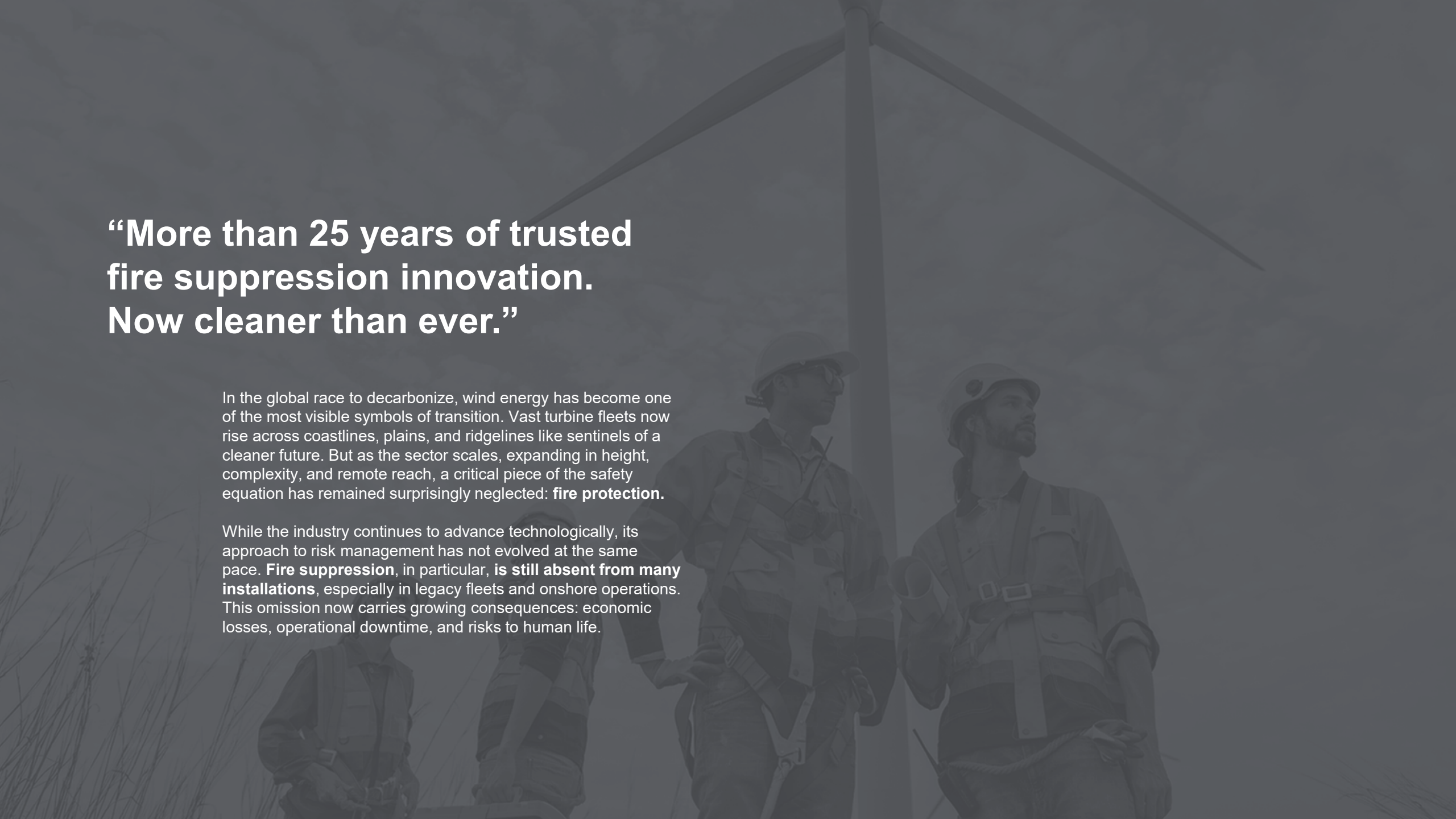
DSPA® Aerosol Fire Suppression

Wind Energy Application



“More than 25 years of trusted fire suppression innovation. Now cleaner than ever.”

In the global race to decarbonize, wind energy has become one of the most visible symbols of transition. Vast turbine fleets now rise across coastlines, plains, and ridgelines like sentinels of a cleaner future. But as the sector scales, expanding in height, complexity, and remote reach, a critical piece of the safety equation has remained surprisingly neglected: **fire protection.**

While the industry continues to advance technologically, its approach to risk management has not evolved at the same pace. **Fire suppression**, in particular, **is still absent from many installations**, especially in legacy fleets and onshore operations. This omission now carries growing consequences: economic losses, operational downtime, and risks to human life.

Company Profile

Since 2002, DSPA.nl is a leading **manufacturer of highly innovative aerosol generators**, which are supplied in complete **fire extinguishing and suppression** systems.

Being a preferred Halon and gas substitute, our products are used worldwide by governments, firefighters, first responders and various industries.

DSPA.nl strives to provide exceptional value to our customers with an intense focus on quality, reliability, service and innovative product development.

Our aerosol Generators are produced in our own production facilities in Nijmegen, The Netherlands, and are equipped with the latest high-tech machines.

Our subsidiary office based in Pune INDIA, provides local commercial and technical support.

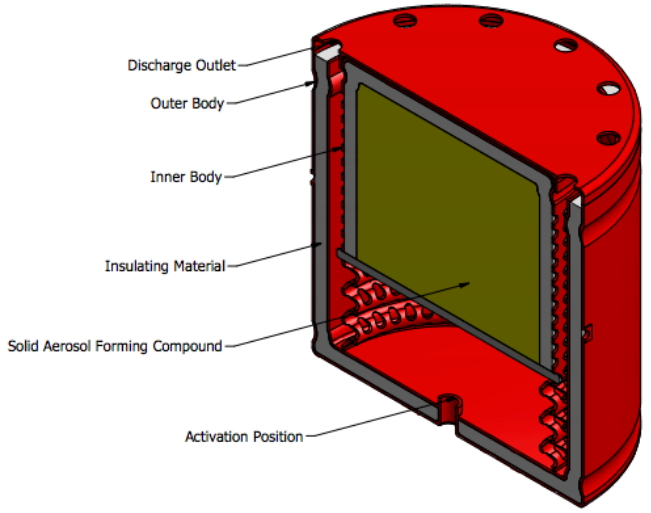
What is DSPA?

Dry Sprinkler Powder Aerosol

Aerosol generators consist of a solid aerosol forming compound in a non-pressurized red canister. This compound aerosolizes rapidly, expanding volumetrically in extremely finely divided solid particles, surrounded by gas: the aerosol fire extinguishing agent. And so it behaves like a gas.

The aerosol is self-generated by a combustion process of the solid aerosol-forming compound, activated by an activation device, also known as the starter.

The solid micro particles fill the compartment completely and attack the combustion process of a fire at a chemical level. As a result, the flames are instantly knocked down and the energy is removed from the fire.



Proven
Technologies

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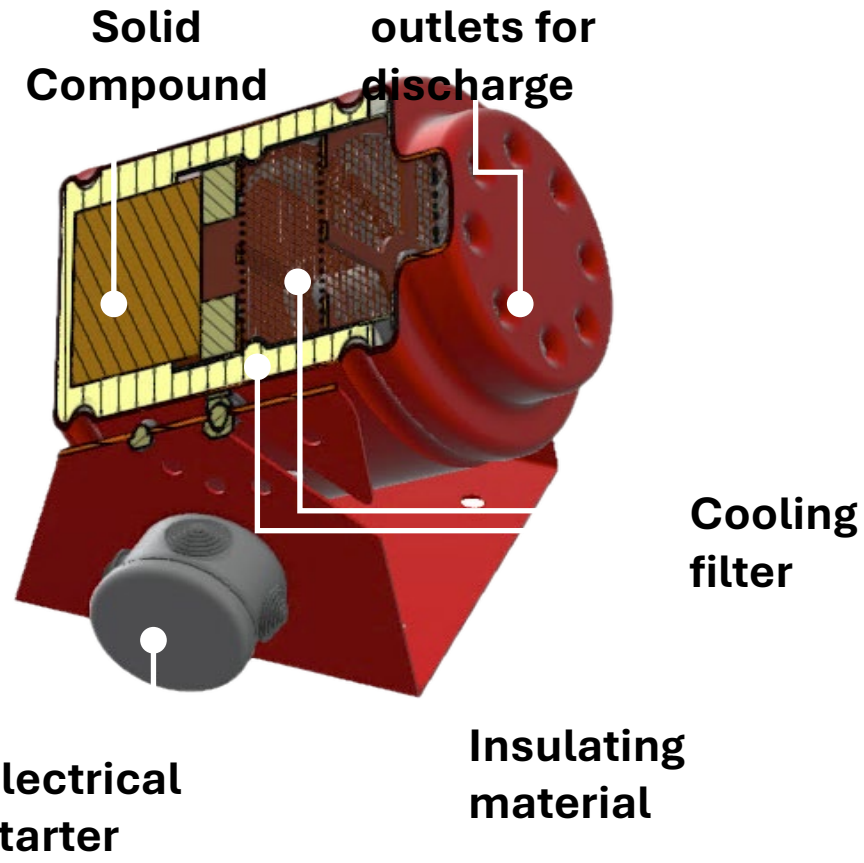


Extinguishing Mechanism

Unlike many other extinguishing agents, DSPA Aerosol interferes with the chain reaction in the fire, leaving oxygen levels intact.

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

This process is called negative catalysm: the K radicals stick to the OH radicals and break the energy chain.

New, stable molecules are formed that will no longer contribute to the chain reaction. The small aerosol particles provide a large surface area for capturing these radicals making them effective extinguishing agents.

Proven
Technologies

Advantages

Efficient

Only a small amount (32-110 g/m^3) of aerosol is needed to extinguish fires. This makes our systems much more efficient and effective than conventional systems, such as FM-200 (550-950 g/m^3) or Novec-1230 (690-1188 g/m^3). With operating conditions ranging from -40°C to +75°C with humidity up to 95%, our systems are applicable in many situations.

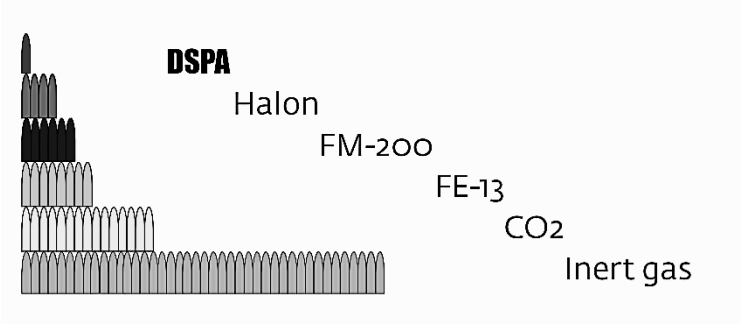
Safe

DSPA generators are unpressurized, nor do they increase pressure inside the room or object during discharge, making transport, installation and use easy and safe. DSPA received the SNAP-listing from the Environmental Protection Agency in the USA. Our aerosol is with zero Ozone Depleting Potential, zero Global Warming Potential and a negligible Atmospheric Life Time, environmentally friendly. Nor is it harmful to humans or animals.

Easy to install & maintain

DSPA generators are easily connected to conventional fire detection systems. Installation without any interruption of ongoing (production) processes is possible. There is no need for expensive pipe work and require far less maintenance compared to other conventional systems. They have a guaranteed serviceable lifetime of 15 years.

And are only to be replaced after that, in comparison to other systems that require expensive refills every 5 years. The non-pressurized system requires only maintenance to the electrical detection and activation unit.



Comparison

Fire class:

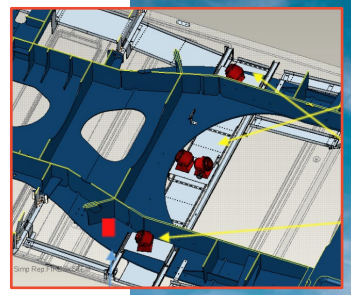
Extinguishing Agent	A	B	C	D	F
Water and Water mist	X				
ABC Extinguishing powder	X	X	X		
BC-Powder		X	X		
D-Powder				X	
Foam	X	X			
Carbon Dioxide CO2			X		
Foam for oils and fats					X
DSPA dry aerosol	X	X	X		X

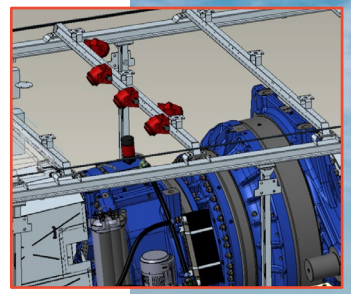
your ideal agent	Halon 1301	HFC's	Inert Gasses	Perfluor-ketones	**DSPA**
Gaseous agent	x	x	x		aerosol
Low chemical reactivity	x	x	x		x
No effect on biological tissues	x	x	x		x
Electrically non-conducting	x	x	x	x	x
High weight efficiency	x	x	x		xx
Low agent costs	x	x	x		xx
High Nozzle area coverage	x	x	x		x
Low system cost	x	x	x		xxx
Low storage volume	x	x		x	xxx
Low number cylinders	x	x		x	ZERO
Low cylinder pressure	x	x		x	ZERO
Low manifold pressure	x	x		x	ZERO
Low enclosure pressure	x	x		x	x
Zero ODP		x	x	x	x
Zero GWP			x		x
non-VOC	x	x	x		x
Efficiency Needed	200-350	x550-950	690-1180	690-1180	32-110

Source: IFP magazine 12/2015

Why Aerosol preferred for Wind Turbines?

- Easy to Retro-FIT, anywhere.
- Light weight and effective: +/- 100gr/m3
- total generator weight <11 KG for >30m3
- **Cabinet protection OR total flooding nacelle**
- No airtight requirement
- Longer hold time than gas: >30'
- NO designated space for cylinder storage
- Environmentally friendly
- Not harmful
- Certified 15-years lifetime
- GREEN alternative !! NO PFAS
- Low and predictable maintenance cost,
- Optional integration in Turbine Mgmt System





Proven
Technologies

Protection Solutions

Experience

- DSPA generators are installed in wind turbines in Australia, Germany, India, Sweden, Taiwan and Korea. Chile / Peru / China
- Custom unit development to be used in converter cabinets. SGRE
- Cabinet suppression solutions SUZLON
- Custom nacelle system with integration. NORDEX VESTAS

Cabinet 0,05 to 10m3

- Standalone (Thermocord or bulb only)
- Integrated (Connected with smoke detectors & complete system)
- SGRE / SUZLON

Object Protection

- Aim generator on risk area
- Fracking trucks China (required witnessed performance test)

Nacelle 30 to 1055m3

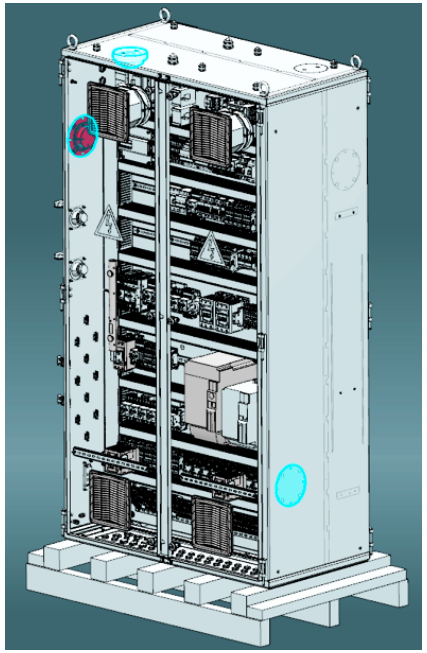
- FDA system
- Including / excluding sideships
- Continuously monitored , shutdown of turbine
- Vestas / Nordex

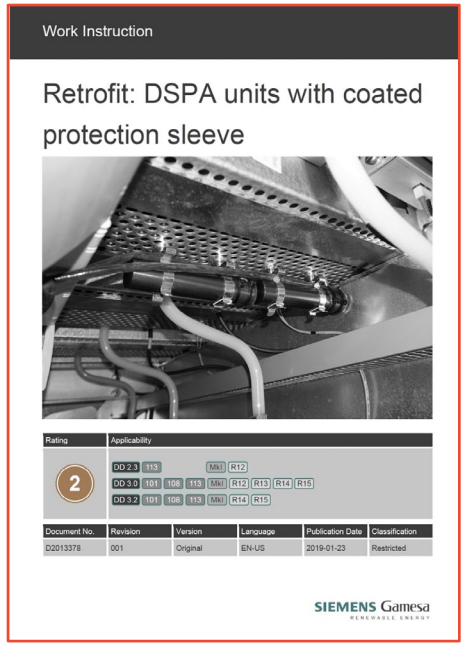
Fire Aerosol Supression Systems For Cabinet

Advantages:

- **Localized protection**: Only the affected cabinet is treated—no need for room-wide flooding.
- **No pressure vessels or pipework**: Simple and compact design.
- **Non-conductive and non-corrosive**: Safe for sensitive electronics.
- **No oxygen depletion**: Safe for personnel.
- **Environmentally friendly**: No GWP, no ozone depletion, no PFAS.

Wind Turbine Fire Philosophy Electrical Cabinet





Proven Technologies

Stand Alone Aerosol System

Thermocord (also called **thermal cord** or **fusible cord**) is a special cord that activates when exposed to a certain temperature—commonly around **170°C to 180°C**. When it breaks, it triggers the activation mechanism of the connected fire suppression device.

Key Benefits:

- No electricity needed
- Automatic activation at fire conditions
- Reliable and NO-maintenance
- Ideal for retrofit installations

Cons

- Limited notification possibilities

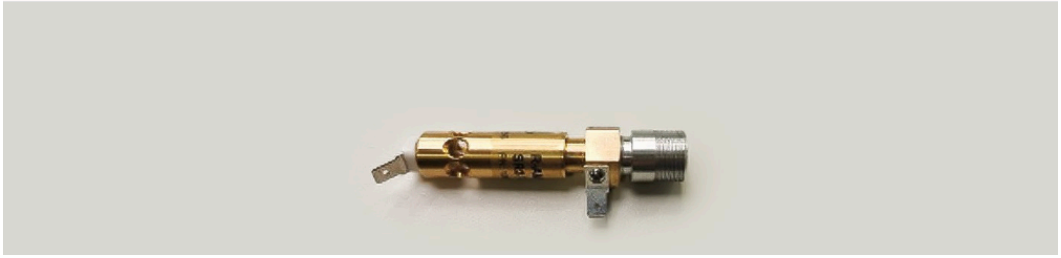
Stand Alone Aerosol System

Bulb Starting Device
Bulb Starting Device (R)

The screw-in thermal Bulb Starting Device is designed for DSPA 11-series generators (11-6, 11-5, 11-4, 11-3). It offers **reliable heat-based activation**, with flexible options for integration with Fire Alarm Control Panels.

Key Features

- Standalone heat activation for automatic response in fire conditions
- Integrated feedback device – NC/NO monitoring allows detection when the bulb bursts
- Adjustable activation temperature – bulbs available in multiple temperature ratings
- Durable brass housing for long-term reliability 15-years lifetime
- Tested to standards: DIN EN 61373:2011, EN 50155:2007
- Remote activation option – Bulb Starting Device (R) includes a coil that heats via FACP current, triggering the generator
- Bulb VDS certified



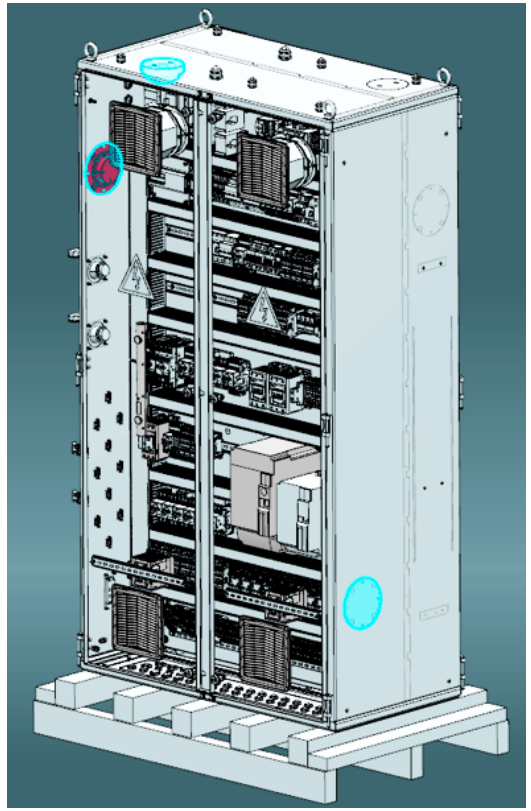
Integrated fire Aerosol suppression System

A **DSPA Integrated Fire Suppression System for Cabinets** is a **pre-engineered, automatic fire suppression solution** specifically designed to protect electrical or technical enclosures.

Key Components:

- **DSPA Aerosol Generator**
- **Detection and Activation System**
  - Typically includes **thermal sensors**, **electrical detection circuits**, and control units.
  - Can be **automatic**, **manual**, or **electrically activated** depending on the design.

- **Mounting System**
  - The generator is installed **inside or on top of the cabinet (option for DSPA 0.45 & DSPA 0.90)**.
  - Direction of discharge is optimized to flood the entire enclosure.
  - Optional magnet mounting



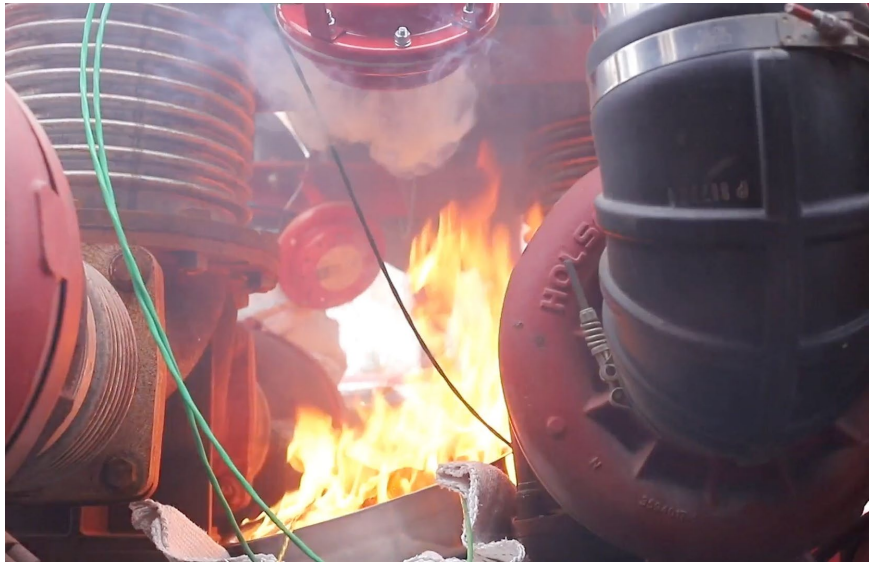
Object Protection

Object fire protection using aerosol systems is designed to automatically detect and suppress fire directly aimed at the known fire risk areas, protecting specific equipment or hazards.

Key Components:

- **DSPA Aerosol Generator**
- **Detection and Activation System**
  - Typically includes **thermal sensors**, **electrical detection circuits**, and control units.
  - Can be **automatic**, **manual**, or **electrically activated** depending on the design.
- **Mounting System**
  - The generator is installed **aiming towards fire risk** .
  - Direction of discharge is optimized
  - Optional magnet mounting

All object protection related cases will be independently witnessed by a NoBo to assess performance.

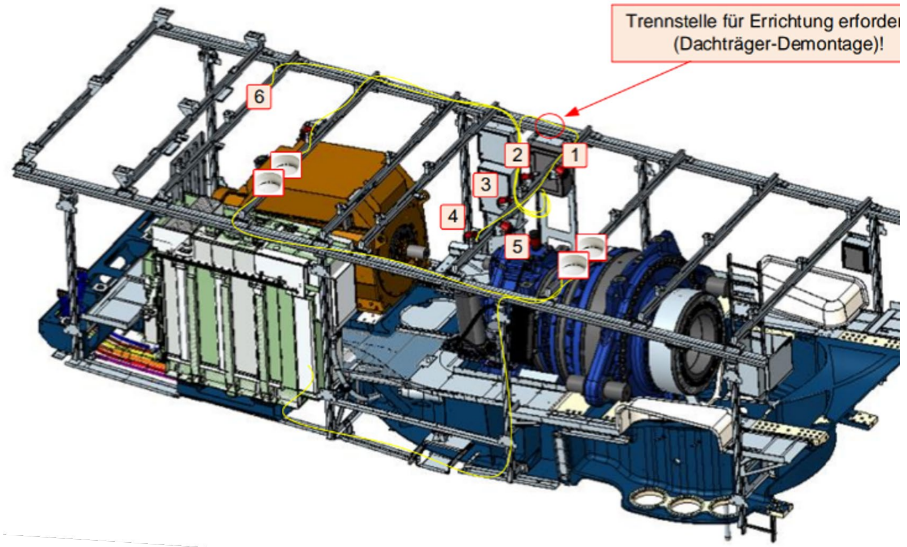


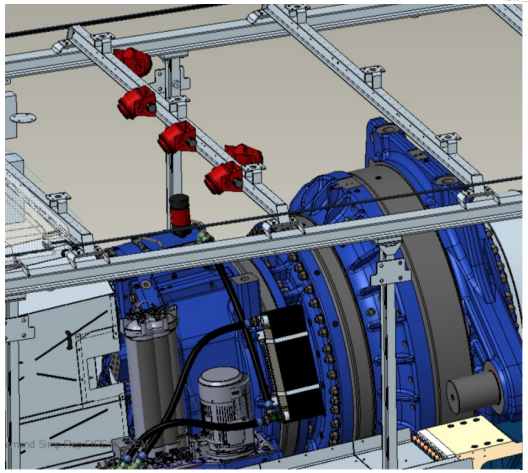
Nacelle detection & suppression

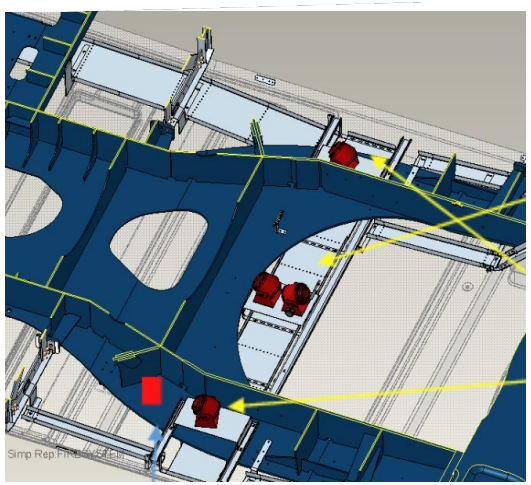
Addressable vs. Conventional

- Addressable – location of detection & suppression (Vestas SGRE)

- Conventional cost effective. (Nordex)





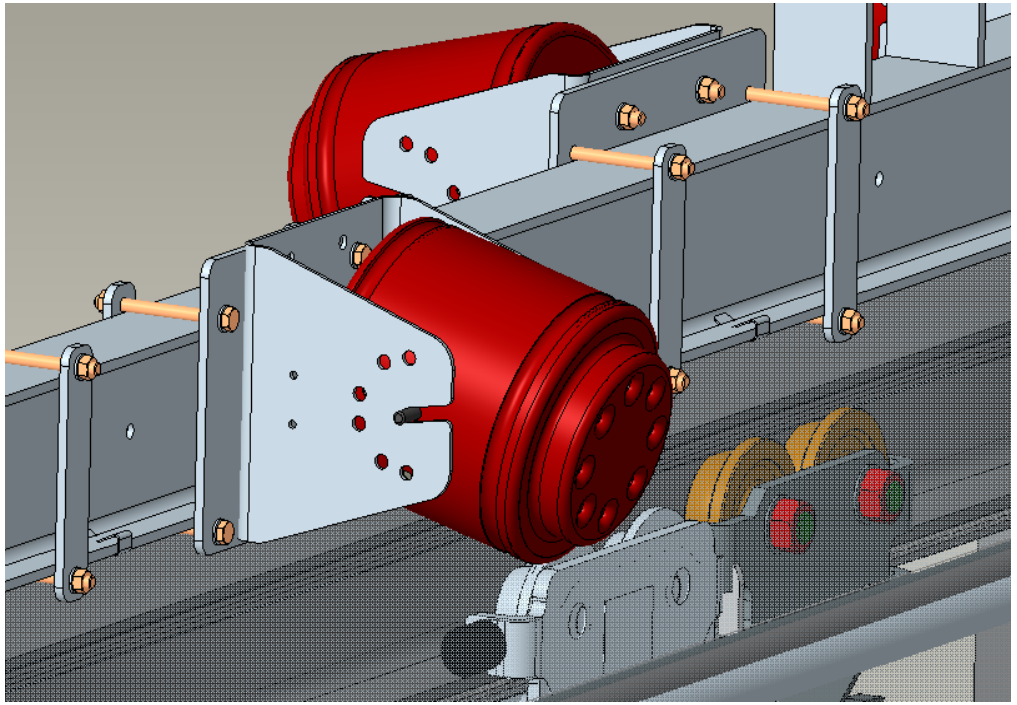


Proven Technologies

Magnet mounting & Extensive vibration

Nordex C-clamp mounting

SGRE / VESTAS Magnet mounting



Customization & Retrofit Capabilities

As the original equipment manufacturer, we offer full flexibility to adapt our solutions to project-specific requirements. Our in-house design and engineering capability enables us to:

Customize fixing brackets to accommodate unique installation constraints, structural layouts, or legacy equipment interfaces.

Retro-fit solutions seamlessly into existing systems without major modifications to the surrounding infrastructure.

Optimize component geometry and mounting methods to ensure safe, reliable, and compliant installation across diverse environments.

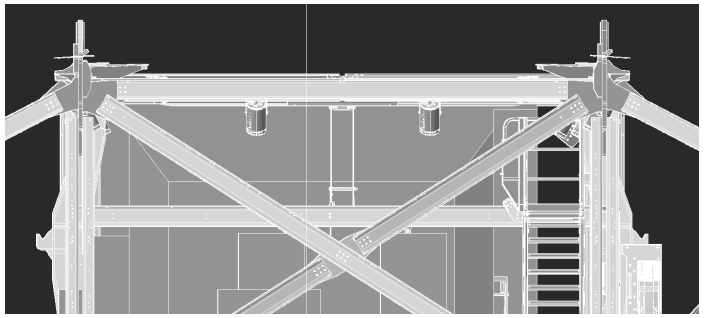
Accelerate design iterations thanks to direct access to manufacturing processes and engineering resources.

This flexibility ensures that each installation is both practical and cost-effective, while maintaining full compliance with performance and safety standards.

Production Bracket

Customized Bracket

Magnet mounting &
Extensive vibration testing



Vestas approved vibration
with magnets suppression units of 20KG

Standard: IEC 60068-2-6
Standard: MIL-810G

Shock test
Standard: IEC 60068-2-27
15G

		RESTRICTED
DOCUMENT: 0178-5495 V00	DESCRIPTION: DVPR Vibration Tests for aerosol generators	PAGE 1/11

RESTRICTED DOCUMENT — Vestas

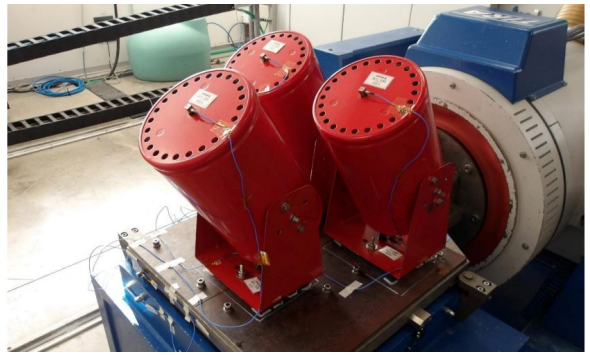
	DVPR VIBRATION TESTS
DOCUMENT: 0178-5495 V00	DESCRIPTION: DVPR Vibration Tests for aerosol generators

DVPR
Vibration Tests

Version History

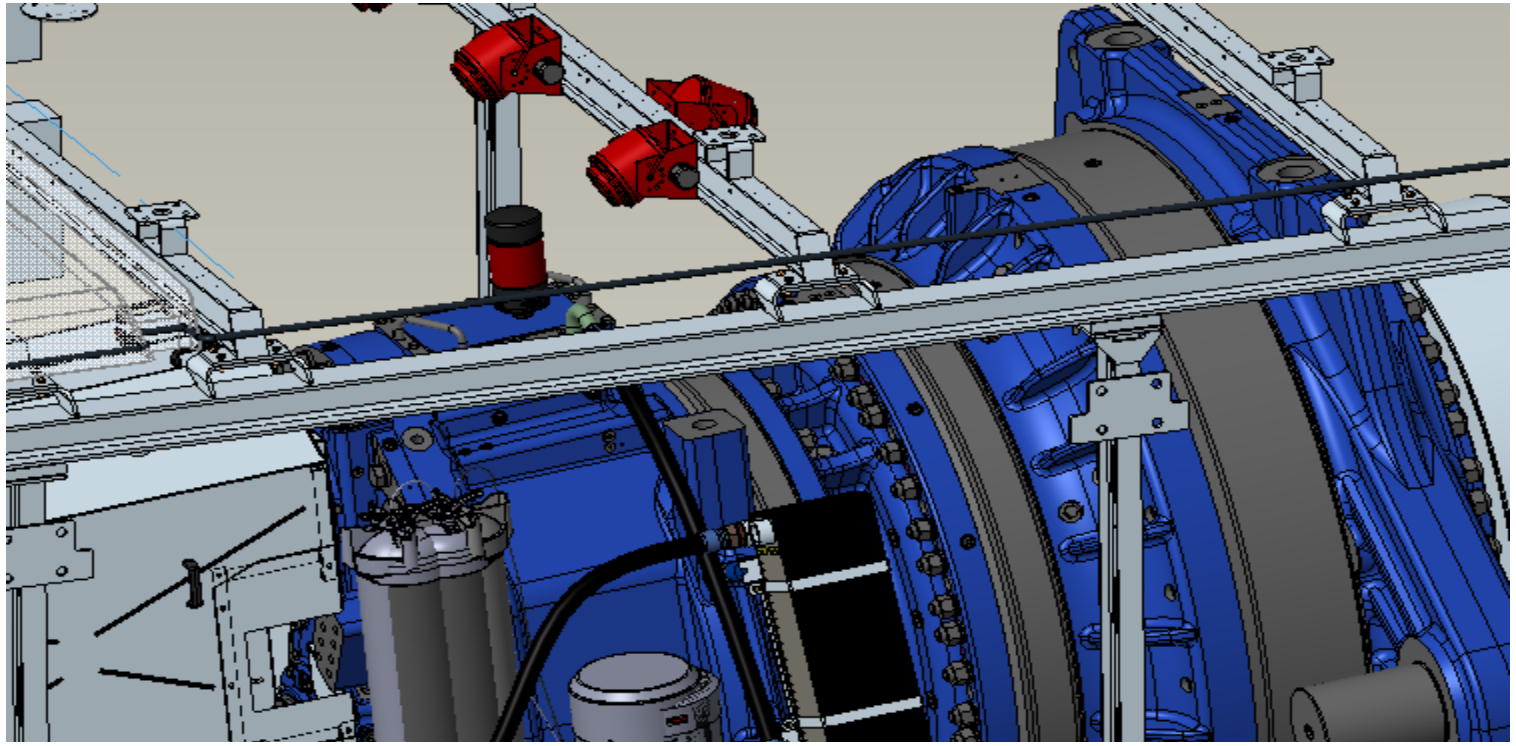
VERSION	DATE	CHANGE
00	20-09-2024	*Initial document, based on template 0062-5463*

Classification: Restricted

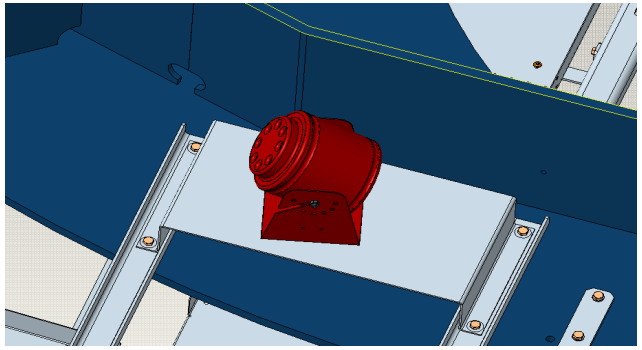


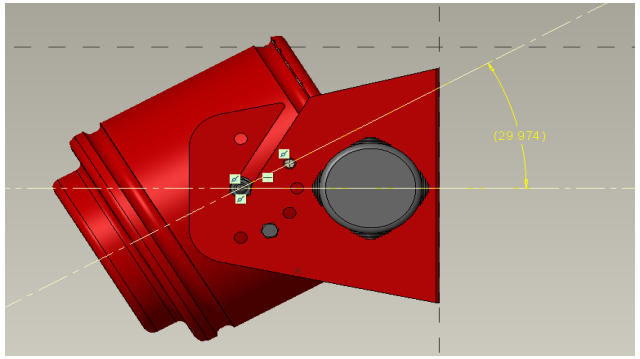
Proven
Technologies

Mounting c-clamp vs magnet



Placement of Aerosol Generator inside Wind Turbine





Installation Generator angle

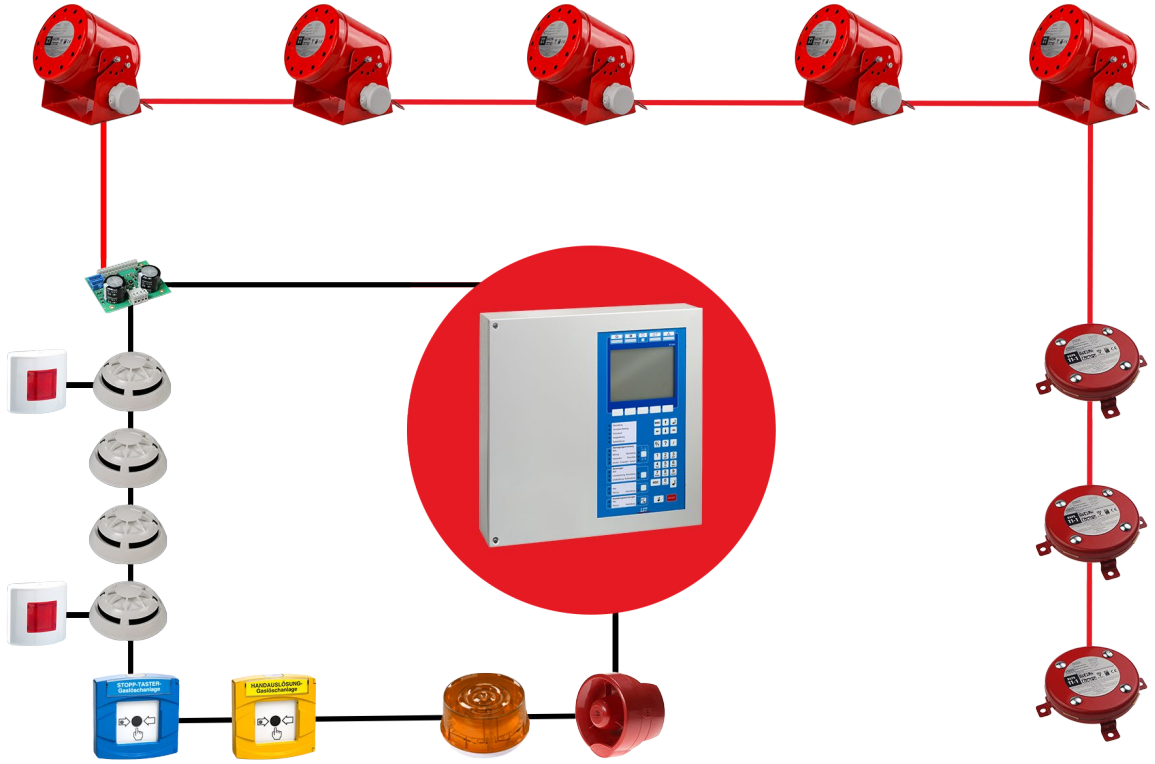
Proven
Technologies

Integrated Systems

A DSPA fixed extinguishing system combines the unique technology of DSPA Aerosol generators with high quality fire panels and accessories of our partners.

Together we have developed uniquely safe and reliable systems that are tailor made for our generators, and applications.

Our integrated systems are fully certified by KIWA.

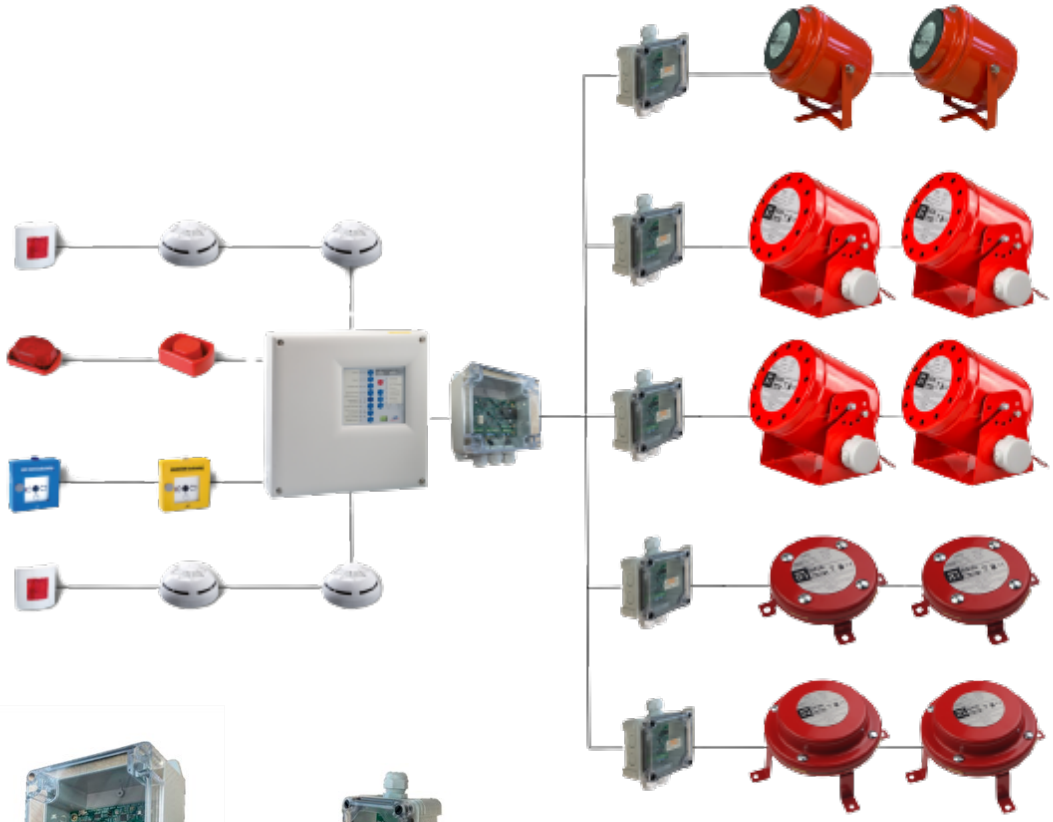


Integrated Systems

The new developed Universal Activation System (UAS) is developed to control and activate regular small to large DSPA condensed aerosol extinguishing systems by one single generic Fire Alarm and Release panel.

With DSPA UAS you can connect up to 400 DSPA generators to one FACP.

The DSPA UAS consists of 1 or 2 DSPA UAS Controllers and a DSPA UAS Forwarder for each 2 connected DSPA condensed aerosol generators



UAS Controller

UAS forwarder

Design & Engineering

After the contract is awarded DSPA will set up an engineering team, consisting of DSPA B.V. , installation companies and wind turbine engineers.
Engineering is done by Engineers having experience in Vestas, Gamesa and Siemens Turbines for more than 20 years.

A good preparation is essential for a smooth and controlled installation process.

For the complete engineering including drawings, writing the manuals as mentioned above, the first installation and the preparation of the teams and the kits to be installed 10 weeks* will be needed.

** depending on scope*

After a period of 10 weeks we will deliver:

- Installation scheme and project description
- Electrical drawings
- Physical drawings
- Technical datasheet of materials
- Installation Manual
- Certifications and approvals of materials
- Commissioning manual
- System Operating & Maintenance Manual
- Installation companies subcontracted

This will be done for all the xx different types of wind turbines.
We will start with installation in the Wind Turbine types mostly available in.....,
since installation time is planned for the whole year.

Installation & Commisioning

Example of done installation
Installation teams from companies in Denmark; Alpha Offshore, a member of the Sparrow Group (now ALTRAD), Global Wind Service and Plant Supervision (subsidiary in India).

Two people of these teams will be also in the engineering team.

Long experience
certified on the necessary qualifications.
Both companies are working worldwide.

A team of 3 installers will be formed.
Two people will be working in the turbine while 1 is on leave for 6 weeks.
The composition of the team will change every 3 weeks, to continue the experience and to prevent loss of efficiency. As alternative a 28 on / 14 days off is possible. If we need to ramp up and more people are needed, these companies can deliver more teams, and alternatively we already have access to other companies on the same level of experience and technical know-how – with branches in US / INDIA.

See for more information:
www.alphaoffshore.dk
www.sparrowsgroup.com
https://globalwindservice.com
https://plant-supervision.com/

Installation & Commisioning

We are convinced that we can meet the deadlines of installation. During the installation at the bigger parks*, a supervisor will be in the team to:

- Execute the commissioning test according to check list
- To file the commissioning fill list
- Deliver the list of materials installed
- To deliver the materials factory test protocols
- Take and deliver photos of every equipment installed
- Deliver one individual report for each Wind Turbine

Training of own engineers and sole supply of supervisor for first turbines commissioning is possible!!

*depending on rfq side

In cooperation with HK-Consult, Alpha Offshore and Global Wind Service

Maintenance:

- Dependent on local requirement; but advised
- **Yearly inspections** Standard certified alarm inspection and test process (alarm, smoke, heat, damages etc.) (standard for all installed fire systems)
- Year 15 DSPA inspection / maintenance Replace DSPA units
- **Cost on discharge Discharge Cost**: Replacement DSPA units plus time / travel / clean-up / reconnection and test of system

Proven Technologies

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

Certifications

• 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 subject 2775: 2019 – Outline of investigation for fixed condensed aerosol extinguishing system units;

• BRL-K23001/06:2019 Evaluation Guideline for aerosol fire extinguishing for the product certificate for fixed dry aerosol fire extinguishing components;

• AS 4487-2013, 'Condensed aerosol fire extinguishing systems – Requirements for system design, installation and commissioning and test methods for components' by Activ Fire.

• ISO 9094:2015 Small craft – Fire protection RINA, ABS

• 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"

Copies of product tests, reports and approvals available upon request

DSPA®

Sustainable Fire Suppression