3/air mixture	Pass		
Application		Recommended for the protection of narrow compartments, such as suspended ceilings, raised floors, cable ducts, transport vehicles etc.		
Shelf life generators		15 years		
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment		

C.2 Technical specifications of DSPA 11-4

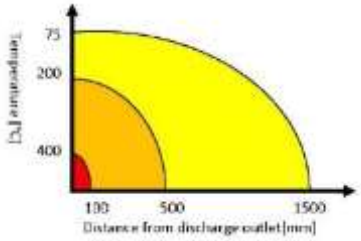
Technical specifications		
Model		**DSPA 11-4**
Type of discharge outlet		Radial
Diameter		165 mm
Height		72 mm
Total weight		2.10 ±0.2kg
Aerosol mass		0.90kg
Discharge time		19-31 sec
Activation		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		3091
Tested mounting positions		Side/Center
Minimum height		1.22 m
Maximum coverage		3.66 x 3.66 m
Maximum height		3.05 m
Maximum coverage		1.83 x 1.83 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of semi large compartments such as storage rooms, archives, technical rooms and server rooms
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

C.3 Technical specifications of DSPA 11-5 and 11-6

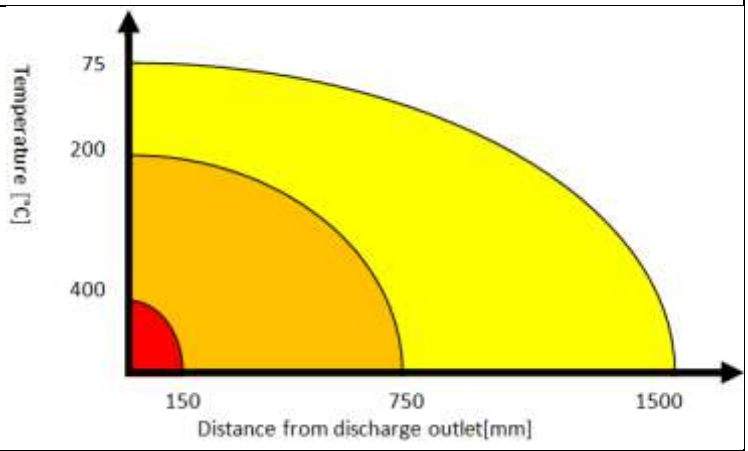
Technical specifications			
Model		**DSPA 11-5**	**DSPA 11-6**
Type of discharge outlet		Radial	Radial
Diameter(without brackets)		217 mm	
Height		99 mm	
Total weight(without brackets)		4.40 ±0.4kg	4.5 ±0.4kg
Aerosol mass		1.40kg	2.3kg
Weight standard bracket		0.48±0.02	
Discharge time		40-60 sec	30-50 sec
Temperature range		From -40°C to +75°C	
Relative humidity		Up to 95% at 54°C	
Mechanical effect		Tested attached to walls at frequency range 50-150 Hz(0.5g)	
Min. distance for persons(75°C) from discharge outlet Min. distance for combustible material(200°C) from discharge outlet Min. distance for construction structures(400°C) from discharge outlet			
Maximum temperature of body		≤ 150°C	
Heat quantity(KJ)		4809	8253
Tested mounting positions		Side/Center	Side/Center
Minimum height		1.22 m	1.22 m
Maximum coverage		4.88 x 3.66 m	7.32 x 3.66 m
Maximum height		3.66 m	3.66 m
Maximum coverage		2.44 x 2.44 m	2.44 x 2.44 m
Corrosion test	Moist H_2S air mixture	Pass	
	Moist CO_2/SO_2 air mixture	Pass	
	Salt spray	Pass	
	Moist NH_3/air mixture	Pass	
Application		Recommended for the protection of semi large compartments such as storage rooms, archives, technical rooms and server rooms	
Shelf life generators		15 years	
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment	

C.4 Technical specifications of DSPA 11-7

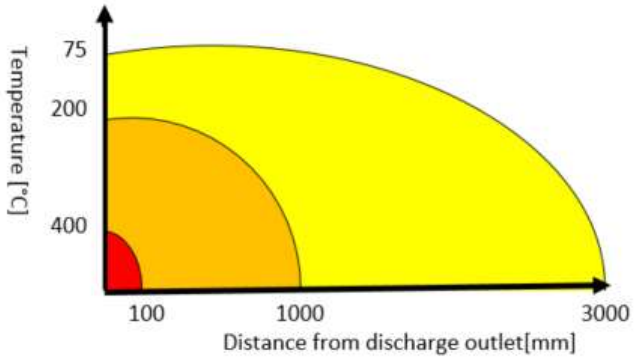
Technical specifications

Model		DSPA 11-7
Type of discharge outlet		Axial
Diameter		165 mm
Height		72 mm
Total weight		2.10 ±0.2kg
Aerosol mass		0.52kg
Discharge time		30-50 sec
Activation		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		3091
Tested mounting positions		Side/Center
Minimum height		1.00 m
Maximum coverage		4.88 x 2.44 m
Maximum height		4.00 m
Maximum coverage		2.44 x 1.22 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of semi large compartments such as storage rooms, archives, technical rooms and server rooms
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

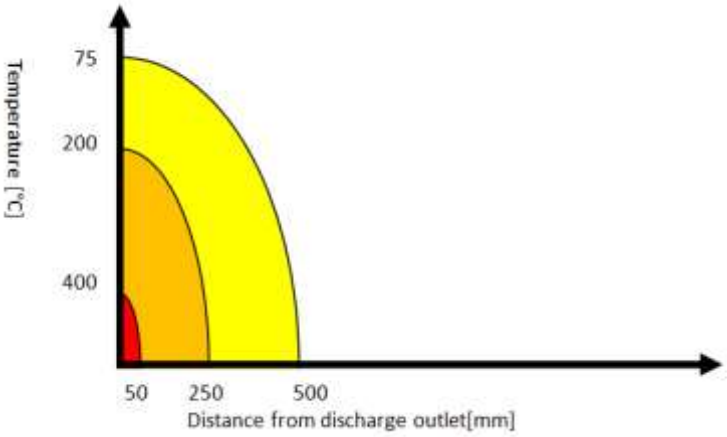
C.5 Technical specifications of DSPA 8-1

Technical specifications		
Model		**DSPA 8-1**
Type of discharge outlet		Axial
Diameter(without brackets)		220 mm
Height		222 mm
Total weight(without brackets)		11.5 ± 1.5 kg
Aerosol mass		3.25 kg
Weight standard bracket		0.58 ± 0.02 kg
Mechanical effect 'standard bracket'		0,5g in the range of frequencies up to 35hertz
Discharge time		67-89 sec
Temperature range		From -40°C to 75°C
Relative humidity		Up to 95% at 54°C
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		12000
Tested mounting positions		Side
Minimum height		2.44 m
Maximum coverage		9.76 x 3.66 m
Maximum height		4.88 m
Maximum coverage		4,88 x 3.66 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of large compartments, such as storage rooms, archives, technical rooms and server rooms
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

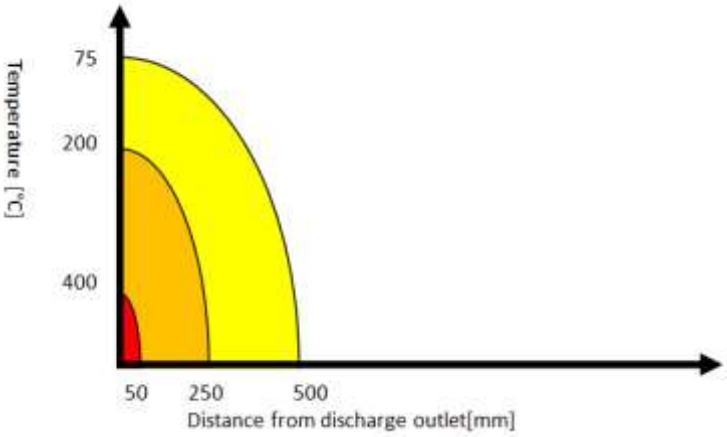
C.6 Technical specifications of DSPA 8-1-60

Technical specifications		
Model		**DSPA 8-1-60**
Type of discharge outlet		Axial
Diameter(without brackets)		220 mm
Height		222 mm
Total weight(without brackets)		11.5 ± 1.5 kg
Aerosol mass		3.25 kg
Weight standard bracket		0.58 ± 0.02 kg
Mechanical effect 'standard bracket'		0,5g in the range of frequencies up to 35hertz
Discharge time		48-58 sec
Temperature range		From -40°C to 75°C
Relative humidity		Up to 95% at 54°C
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		12000
Tested mounting positions		Side
Minimum height		2.44 m
Maximum coverage		7.32 x 4.00 m
Maximum height		6.10 m
Maximum coverage		4,88 x 2.44 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of large compartments, such as storage rooms, archives, technical rooms and server rooms
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

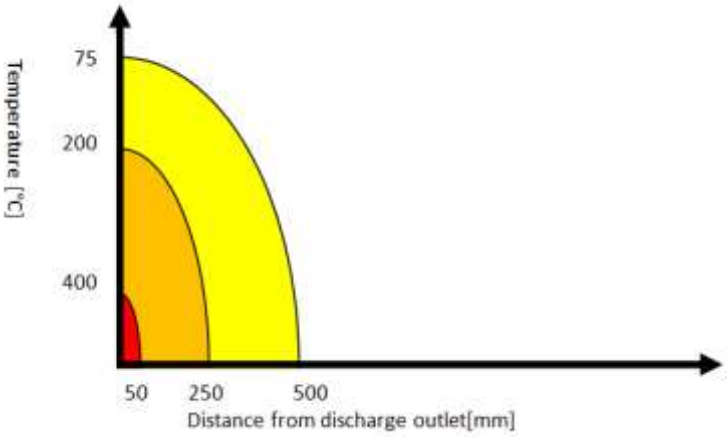
C.7 Technical specifications of DSPA 12-1

Technical specifications		
Model		**DSPA 12-1**
Type of discharge outlet		Radial
Diameter(without brackets)		75 mm
Height		20 mm
Total weight(without brackets)		100 gr
Aerosol mass		15 gr
Discharge time		5 sec
Activation, shelf life		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		55
Tested mounting positions		Side/Center
Minimum height		0.50 m
Maximum coverage		0.81 x 0.73 m
Maximum height		T.B.D.
Maximum coverage		-
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of small compartments such as electrical and technical cabinets
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

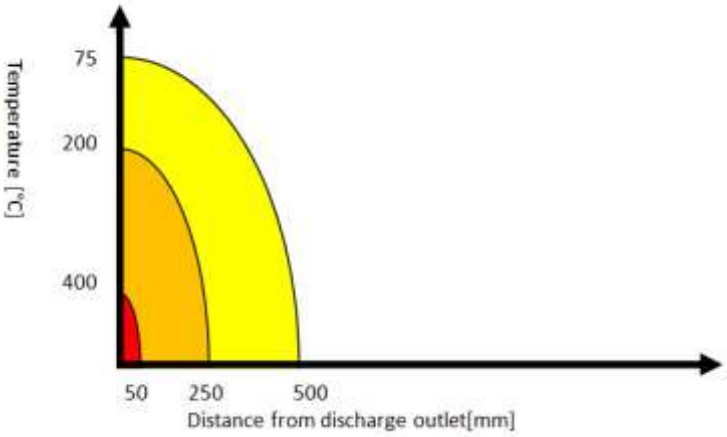
C.8 Technical specifications of DSPA 12-2

Technical specifications		
Model		**DSPA 12-2**
Type of discharge outlet		Radial
Diameter(without brackets)		75 mm
Height		28 mm
Total weight(without brackets)		150 gr
Aerosol mass		30 gr
Discharge time		8 sec
Activation, shelf life		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		110
Tested mounting positions		Side/Center
Minimum height		0.50 m
Maximum coverage		1.60 x 0.81 m
Maximum height		0.81 m
Maximum coverage		0.80 x 0.74 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of small compartments such as electrical and technical cabinets
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

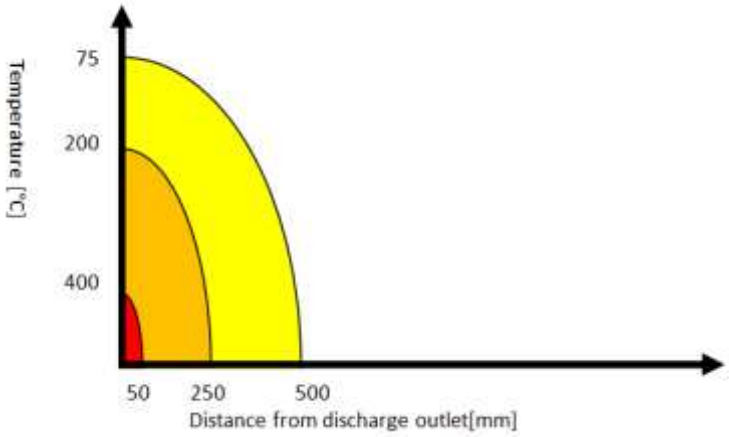
C.9 Technical specifications of DSPA 12-3

Technical specifications		
Model		**DSPA 12-3**
Type of discharge outlet		Radial
Diameter(without brackets)		105 mm
Height		20 mm
Total weight(without brackets)		500 gr
Aerosol mass		55 gr
Discharge time		6 sec
Activation, shelf life		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		189
Tested mounting positions		Side/Center
Minimum height		0.80 m
Maximum coverage		1.50 x 0.81 m
Maximum height		1.99 m
Maximum coverage		0.86 x 0.81 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of small compartments such as electrical and technical cabinets
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

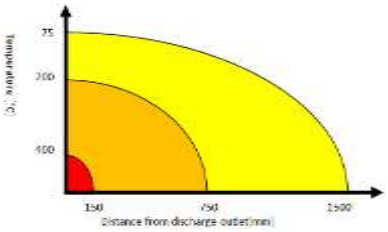
C.10 Technical specifications of DSPA 12-4

Technical specifications		
Model		**DSPA 12-4**
Type of discharge outlet		Radial
Diameter(without brackets)		105 mm
Height		28 mm
Total weight(without brackets)		650 gr
Aerosol mass		110 gr
Discharge time		10 sec
Activation, shelf life		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet Min. distance for combustible material(200°C) from discharge outlet Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		378
Tested mounting positions		Side/Center
Minimum height		1.60 m
Maximum coverage		1.99 x 0.81 m
Maximum height		1.99 m
Maximum coverage		1.60 x 0.81 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of small compartments such as electrical and technical cabinets
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

C.11 Technical specifications of DSPA 12-5

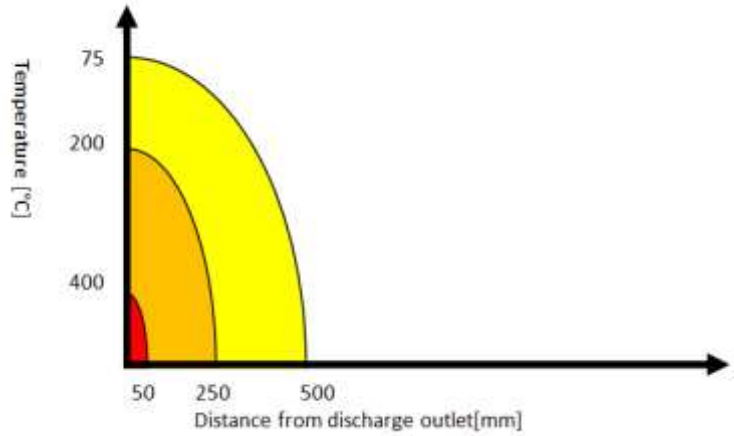
Technical specifications		
Model		**DSPA 12-5**
Type of discharge outlet		Radial
Diameter(without brackets)		80 mm
Height		16 mm
Total weight(without brackets)		70 gr
Aerosol mass		5 gr
Discharge time		3 sec
Activation, shelf life		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		18
Tested mounting positions		Side/Center
Minimum height		N.A.
Maximum coverage		-
Maximum height		0.53 m
Maximum coverage		0.59 x 0.25 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of small compartments such as electrical and technical cabinets
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

C.12 Technical specifications of DSPA 17-1

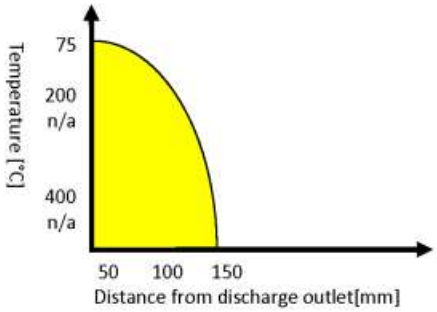
Technical specifications		
Model		**DSPA 17-1**
Type of discharge outlet		Radial
Diameter(without brackets)		184 mm
Height		106 mm
Total weight(without brackets)		3.34 ±0.4kg
Aerosol mass		2.30 kg
Weight standard bracket		0.48±0.02
Discharge time		40 sec
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		8253
Tested mounting positions		Side/Center
Minimum height		1.22 m
Maximum coverage		7.32 x 3.66 m
Maximum height		3.66 m
Maximum coverage		2.44 x 2.44 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of semi large compartments such as storage rooms, archives, technical rooms and server rooms
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

C.13 Technical specifications of FE100

Tests for the FE100 are passed, certification pending!

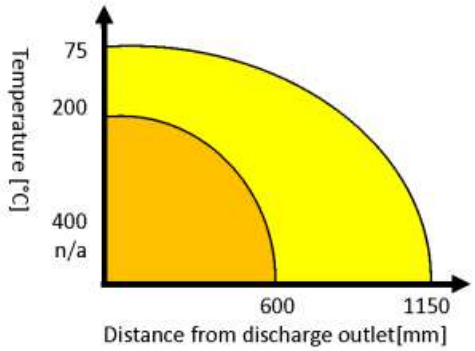
Technical specifications		
Model		**FE100**
Type of discharge outlet		Axial
Diameter		50 mm
Length		185 mm
Total weight		655 gr
Aerosol mass		100 gr
Discharge time		55 sec
Activation, shelf life		Built-in
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet		
Min. distance for combustible material(200°C) from discharge outlet		
Min. distance for construction structures(400°C) from discharge outlet		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		343
Tested mounting positions		Side/Center
Minimum height		0.50 m
Maximum coverage		2.00 x 1.60 m
Maximum height		2.00 m
Maximum coverage		1.60 x 0.80 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of small compartments such as electrical and technical cabinets
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

C.14 Technical specifications of DSPA 0.45-2 and 0.90-2

Technical specifications			
Model		**DSPA 0.45-2**	**DSPA 0.90-2**
Type of discharge outlet		Outlet tube	Outlet tube
Diameter		36 mm	36
Length		150 mm	95
Total weight		285 gr	155
Aerosol mass		90 gr	45 gr
Discharge time		27-28 sec	53-57 sec
Activation, shelf life		Built-in	
Temperature range		From -40°C to +75°C	
Relative humidity		Up to 95% at 54°C	
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)	
Min. distance for persons(75°C) from discharge outlet 150 mm			
Min. distance for combustible material(200°C) from discharge outlet Not applicable			
Min. distance for construction structures(400°C) from discharge outlet Not applicable			
Maximum temperature of body		≤ 150°C	
Heat quantity(KJ)		155	310
Tested mounting positions		Magnets / U-Brackets	
Minimum height		0.50 m	0.50
Maximum coverage		2.00 x 1.00 m	2.00 x 2.00
Maximum height		1.00 m	2.00
Maximum coverage		0.50 x 2.00 m	0.50 x 2.00
Corrosion test	Moist H_2S air mixture	Pass	
	Moist CO_2/SO_2 air mixture	Pass	
	Salt spray	Pass	
	Moist NH_3/air mixture	Pass	
Application		Recommended for the protection of small compartments such as electrical and technical cabinets	
Shelf life generators		15 years	
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment	

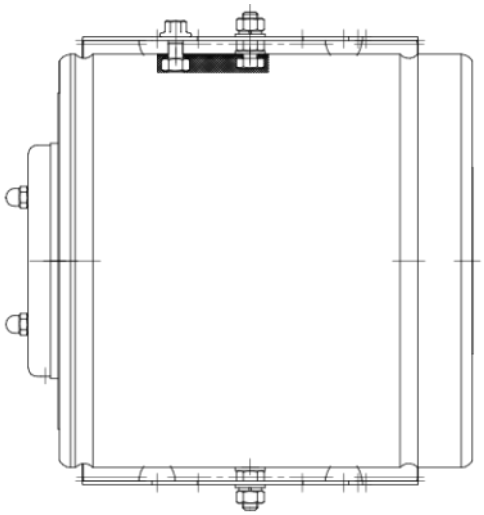
C.15 Technical specifications of DSPA 2-4-1

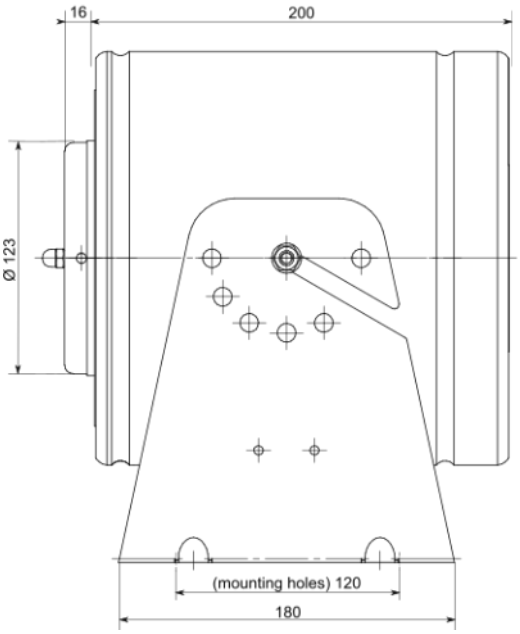
Technical specifications

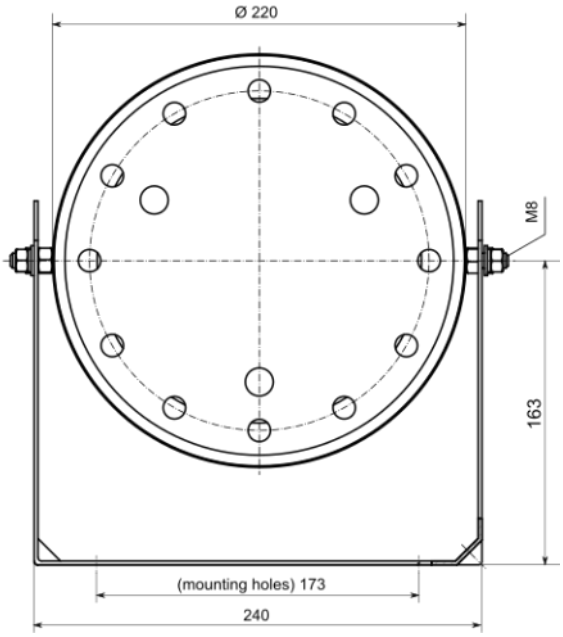
Model		DSPA 2-4-1
Type of discharge outlet		Axial
Diameter(without brackets)		172 mm
Height		179 mm
Total weight(without brackets)		4.60 ±0.4kg
Aerosol mass		1.60 kg
Weight standard bracket		0.48±0.02
Discharge time		48-53 sec
Temperature range		From -40°C to +75°C
Relative humidity		Up to 95% at 54°C
Mechanical effect		Tested attached to machinery with frequency range 50 Hz to 150 Hz:30 m/s2 (= 3,0 g)
Min. distance for persons(75°C) from discharge outlet: 1150 mm Min. distance for combustible material(200°C) from discharge outlet: 600 mm Min. distance for construction structures(400°C) from discharge outlet: Not applicable		
Maximum temperature of body		≤ 150°C
Heat quantity(KJ)		550
Tested mounting positions		Side/Center
Minimum height		2.44 m
Maximum coverage		3.66 x 4.00 m
Maximum height		6.10 m
Maximum coverage		2.44 x 2.44 m
Corrosion test	Moist H_2S air mixture	Pass
	Moist CO_2/SO_2 air mixture	Pass
	Salt spray	Pass
	Moist NH_3/air mixture	Pass
Application		Recommended for the protection of semi large compartments such as storage rooms, archives, technical rooms and server rooms
Shelf life generators		15 years
Storage conditions		In closed storage rooms at 5°C to 40°C and relative humidity up to 80% without the presence of aggressive environment

Appendix D - DRAWINGS & PICTURE OF DSPA TYPE

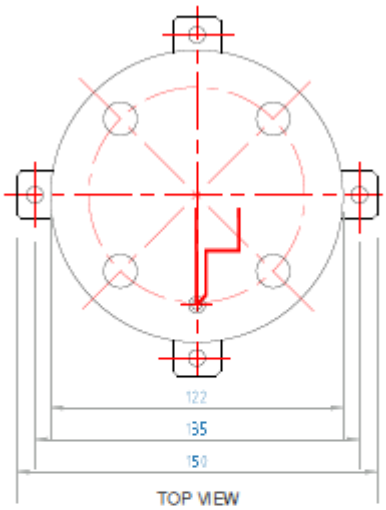
DSPA 8-1

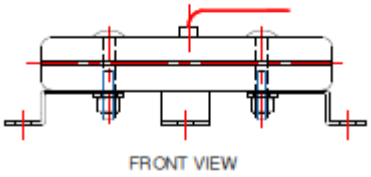


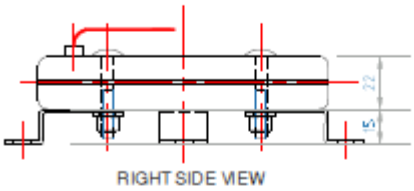




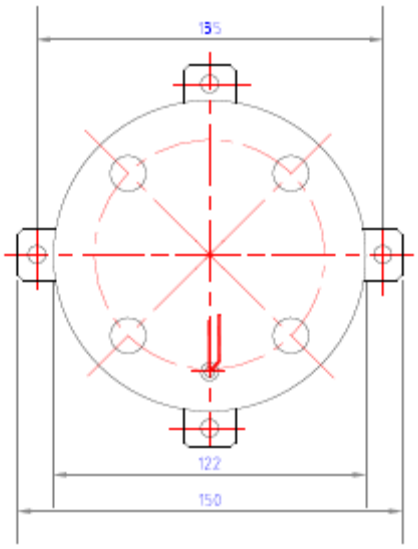
DSPA 11-1



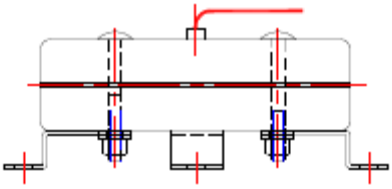




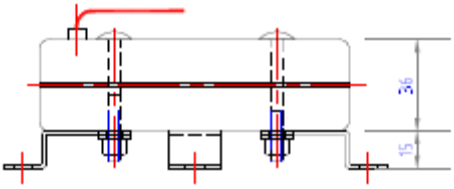
DSPA 11-2



TOP VIEW

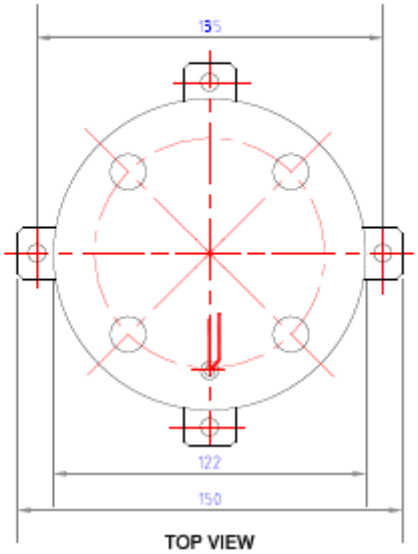


FRONT VIEW

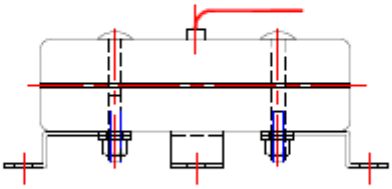


RIGHT SIDE VIEW

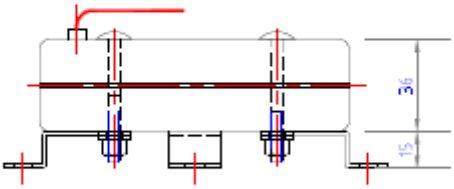
DSPA 11-3



TOP VIEW

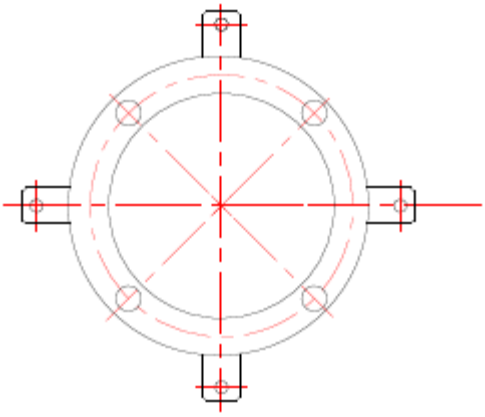


FRONT VIEW

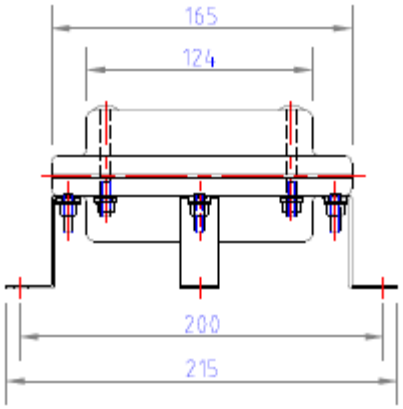


RIGHT SIDE VIEW

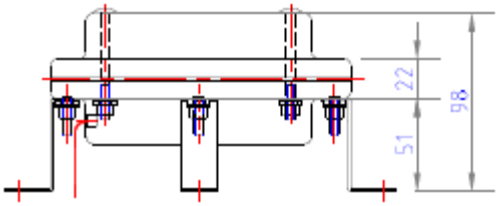
DSPA 11-4



TOP VIEW

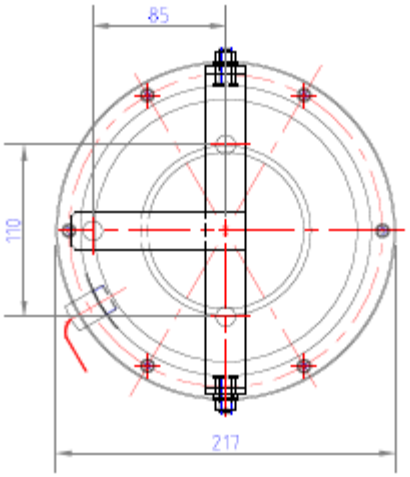


FRONT VIEW

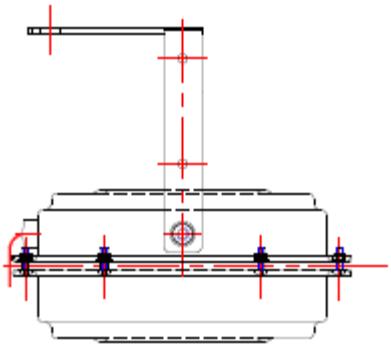


RIGHT SIDE VIEW

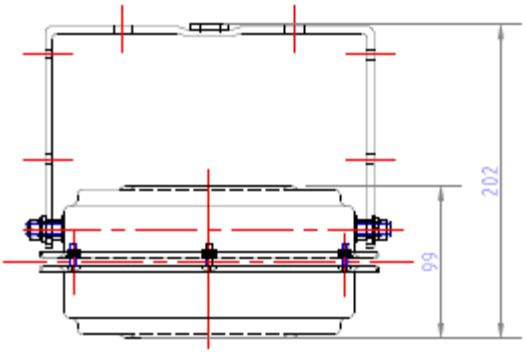
DSPA 11-5



TOP VIEW

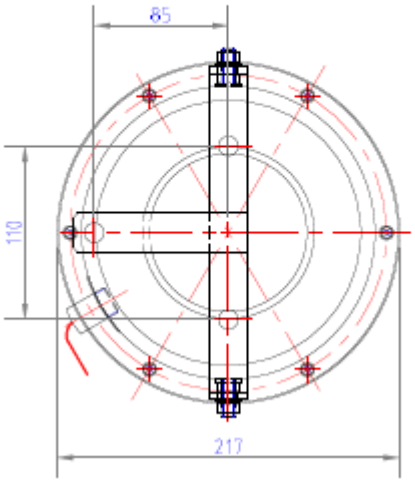


FRONT VIEW

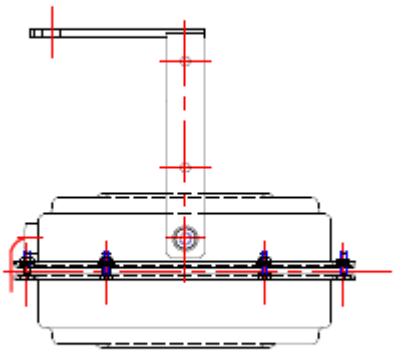


RIGHT SIDE VIEW

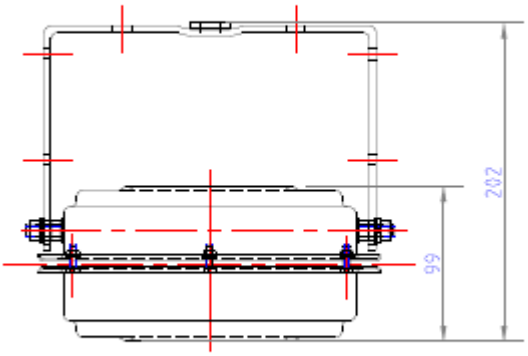
DSPA 11-6



TOP VIEW

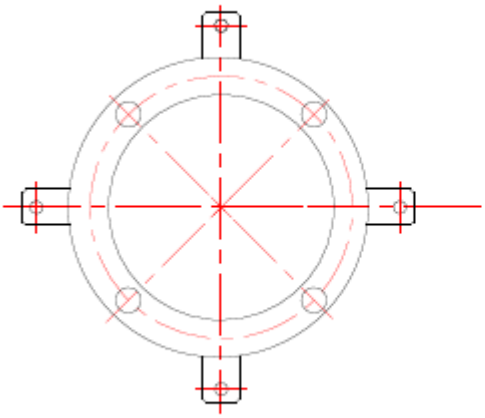


FRONT VIEW

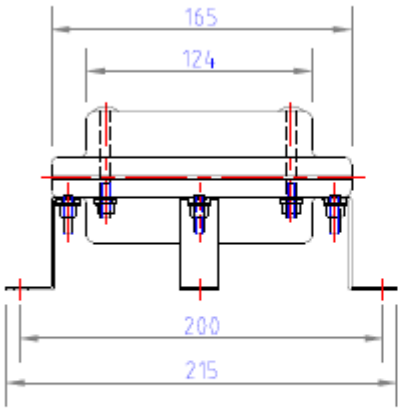


RIGHT SIDE VIEW

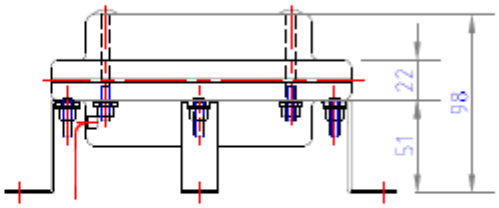
DSPA 11-7



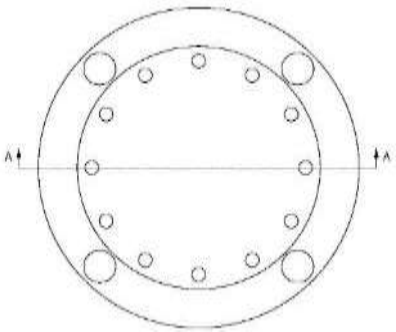
TOP VIEW



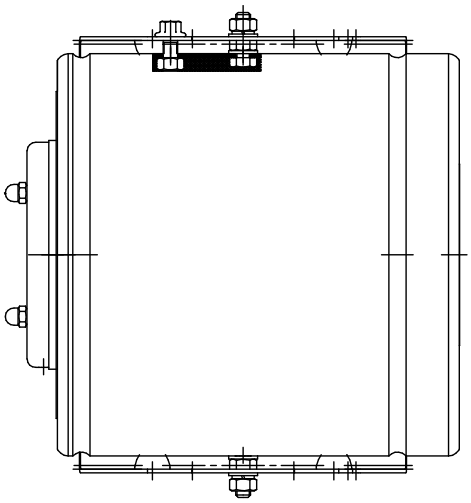
FRONT VIEW

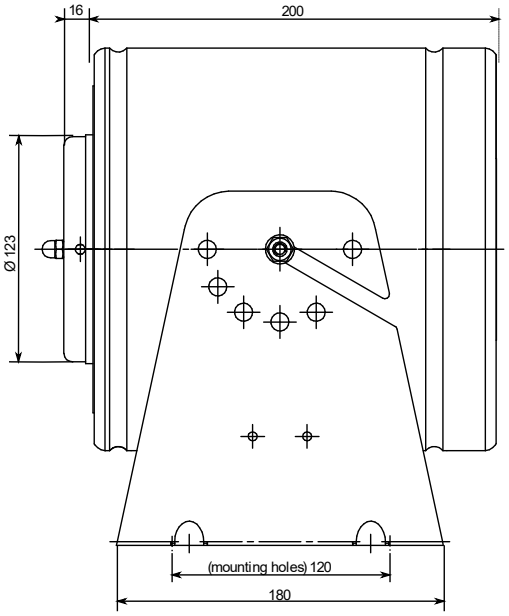


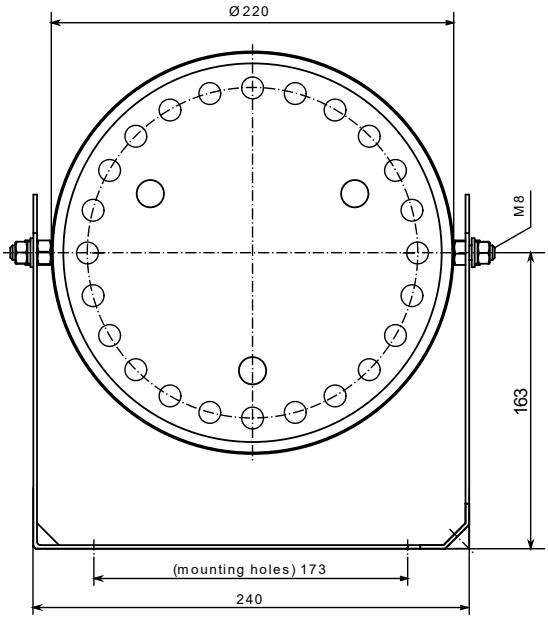
RIGHT SIDE VIEW



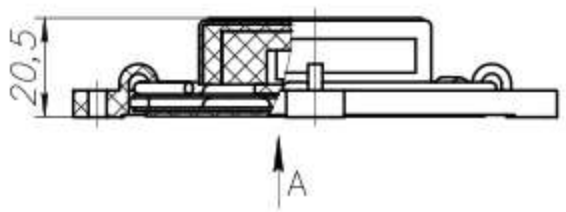
DSPA 8-1-60



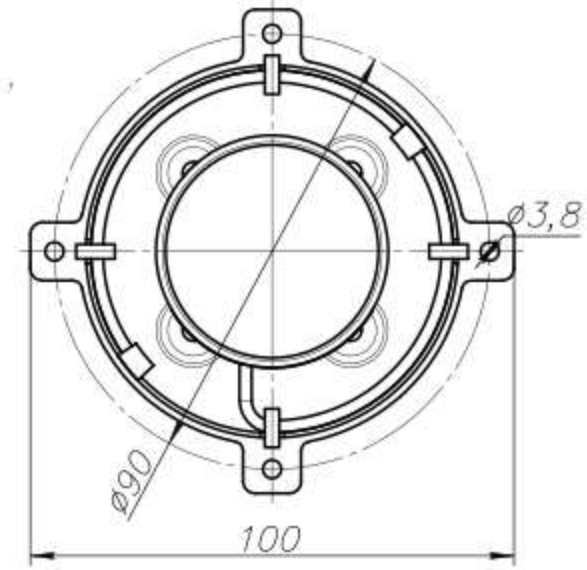

16
200
Ø 123
(mounting holes) 120
180


Ø 220
M 8
163
(mounting holes) 173
240

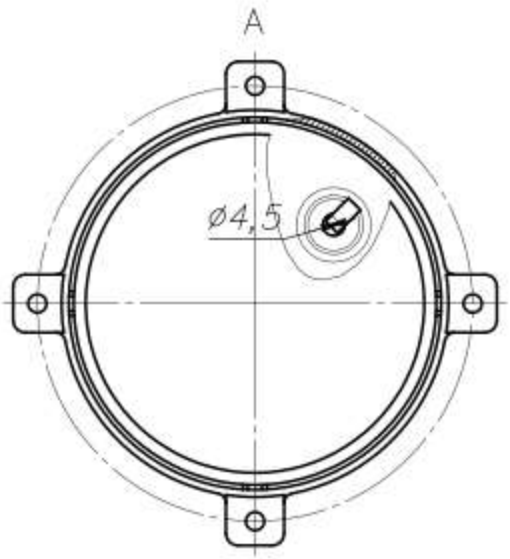
DSPA 12-1



CROSS SECTION

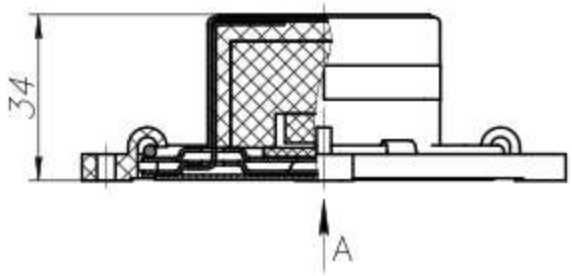


BOTTOM VIEW

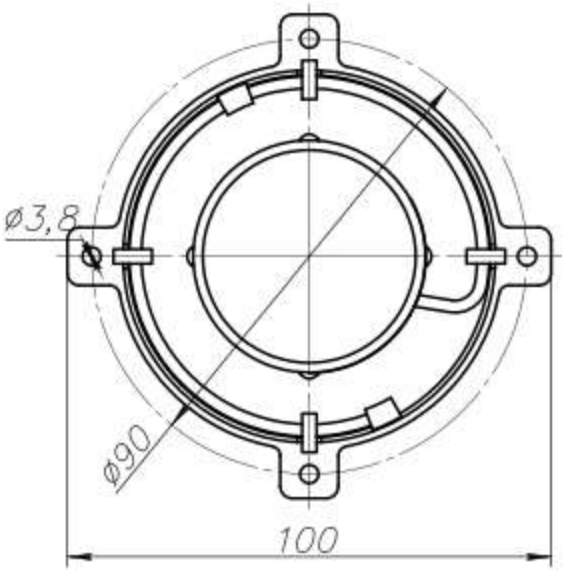


TOP VIEW

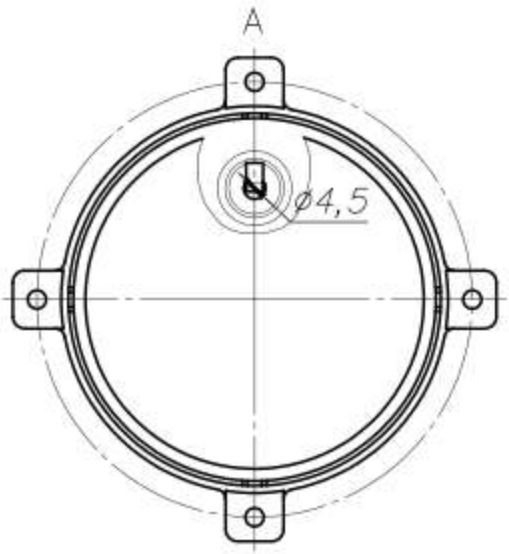
DSPA 12-2



CROSS SECTION

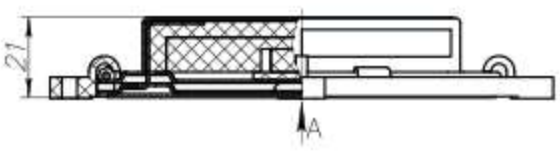


TOP VIEW

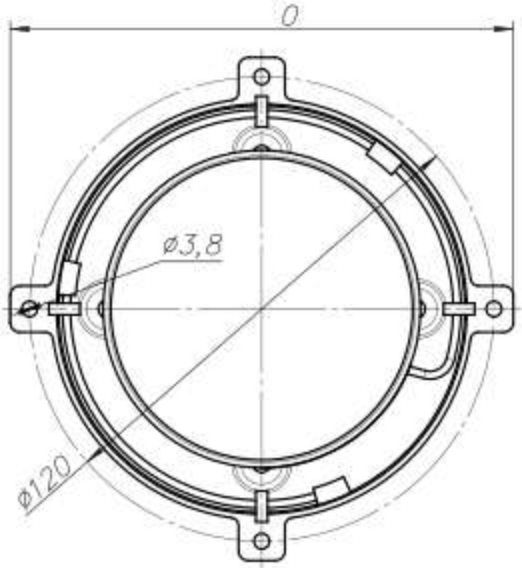


BOTTOM VIEW

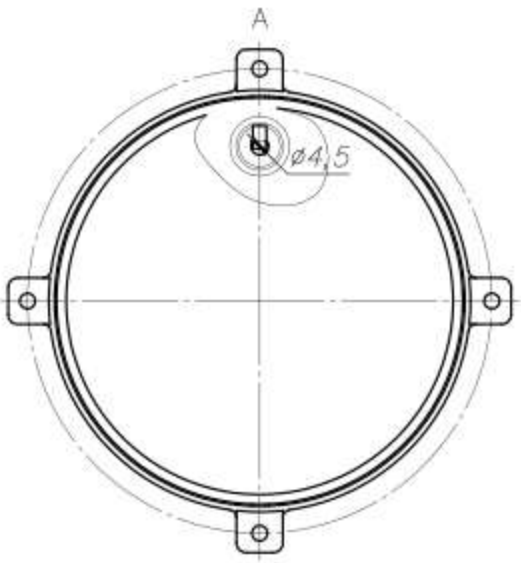
DSPA 12-3



CROSS SECTION

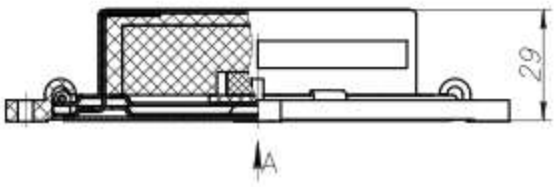


TOP VIEW

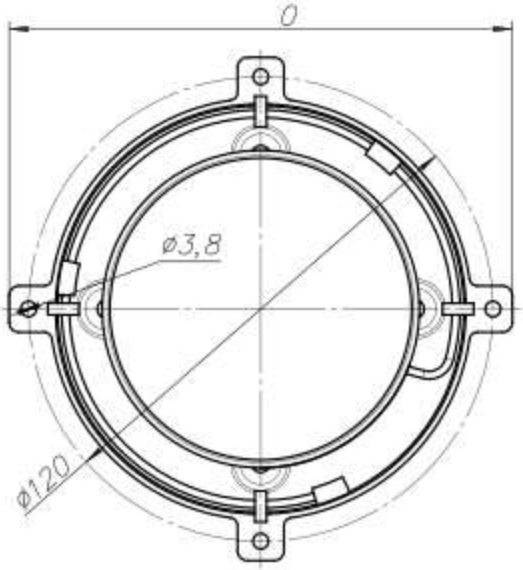


BOTTOM VIEW

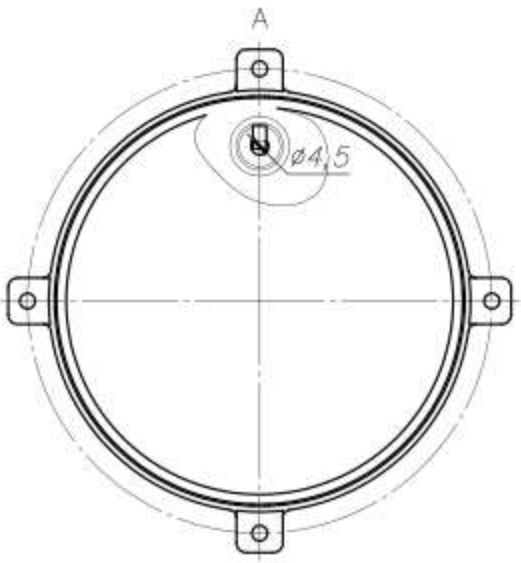
DSPA 12-4



CROSS SECTION

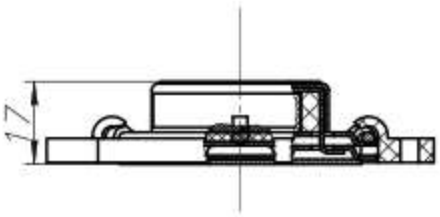


TOP VIEW

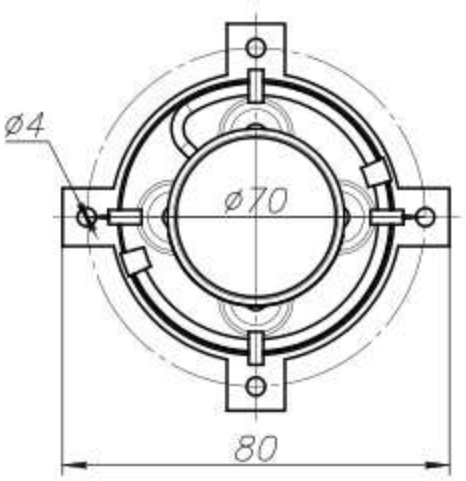


BOTTOM VIEW

DSPA 12-5

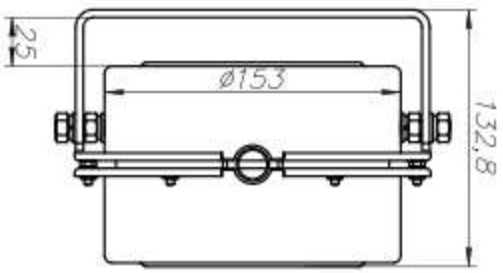


CROSS SECTION

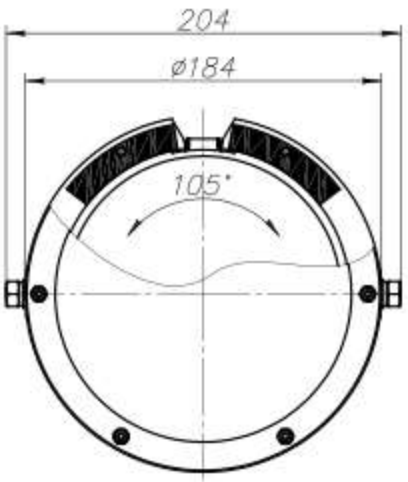


TOP VIEW

DSPA 17-1

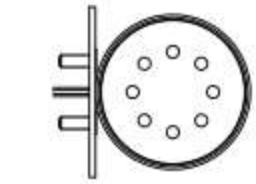


SIDE VIEW

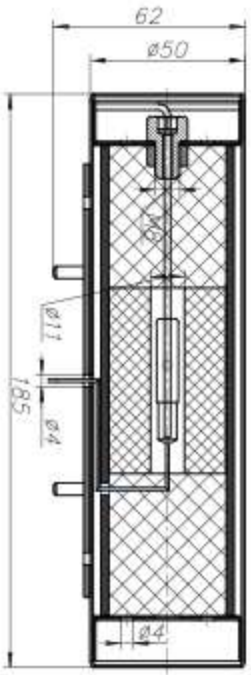


BOTTOM VIEW

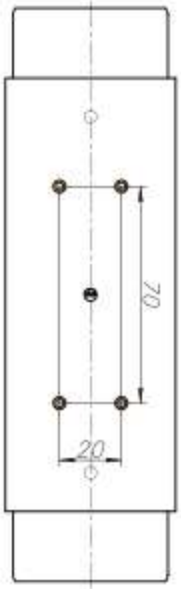
FE100



LEFT VIEW

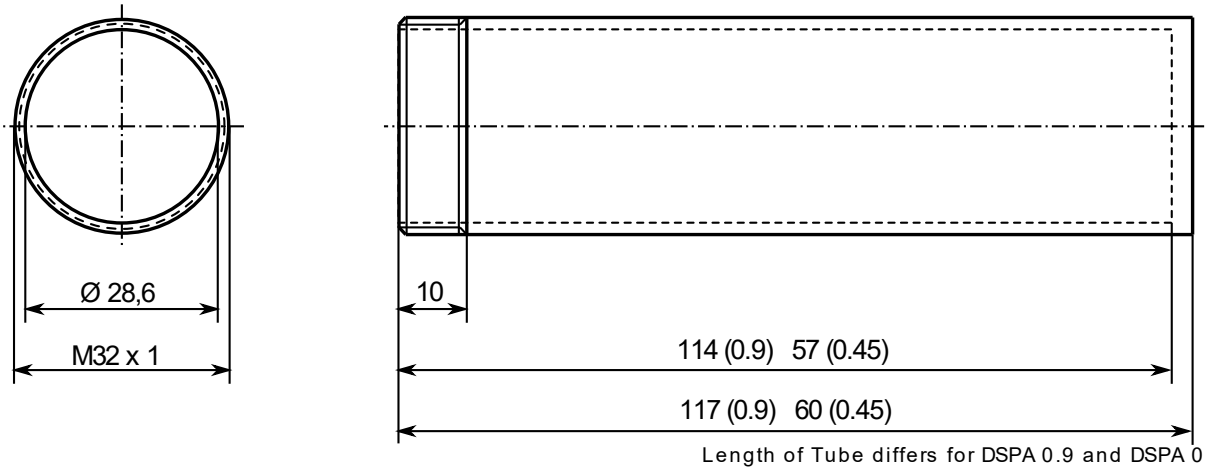


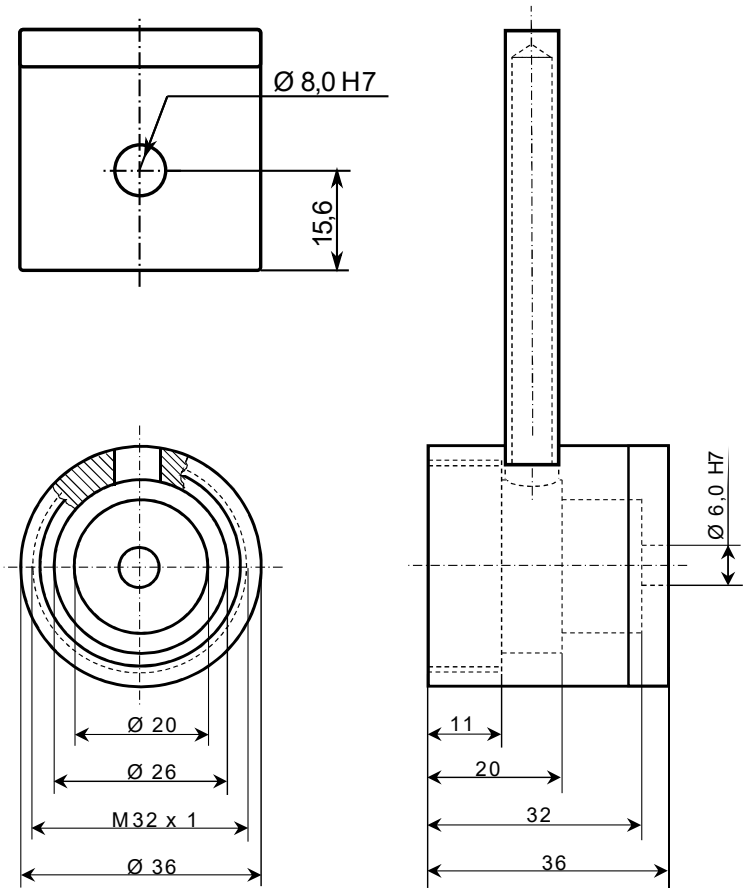
CROSS SECTION



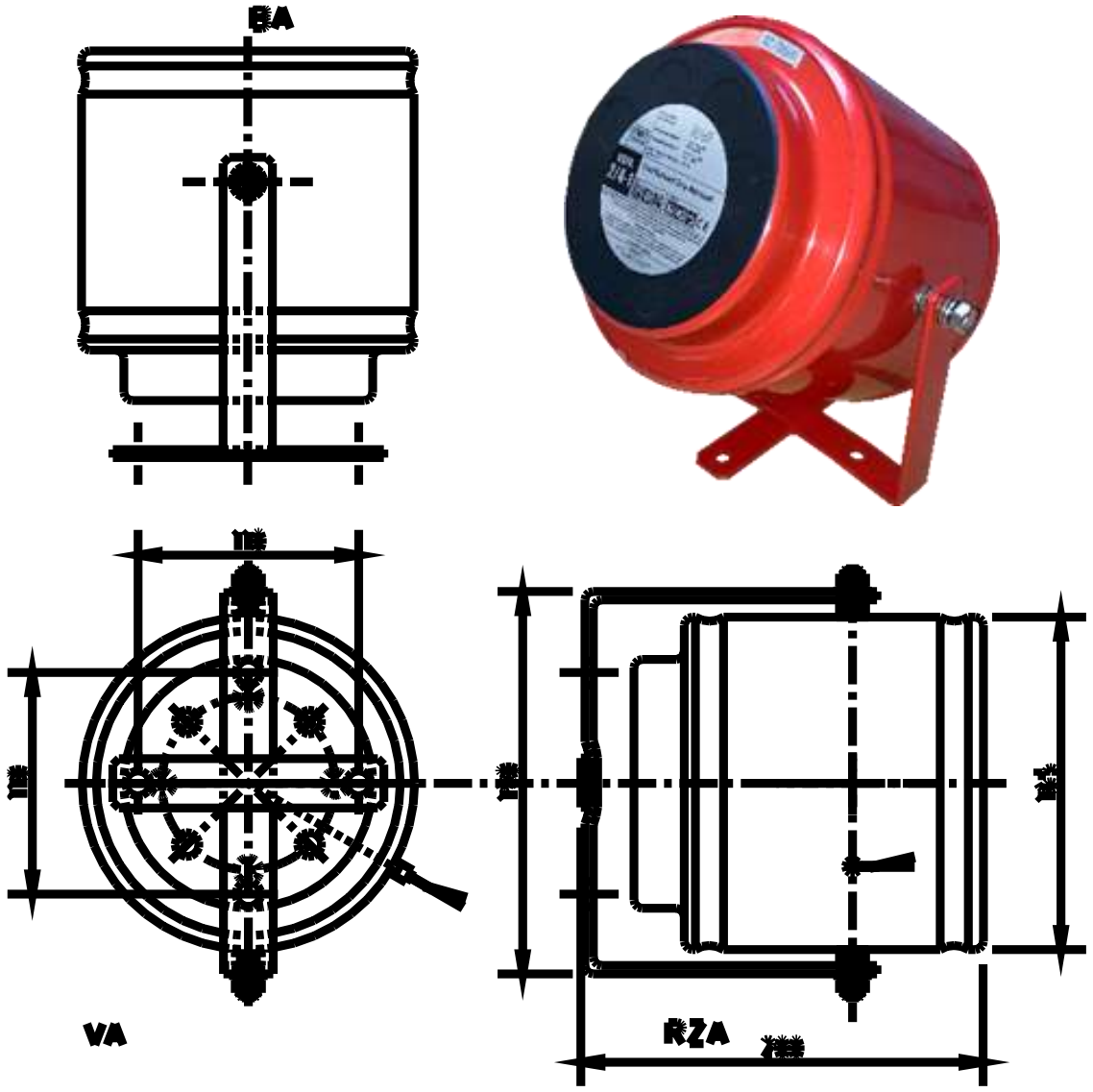
BOTTOM VIEW

DSPA 0.45-2 and 0.90-2





DSPA 2-4-1



Appendix E – Correction value K2

δ = Leakage parameter (m-1)	Parameter of Leakage distribution (ψ) according to the height of protected enclosure (%)											
	0	5	10	20	30	40	50	60	70	80	90	100
0,000	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025
0,001	1,028	1,031	1,037	1,049	1,062	1,075	1,087	1,089	1,089	1,074	1,057	1,046
0,002	1,032	1,037	1,048	1,073	1,098	1,122	1,146	1,150	1,150	1,122	1,088	1,066
0,003	1,035	1,042	1,060	1,097	1,133	1,169	1,203	1,208	1,208	1,168	1,119	1,086
0,004	1,038	1,048	1,071	1,120	1,167	1,214	1,258	1,265	1,265	1,213	1,149	1,106
0,005	1,041	1,053	1,082	1,143	1,201	1,258	1,312	1,320	1,320	1,257	1,178	1,125
0,006	1,045	1,059	1,094	1,166	1,234	1,301	1,363	1,373	1,373	1,299	1,207	1,144
0,007	1,048	1,064	1,105	1,188	1,266	1,343	1,413	1,424	1,424	1,340	1,235	1,163
0,008	1,051	1,070	1,116	1,210	1,298	1,384	1,462	1,473	1,473	1,380	1,262	1,181
0,009	1,054	1,075	1,127	1,232	1,329	1,423	1,508	1,521	1,521	1,419	1,289	1,200
0,010	1,057	1,081	1,138	1,253	1,360	1,462	1,554	1,568	1,568	1,456	1,315	1,217
0,011	1,060	1,086	1,149	1,275	1,390	1,500	1,598	1,612	1,612	1,493	1,341	1,235
0,012	1,064	1,092	1,160	1,296	1,419	1,536	1,641	1,656	1,656	1,529	1,366	1,252
0,013	1,067	1,097	1,170	1,316	1,448	1,572	1,682	1,698	1,698	1,563	1,391	1,269
0,014	1,070	1,103	1,181	1,337	1,476	1,607	1,722	1,739	1,739	1,597	1,415	1,286
0,015	1,073	1,108	1,192	1,357	1,504	1,641	1,761	1,779	1,779	1,630	1,439	1,303
0,016	1,076	1,114	1,202	1,377	1,531	1,675	1,799	1,817	1,817	1,662	1,462	1,319
0,017	1,079	1,119	1,213	1,396	1,558	1,707	1,836	1,855	1,855	1,693	1,485	1,335
0,018	1,083	1,124	1,223	1,416	1,585	1,739	1,872	1,891	1,891	1,724	1,508	1,351
0,019	1,086	1,130	1,234	1,435	1,610	1,770	1,907	1,926	1,926	1,754	1,530	1,367
0,020	1,089	1,135	1,244	1,454	1,636	1,800	1,941	1,961	1,961	1,783	1,552	1,382
0,021	1,092	1,140	1,254	1,473	1,661	1,830	1,974	1,994	1,994	1,811	1,573	1,397
0,022	1,095	1,146	1,264	1,491	1,685	1,859	2,006	2,027	2,027	1,839	1,594	1,412
0,023	1,098	1,151	1,275	1,510	1,709	1,888	2,038	2,058	2,058	1,866	1,614	1,427
0,024	1,101	1,156	1,285	1,528	1,733	1,915	2,068	2,089	2,089	1,892	1,634	1,442
0,025	1,104	1,161	1,295	1,546	1,756	1,943	2,098	2,119	2,119	1,918	1,654	1,456
0,026	1,107	1,167	1,305	1,563	1,779	1,969	2,127	2,149	2,149	1,943	1,674	1,470
0,027	1,111	1,172	1,315	1,581	1,802	1,995	2,156	2,177	2,177	1,968	1,693	1,484
0,028	1,114	1,177	1,324	1,598	1,824	2,021	2,183	2,205	2,205	1,992	1,712	1,498
0,029	1,117	1,182	1,334	1,615	1,846	2,046	2,210	2,232	2,232	2,016	1,730	1,511
0,030	1,120	1,188	1,344	1,632	1,867	2,071	2,237	2,259	2,259	2,039	1,748	1,525
0,031	1,123	1,193	1,354	1,648	1,888	2,095	2,263	2,285	2,285	2,061	1,766	1,538
0,032	1,126	1,198	1,363	1,665	1,909	2,118	2,288	2,310	2,310	2,083	1,784	1,551
0,033	1,129	1,203	1,373	1,681	1,929	2,141	2,313	2,335	2,335	2,105	1,801	1,564
0,034	1,132	1,208	1,382	1,697	1,949	2,164	2,337	2,359	2,359	2,126	1,818	1,577
0,035	1,135	1,213	1,392	1,713	1,969	2,186	2,360	2,382	2,382	2,147	1,834	1,589
0,036	1,138	1,218	1,401	1,729	1,989	2,208	2,383	2,405	2,405	2,167	1,851	1,602
0,037	1,141	1,223	1,410	1,745	2,008	2,229	2,406	2,428	2,428	2,187	1,867	1,614
0,038	1,144	1,229	1,420	1,760	2,027	2,250	2,428	2,450	2,450	2,207	1,883	1,626
0,039	1,147	1,234	1,429	1,775	2,045	2,271	2,449	2,472	2,472	2,226	1,899	1,638
0,040	1,150	1,239	1,438	1,790	2,064	2,291	2,470	2,493	2,493	2,245	1,914	1,649
0,050	1,185	1,261	1,497	1,883	2,217	2,459	2,638	2,672	2,672	2,417	2,050	1,742

δ = Leakage parameter (m-1)	Parameter of Leakage distribution (ψ) according to the height of protected enclosure (%)											
	0	5	10	20	30	40	50	60	70	80	90	100
0,060	1,208	1,294	1,550	1,983	2,327	2,600	2,792	2,833	2,833	2,544	2,167	1,817
0,070	1,226	1,318	1,617	2,075	2,458	2,733	2,942	2,992	2,992	2,698	2,268	1,878
0,080	1,263	1,356	1,667	2,175	2,577	2,892	3,100	3,159	3,159	2,843	2,391	1,975
0,090	1,294	1,393	1,733	2,292	2,708	3,058	3,294	3,358	3,358	3,000	2,525	2,066
0,100	1,319	1,438	1,781	2,358	2,808	3,168	3,418	3,462	3,462	3,107	2,614	2,138
0,110	1,351	1,468	1,854	2,454	2,932	3,300	3,556	3,597	3,597	3,225	2,713	2,228
0,120	1,382	1,504	1,923	2,556	3,049	3,423	3,683	3,721	3,721	3,334	2,804	2,298
0,130	1,413	1,540	1,988	2,653	3,160	3,535	3,798	3,834	3,834	3,435	2,888	2,363
0,140	1,444	1,577	2,048	2,745	3,265	3,638	3,901	3,937	3,937	3,526	2,963	2,423
0,150	1,476	1,612	2,103	2,833	3,363	3,732	3,992	4,028	4,028	3,608	3,031	2,475
0,160	1,507	1,648	2,153	2,915	3,453	3,817	4,071	4,109	4,109	3,681	3,091	2,521
0,170	1,538	1,683	2,199	2,993	3,538	3,892	4,138	4,180	4,180	3,745	3,143	2,561
0,180	1,569	1,718	2,240	3,067	3,617	3,957	4,194	4,239	4,239	3,801	3,225	2,595
0,190	1,600	1,752	2,276	3,135	3,688	4,013	4,238	4,288	4,288	3,847	3,267	2,622
0,200	1,632	1,786	2,308	3,199	3,753	4,059	4,269	4,326	4,326	3,884	3,333	2,643

Appendix F – Overview Activation Equipment

The following equipment is approved by DSPA B.V. to be compliant with the DSPA aerosol generators.

The overview starts with activation equipment which is also approved according the BRL K23003 by the Notified Body KIWA. This equipment is certified to applicable standards where possible and in compliance with the specifications of the applicable standards, as specified into the Declaration given by KIWA.

LST BC06-2EXT/INT11 (BRL K23003 – approved)
Fire Detection and Extinguishing panel BC06-2EXT/INT11 of Labor Strauss Sicherungsanlagenbau GmbH Wien (LST).

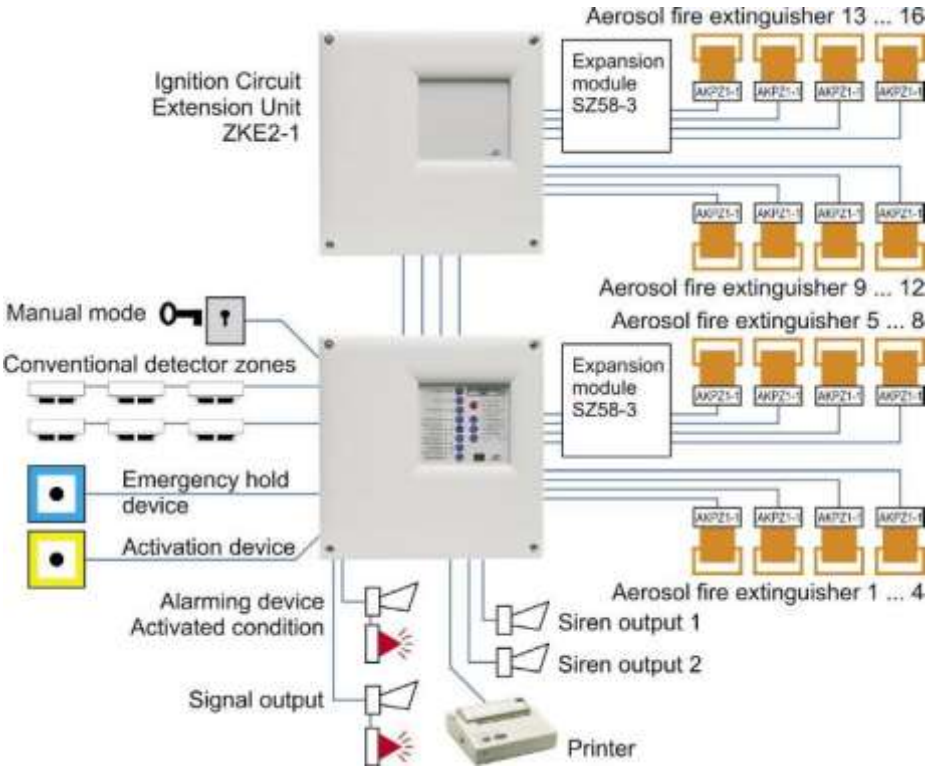


Figure 13 The LST Fire Detection Control Panel BC06-2EXT/INT11.

In order to meet the high current demands of a large aerosol extinguishing system, LST has designed the Ignition Circuit Extension Unit ZKE2-1. The INT11 version of the BC06-2EXT has one Ignition Circuit Unit integrated. With this panel a system up to 48 DSPA aerosol generators can be build.

The fire detection and extinguishing panel BC06-2EXT is certified according EN 54-2, EN 54-4 and EN 12094-1. The Circuit Extension is approved according the BRK K23003.

The BC06-2EXT/INT11 version is only sold by DSPA B.V.

PH Fighter MPR+ (BRL K23003 – approved)
Fire Detection and Extinguishing panel Fighter MPR+ of Paradox Hellas S.A.

Figure 14 The Paradox Hellas Fire Detection Control Panel Fighter MPR+.

Paradox Hellas has designed a Sequential Activator to control the activation of 2 DSPA aerosol generators per activator. With those Sequential Activators a DSPA aerosol extinguishing system can be build with a maximum of 40 generators.

The Paradox Fighter panel is certified according EN 54-2, EN 54-4 and EN 12094-1. The extension with the Sequential Activators is approved according the BRL K23003.

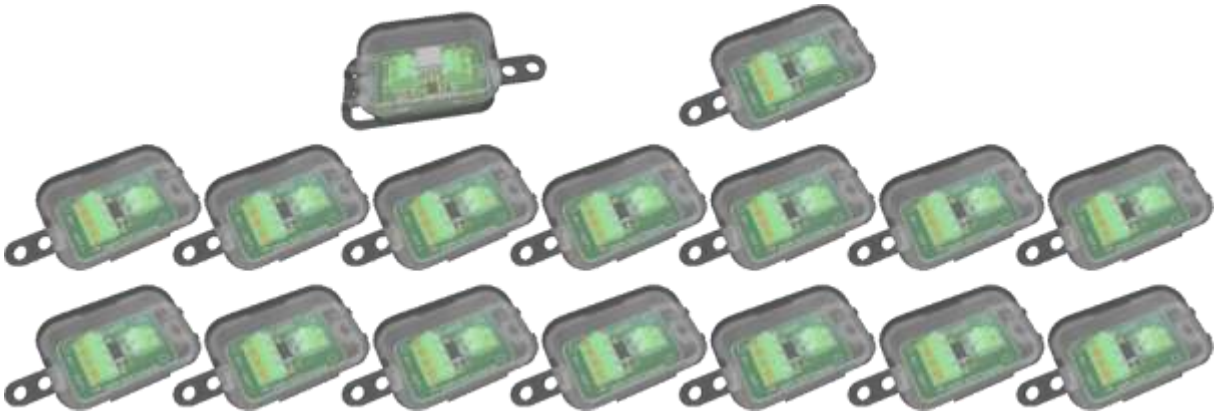
µFEP (BRL K23003 – approved)
Fire Detection & Extinguishing Control panel with integrated UPS.

Figure 15 µFEP Standalone Detection Extinguishing Control Unit

The µ-FEP is designed to be a stand-alone fire detection-extinguishant release panel used in systems for e.g. electrical cabinets, CNC machines, engine rooms, small area's or other equipment in which the user should be able to extinguish a fire rapidly and effective. The µFEP is capable to control the activation up to 10 DSPA aerosol generators.
The µFEP is approved according the BRL K23003. All functions of the µFEP are in compliance with the specifications of the applicable standards, as specified into the Declaration given by KIWA.

DSPA UAS - Universal Activation System (EN54-18 Certified, SCP04 – K21045 Approved)
Panel independent secure activation. There is nothing an installer is more familiar with than his own extinguishing control panels. DSPA has developed the unique, easy to integrate DSPA Universal Activation System. Capable of controlling, monitoring and activating up to 400 DSPA condensed aerosol generators simultaneously, no matter which control panel is connected.

DSPA SCR – Simple Circuit Regulator (SCP04 – K21045 Approved)
The DSPA Simple Circuit Regulator is designed to provide a seamless integration between DSPA condensed aerosol generators and fire control panels.



Building reliable and efficient DSPA condensed aerosol suppression systems by any extinguishing control panel, independent of its manufacturer. This enables you to use your locally known and familiar equipment to engineer a complete suppression system, increasing the reliability and quality of the final build fire suppression system.

AMP 6L

Aerosol Management Panel AMP-6L supplied by DSPA B.V.

Figure 16 AMP-6L Aerosol Management Panel

The AMP-6L is designed to manage the activation up to 60 DSPA aerosol generators. The AMP-6L can be used as a stand-alone manual controlled extinguishing system, but can also controlled by all generic fire detection and extinguishing systems.

SAS

Automotive System SAS CU supplied by DSPA B.V.

Figure 17 SAS Automotive System – Central Unit

The SAS Automotive System is an integrated system for the fire detection and extinguishment, specifically developed to protect private/public vehicles.

NOFIQ FMD

The NOFIQ Fire Management Device (FMD) supplied by DSPA B.V.

Figure 18 NOFIQ Fire Management Device (FMD)

The NOFIQ FMD is part of the NOFIQ fire prevention system. The NOFIQ system has been especially designed for detecting, alarming and extinguishing a fire in enclosed compartments containing electrical components.