High Risk Areas in the Industry

Gniewosz Siemiątkowski
Business Development Manager CEE

VID FIREKILL®
LOW PRESSURE WATERMIST

Date: 2025

Agenda

01 FM Approvals in Industry protection

02 FM HC1-HC3 occupancies

03 Total flooding

04 Local application

05 High risk industrial objects

06 Biomass storage and transportation

07 Cable tunnels and Trafo

08 Watermist curtains

The most complete available standard

FM Approvals

FM 5560 Examination Standard for Water Mist Systems

FM DS 4-2 Water Mist Systems

FM DS 3-26 Fire Protection for Non-Storage Occupancies

FM DS 7-79 Fire Protection for Gas Turbines and Electric generators

FM DS 7-101 Fire Protection for Steam Turbines and Electric generators

Strong compliance and reliability

FM Approvals

- Real Scale tested in FM laboratory
- Component testing
- Continuous audit
- Worldwide recognized benchmark

6: Cardboard carton with polystyrene trays

10: 210901-1 Showing no damage to left main fuel end array

5

FM DS. 3-26 hazard classification

	Table 2.2.2. Hazard Categories Based on Predominant Occupancy
HC-1	Areas with light overall combustible loading with limited combustibles used in processes, or operations of low hazard. This includes combustible furnishings that are typically noncontinuous in well-subdivided areas. This hazard category does not include any incidental storage of plastics, or plastics used in the construction of walls and/or ceilings. This hazard category can have incidental amounts of ignitable liquids in accordance with 2.3.2.4. Examples include residential, offices, noncombustible manufacturing, and hospitals.
HC-2	Areas with moderate continuous combustible loading with combustibles in processes, or operations of moderate hazard due to limited quantities of plastics or ignitable liquids. Examples include manufacturing, such as machine shops, woodworking, and electronic assembly, as well as retail, theatres, and food production.
HC-3	Areas with generally continuous heavier combustible loading with limited quantities of ignitable liquids and/or heavier amounts of plastics. Examples include plastic manufacturing, vehicle manufacturing and assembly, and printing plants.

FM DS. 3-26 hazard classification

Occupancy	Hazard Classification	Fire Test Protocol	FM Approved Solution
Metal, glas, ceramic or cement production plant.	HC-1	Water Mist: FM5560 Appendix G	OH-VSO
Meat processing plant	HC-2	Water Mist: FM5560 Appendix P	OH-PX2
Chockolate, biscuit factories	HC-2	Water Mist: FM5560 Appendix P	OH-PX2
Woodworking and furniture factories	HC-2	Water Mist: FM5560 Appendix P	OH-PX2
Plastic factories, Injection moulding plants	HC-3	Water Mist: FM5560 Appendix P	OH-PX2
Battery, car assembly plants	HC-3	Water Mist: FM5560 Appendix P	OH-PX2
Electrical room, dry transformer room	HC-2 (technical areas)	Water Mist: FM5560 Appendix P	OH-PX2

FM hazards classification – flamable liquids risks

Occupancy	Hazard Classification	Fire Test Protocol	FM Approved Solution
Oil transformer room	Machinery spaces below 260m3	Water Mist: FM5560 Appendix C	B1 (Total Flooding)
Generator rooms	Machinery space above 260m3	Water Mist: FM5560 Appendix E	K6 (Total Flooding) or LAK7 (Local Application)
Oil basement	Machinery space above 260m3	Water Mist: FM5560 Appendix E or I	K6 (Total Flooding)
Hydraulic press in large enclosure	Local aplication	Water Mist: FM5560 Appendix I	LAK7 (Local Application)
Gas Turbine in power plant	Local aplication	Water Mist: FM5560 Appendix I	LAK7 (Local Application)

HC-1 occupancies

FM 5560 Appendix G

Areas as defined by FM

Production areas without comustibles and hydraulic machines;

Offices, common areas;

Determine the design area for water mist systems FM Approved for use in HC-1 occupancies with unrestricted enclosure areas using whichever of the following is greater:

A. The hydraulically most remote nine (9) automatic nozzles
B. All automatic nozzles within a 1500 ft2 (140 m2) demand area

In case compartment is smaller – calculate all nozzles in the compartment..

For corridors supplied with one row of nozzles calculate demand for 5 nozzles or whole demand area whichever is less.

HC-2 and HC-3 occupancies

FM 5560 Appendix P

Areas defined as HC-2 and HC-3 by FM DS 3-26 :

Production areas up to 7.6m height with incidental storage of plastics.

Technical areas

Electrical rooms

Dry transformer

Battery room

Storage (see FM DS 3-26 limitation)

Determine the design area for water mist systems FM Approved for HC-2 and HC-3 occupancies using whichever of the following is greater:

A. The hydraulically most remote nine (9) automatic nozzles.
B. The hydraulically most remote number of automatic nozzles as specified in the FM Approval listing.

Ceiling height in the production hall: Isn’t it to high for water mist?

Standard Solutions HC1 was so far limited to 5m height;

OH-PX2 nozzles has been tested in FM for HC-3 risk with ceiling height up to 7.6m;

Aditional test has been done in DFL in Denmark on the same protocol with height up to 12m.;

How to adress storage in nonstorage areas?

Treat solid-pile, palletized, rack, shelf, or bin-box storage of Class 1-3 commodities up to 10 ft (3m) high and no more than 200 ft2 (20 m2) in area as incidental to the occupancy.

In HC-2 and HC-3 occupancies, treat solid-pile, palletized, rack, shelf, or bin-box storage of plastic commodities up to 6 ft (1.8 m) high and no more than 64 ft2 (6 m2) in area (approximately four pallets) as incidental to the occupancy.

Multiple areas of storage within the limits listed above may still be considered as incidental to the occupancy if separated by aisles not less than 8 ft (2.4 m) wide.

Benefits over conventional sprinkler

Water consumption

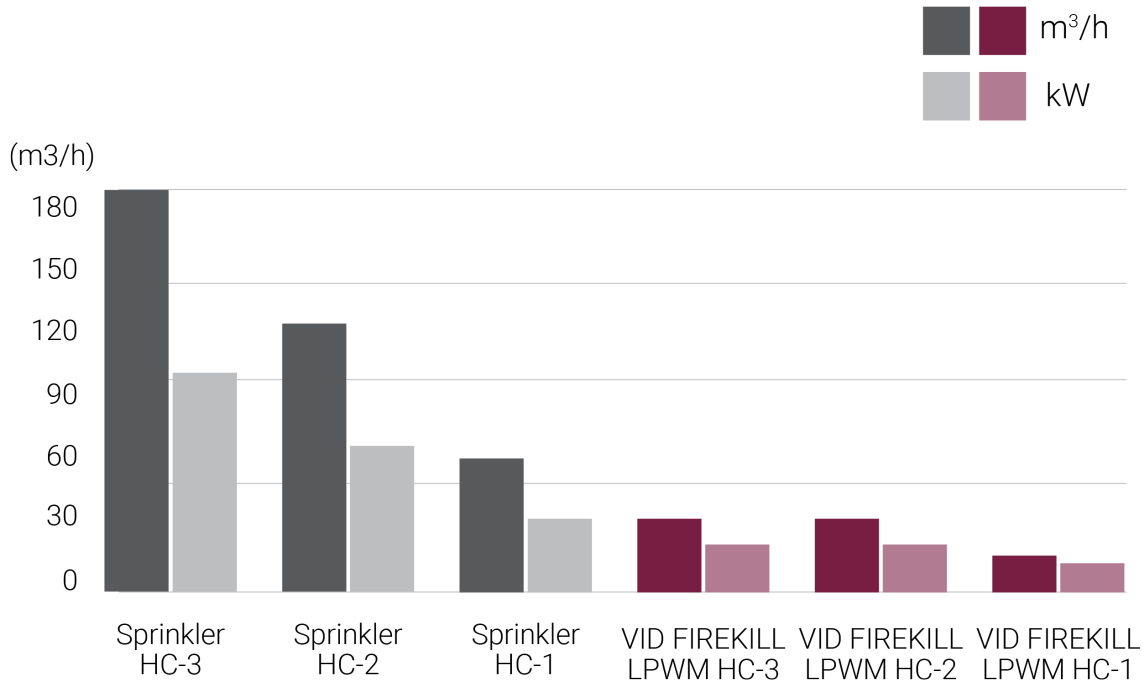
Less space

Less property loss

Less power

Less obstructions

Easier and flexible design



Other benefits

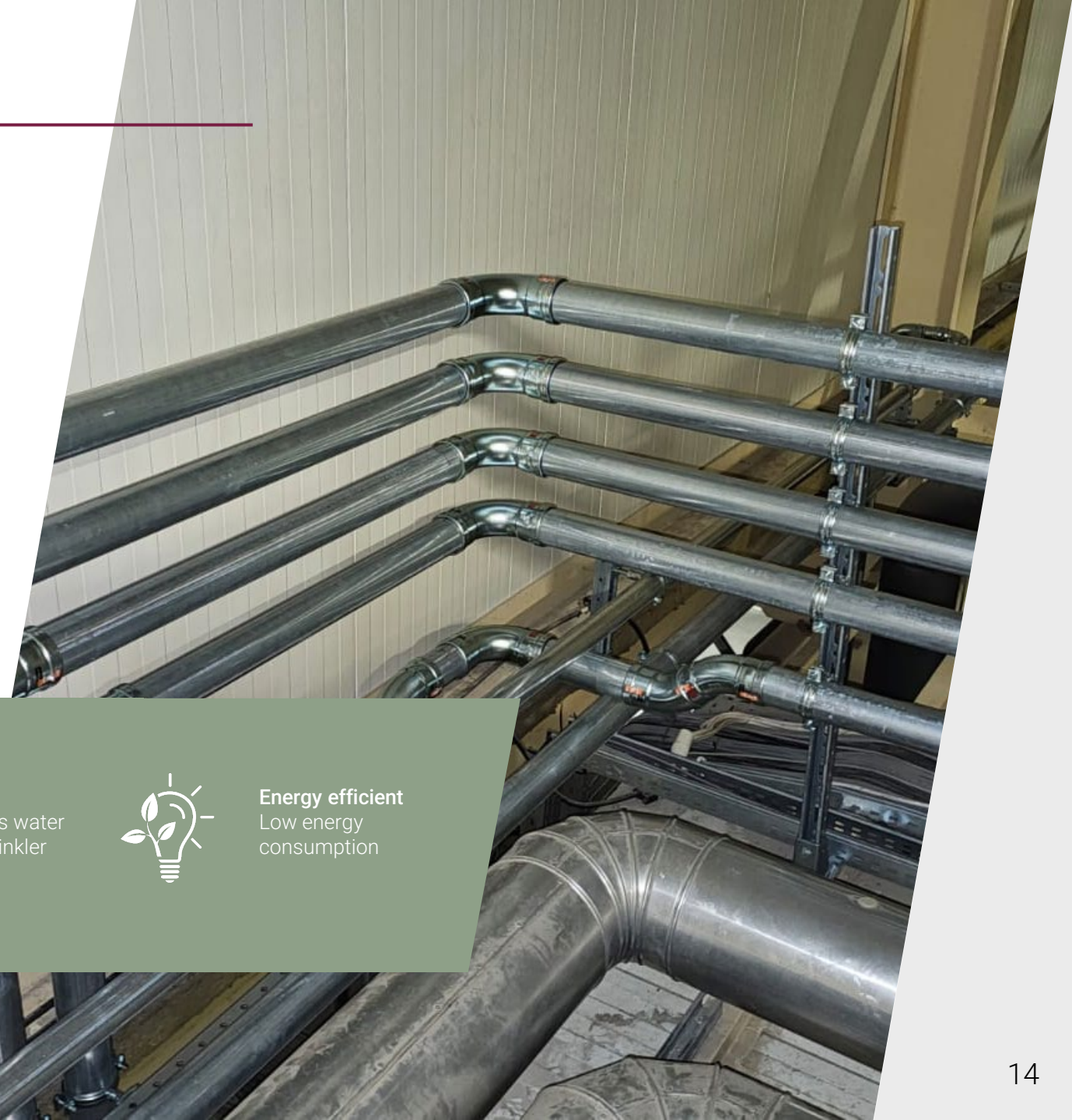
The VID FIREKILL system is the most environmentally friendly solution found on the market.

Sustainability 70% less CO-2e

Lower ceiling strenght requirements due to lower weight

Performance tested to achieve flexibility

Much smaller pipes easier to fit in in existing buildings during night/weekend producion brakes.



Sustainable solution
Reduced CO2 emissions by up to 70%
Sustainable fire safety design
Reduced production footprint

Water saving
Uses up to 80% less water than traditional sprinkler systems

Energy efficient
Low energy consumption

Machinery Generator rooms

FM APPROVED

as defined in FM5560

- Internal Combustion Engines
- Oil pumps, Fuel filters
- Generators, Combustion turbines
- Transformer vaults
- Gear boxes, Drive shafts, Lubricated skids
- Diesel engine driven generators

Low Pressure Water Mist

FM APPROVED

Nozzle type:
B1/BM1 Pendent - Kv 2,8

Nozzle type:
K6 Pendent - Kv 5,6

Nozzle type	: B1 / BM1	K6	K6	K6
Room volume	: 260 m3	320 m3	800m3	4610 m3
Min pressure at the nozzle	: 12,5 bar	10,5 bar	7,7 bar	7,7 bar
Max height	: 5,00 m	5,00 m	8,00 m	12,00 m
Max nozzle spacing	: 3,85 m	4,00 m	3,30 m	3,00 m
Design operational time	: 10 min.	21 min.	29 min.	83 min.
Water density	: 0,75 mm	1,1 mm	1,4 mm	1,7 mm

FM 5560 series of tests

A series involving spray fires and pool fires of which some are concealed around the premises of a engine Mock-up.

Tests are conducted with Diesel and Heptane as fuels.

All tests conducted with a ventilation opening of 4m².

Low Pressure spray angled 45 degrees on top of Mock-Up, accordingly to IMO MSC/Circ.1165

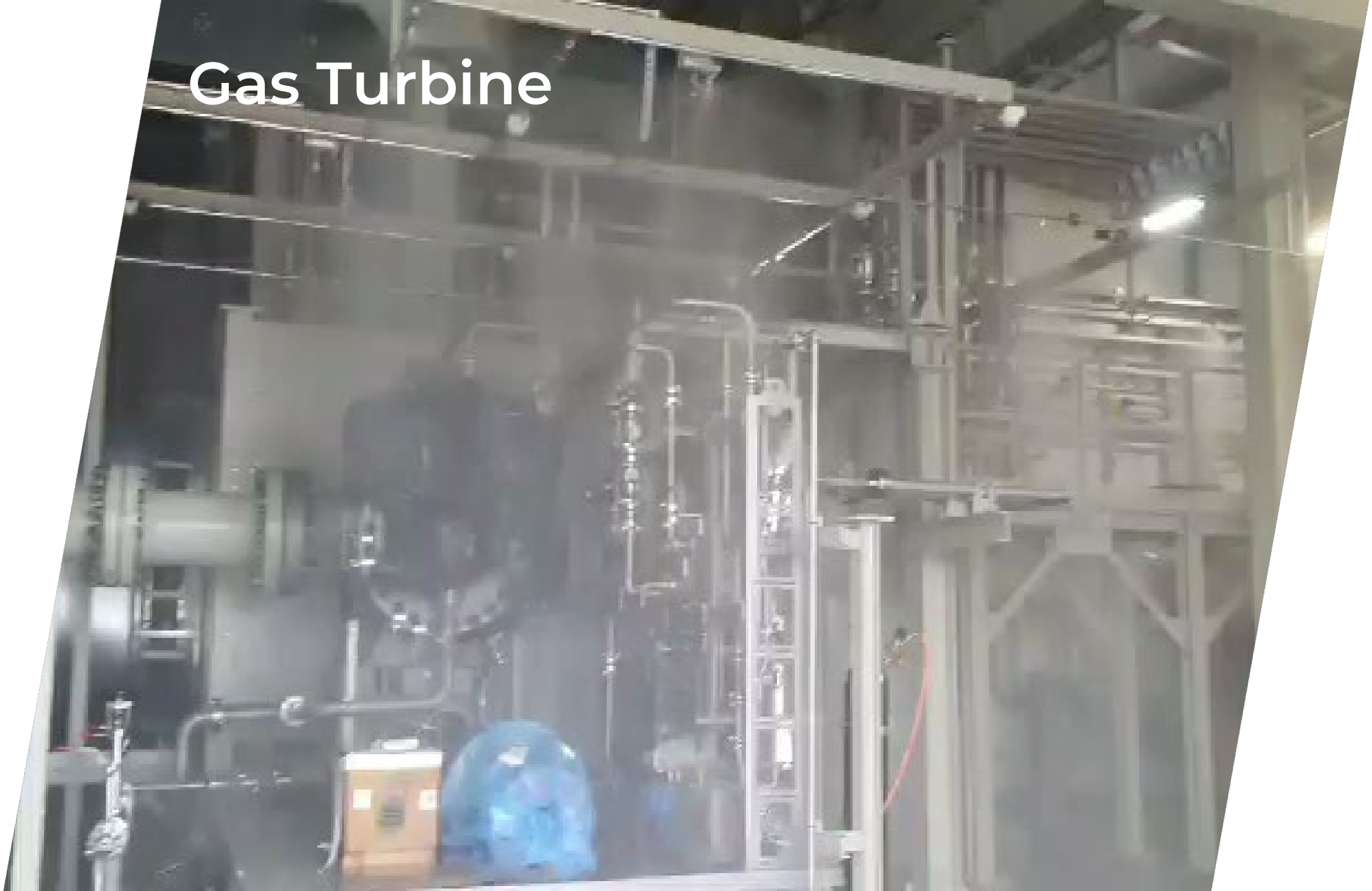
VID Fire-Kill model K6

8 bar water pressure

Spacing 4m

Test Enclosure 10 x 10 x 5m

Gas Turbine



Local application

as defined in FM5560

- Steam Turbine bearings
- Generator bearings
- Lubrication oil modules
- Gear modules
- Control oil modules
- Channel fires
- Pool fires

Local application water mist system is designed for extinguishing ignitable liquid hazards located in large enclosure.

Nozzle type: LAK-7 Pendent Horizontal Kv metric: 7,0

Application	Pool	Channel	Spray	Pool / Spray
Min Water Pressure	8 bar	8 bar	9,0 bar	10,0 bar
Nominal Flowrate at min pressure	19,80 lpm	19,80 lpm	21,00 lpm	22,00 lpm
Water Density at min. pressure	4,95 lpm/m2	9,90 lpm/m2	N/A	11,20 lpm/m2

FM 5560 Appendix I series of tests

A series involving spray fires, pool fires and combines spray and pool.

One of the pool fire includes an obstruction using an oil barrel in the centre.

Tests are conducted with Diesel as fuel.

Industrial High Risk
VID FIREKILL system

Nozzle type: K6 Kv 5,6
Pendent/horizontal
6 bars

- Loading stations such as shredder top parts.
- Local protection of volumes below machines such as shredder bottom parts.
- Local protection of high-risk areas on parts of a machine or a whole machine where the main risk is class A or class B fuels.
- Local protection of surrounding risks found next to mechanical machinery.

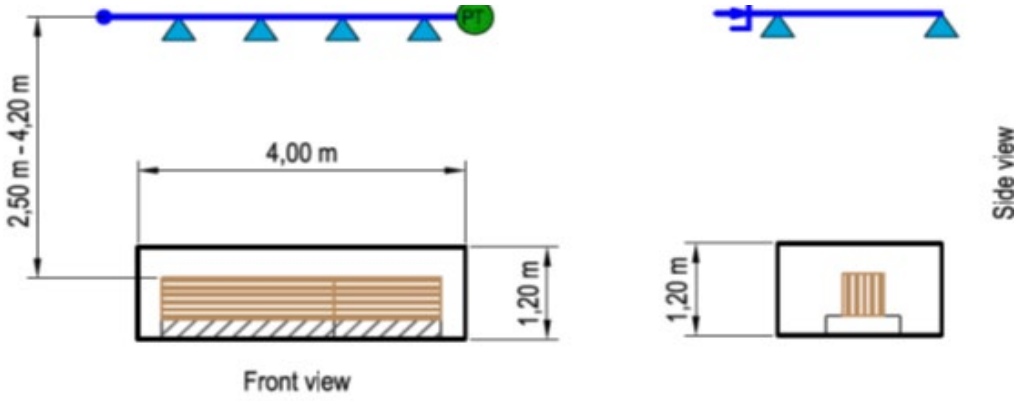
Industrial High Risk system

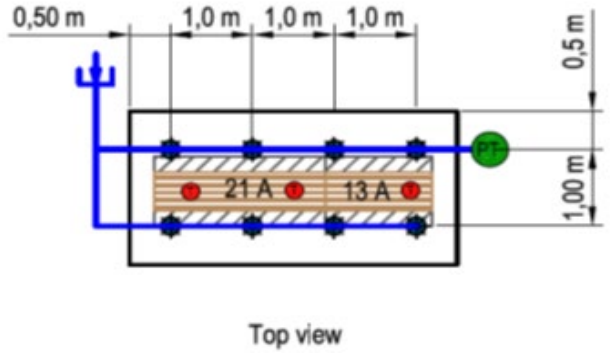
is a local application water mist system designed for variety of hazards.

The VID FIREKILL system in a blast:

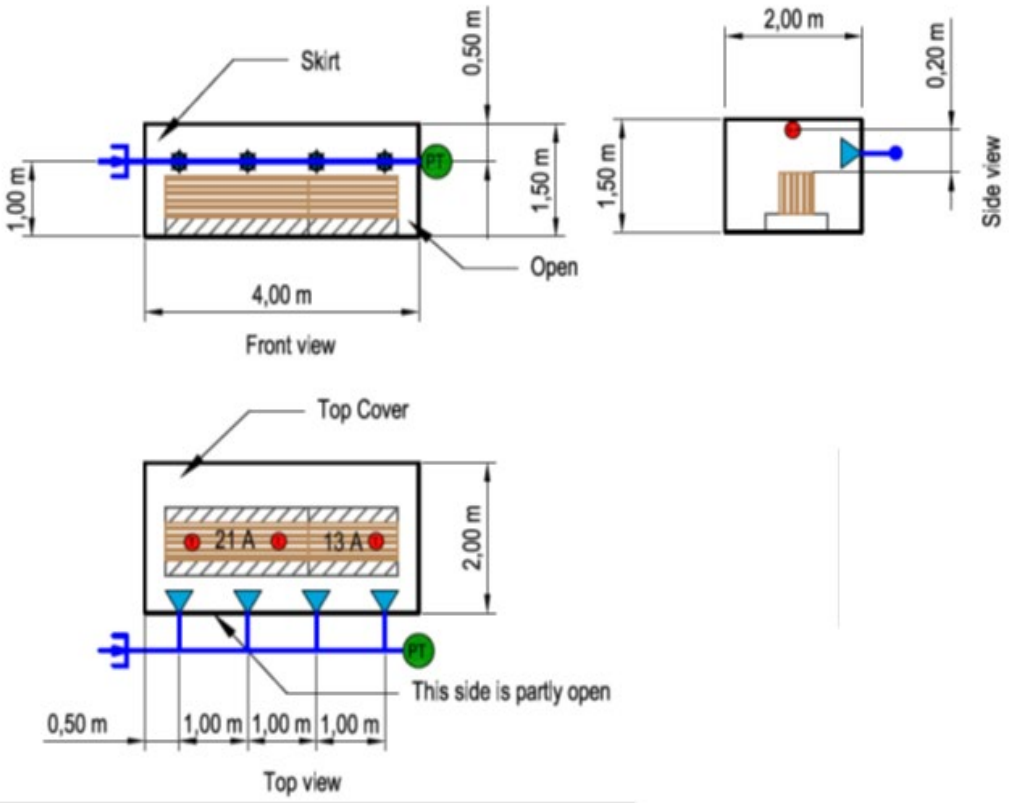
- FF methods
  - absorbs heat, reduces radiant heat
  - wetten the Surface
- Nozzles installed near to the object
- Operates only in a small part of enclosure
- SAS supply possible
- For risk level from medium to very high acc. to EN ISO 19353:2016

Loading stations such as shredder top parts





Local protection of volumes below machines such as shredder bottom parts.



Fleet 2V system

with BM1 nozzles and N-pipes

- Enclosures not higher than 15m where wood is stored in piles up to 8m.

- Simmilar risks with class A fires in larger enclosures

VID FIREKILL Fleet 2V system

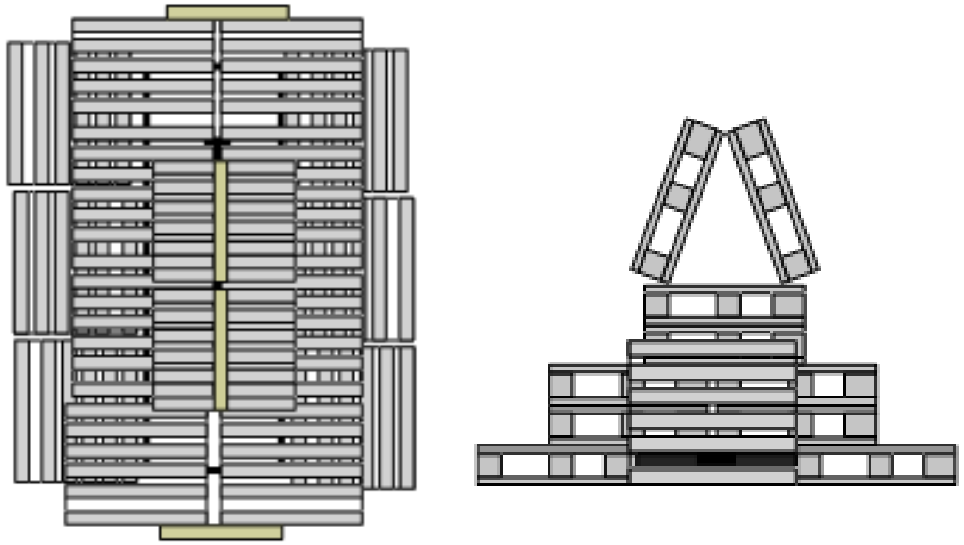
for wood fire risk in large enclosures – Biomass storage

The VID FIREKILL system in a blast:

- FF methods
  - absorbs heat, reduces radiant heat
  - wetten the surface
  - reduce oxygen level in the vinicity of fire
- Nozzles installed on the ceiling
- Total floding system
- Up to 15m height enclosures

Side Pallet Set-Up

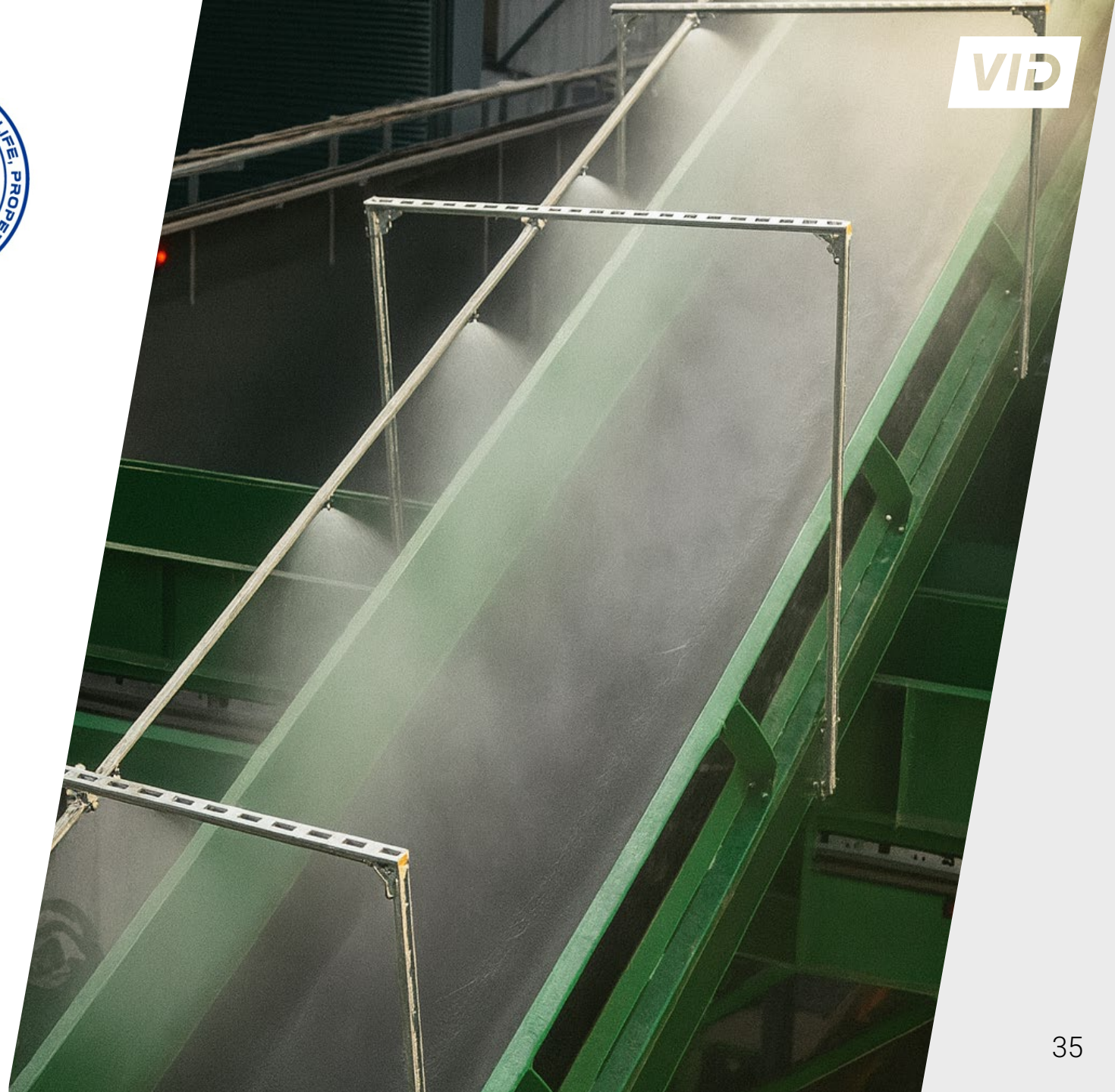
- 32 wooden euro pallets,
- 1M x 3M heptane pool.



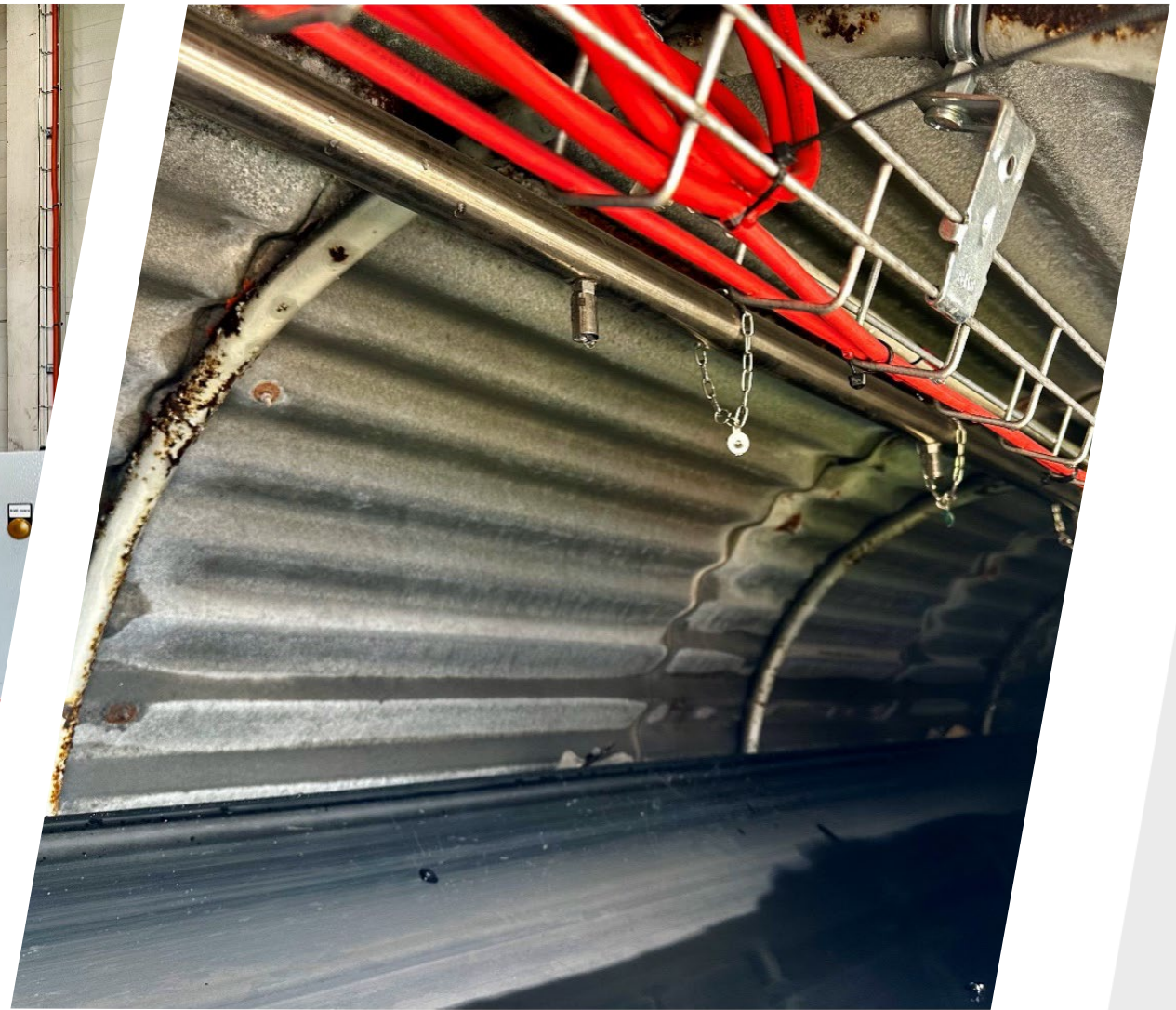
VID FIREKILLI C 1,5 and 3V C 2 system conveyors

The VID FIREKILL system in a blast:

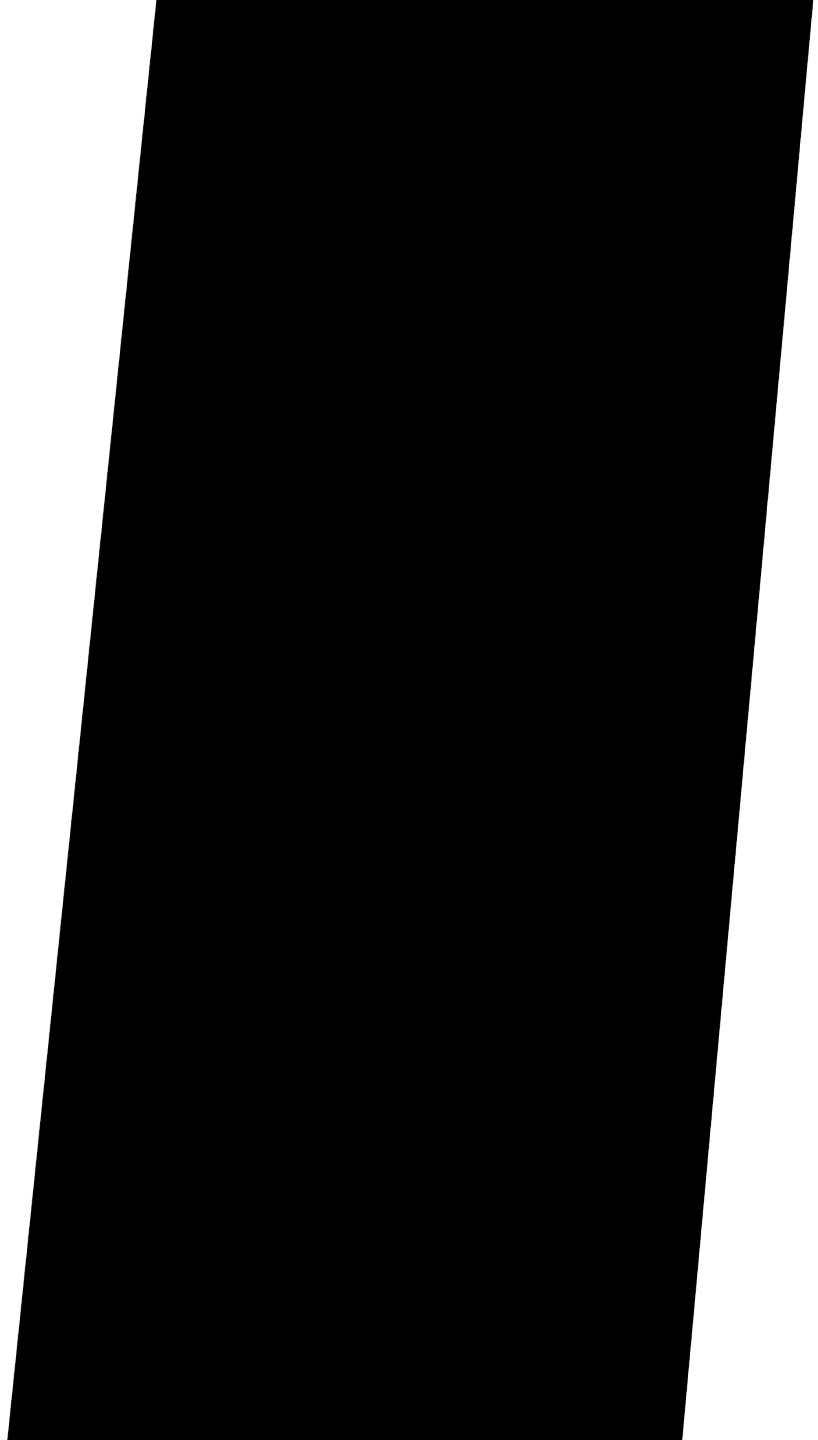
- FF methods
  - absorbs heat, reduces radiant heat
  - wetten the surface
  - blow the fire out
- Nozzles installed above the conveyor
- Conveyor width up to 2,5m with one row
- No lenght limitations



System installed



System in operation

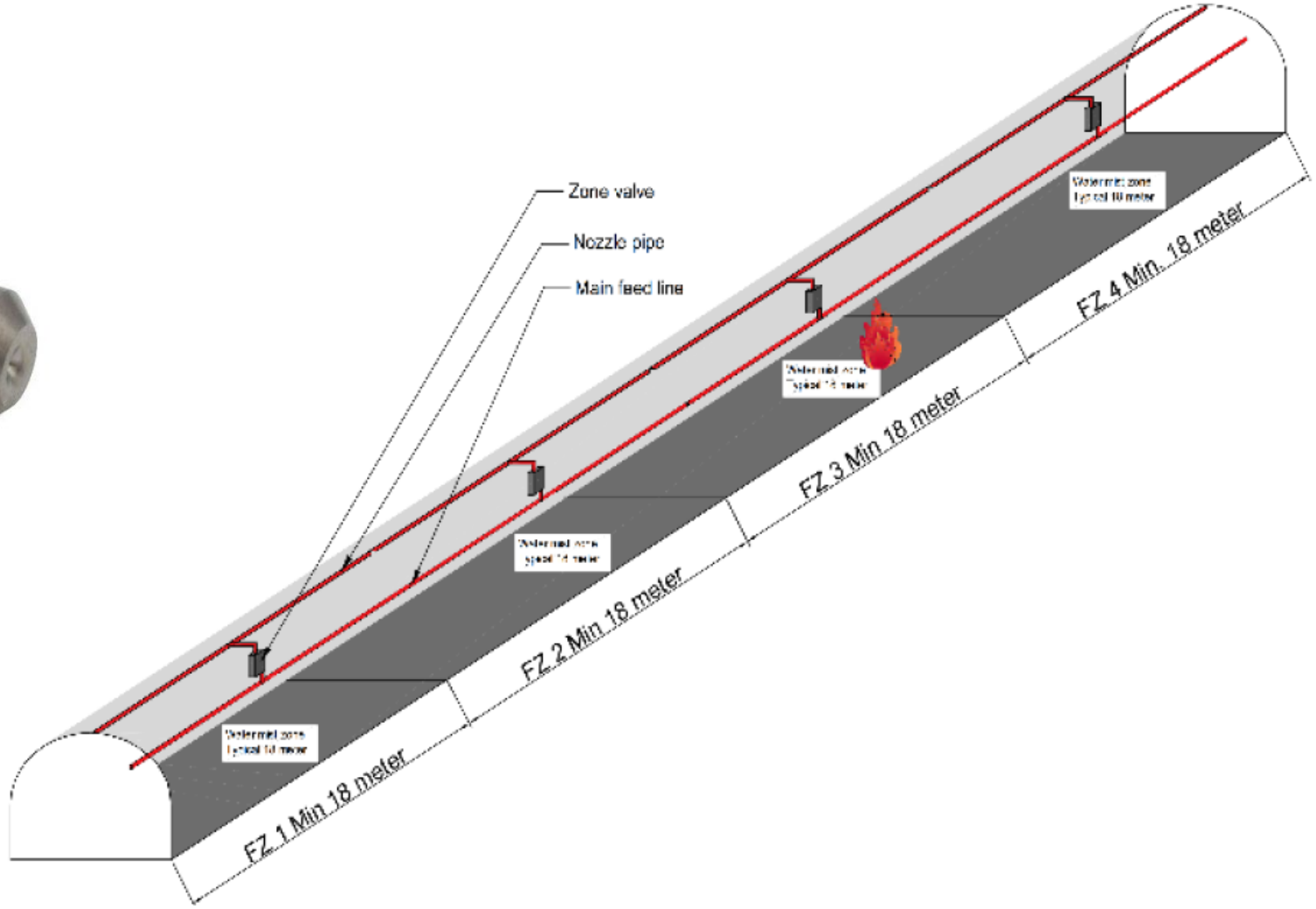


Cable tunnels based on VdS protocole.

The VID FIREKILL system in a blast:

- FF methods
  - absorbs heat, reduces radiant heat
  - wetten the Surface
  - Oxygen reduction in zone operation
- Nozzles installed near to the object
- Operates only in a small part of enclosure
- Operation method: control and supress

Cable tunnels



TRAFO up to 132kV based on DFL protocole

The VID FIREKILL system in a blast:

- FF methods

  absorbs heat, reduces radiant heat

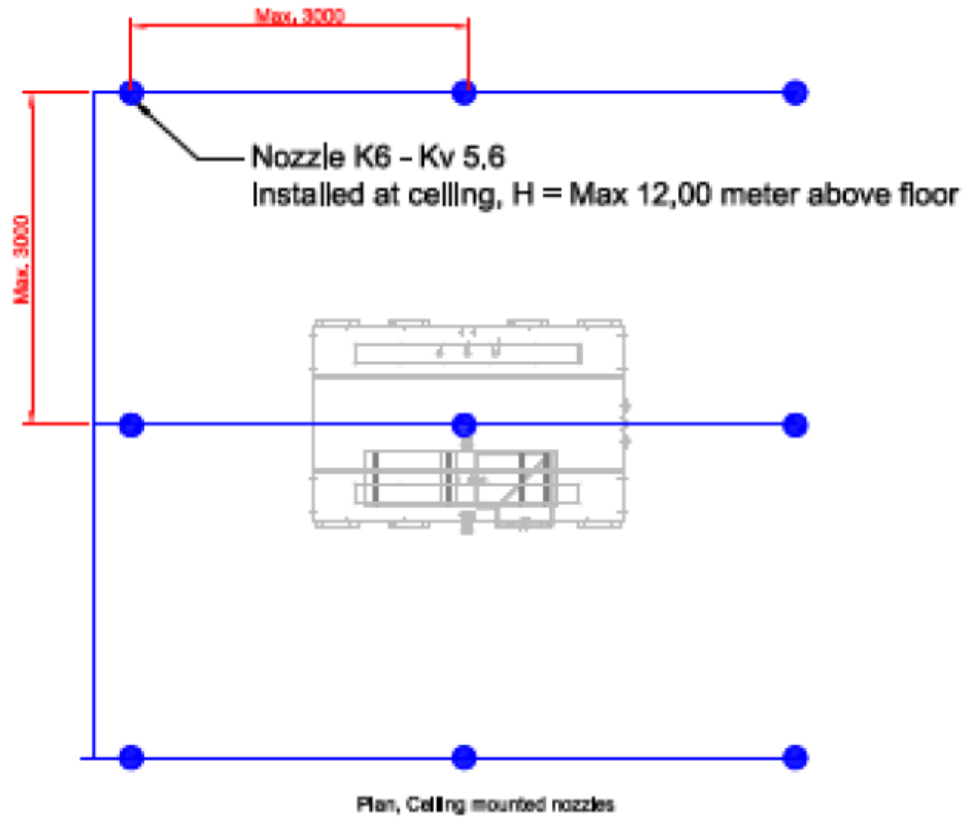
  blowing the fire

- Nozzles installed near to the object
- Operates only in a small part of enclosure
- Operation method: extinguish

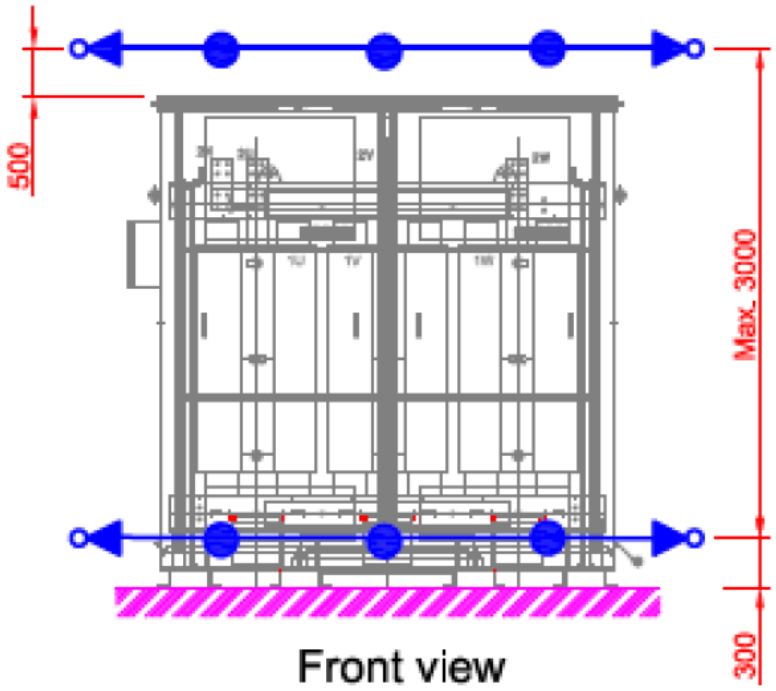
TRAFO up to 132kV based on DFL protocole. – test set

The fire test room was provided with a 4m x 4m door opening for air ventilation during the fires, and a total of two ventilation fans where used to create minimum 4 m/s ventilation rate when measured at the fire test mock-up.

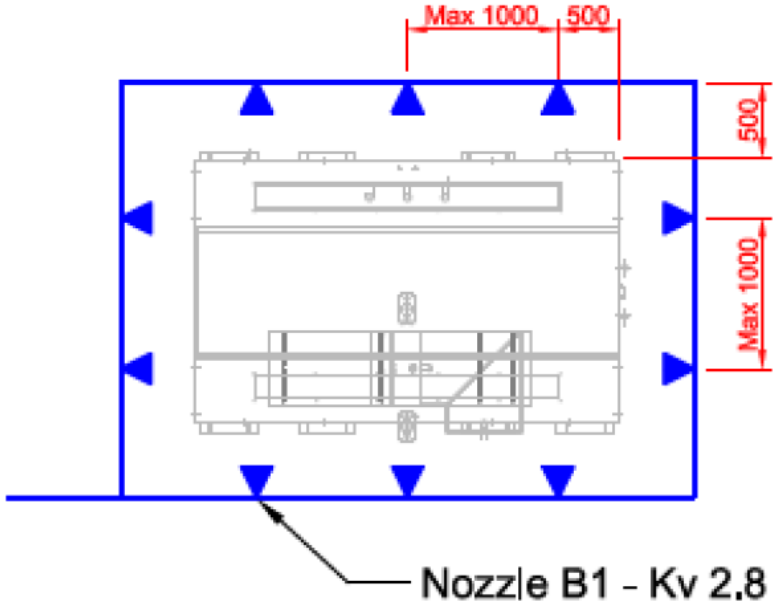
TRAFO up to 132kV based on DFL protocole – design guide



TRAFO up to 132kV based on DFL protocole – design guide



Front view



Plan

TRAFO up to 132kV based on DFL protocole - spray

Model K6 and Model B1 nozzle spray only

Model B1 nozzle spray only

Li-ion batteries in the Industry applying FM DS 3-26

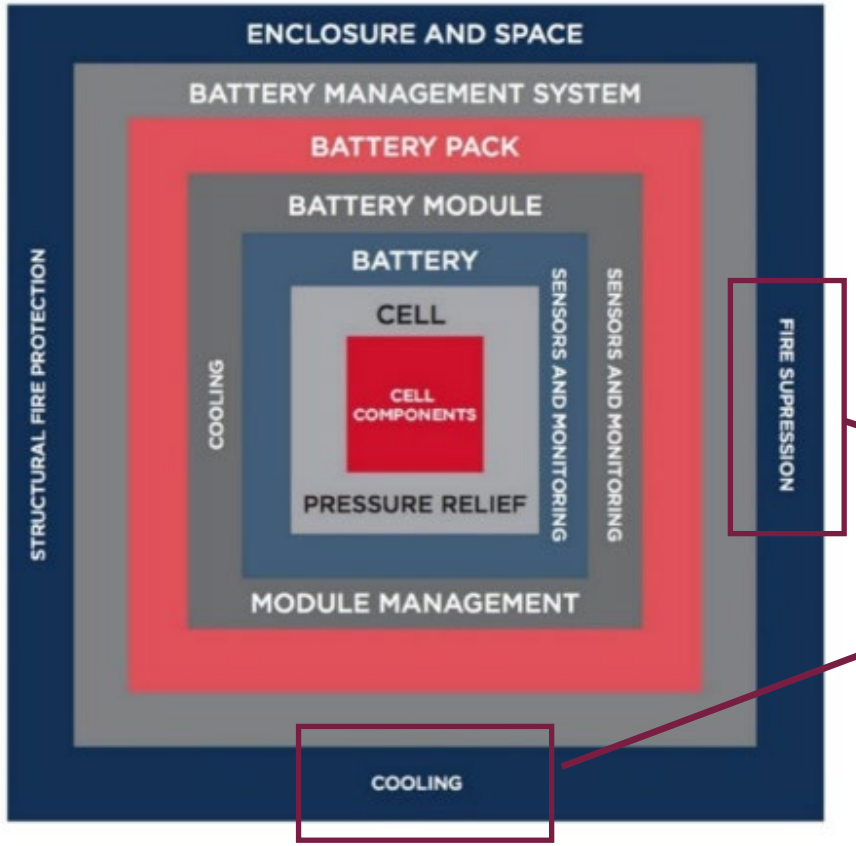
Some facilities are having installed in separate UPS rooms or containers providing the necessary power backup

3.3 Lithium-Ion Batteries
Lithium-ion battery protection in nonstorage occupancies is based on maintaining a hazard less than or equal to that of incidental storage. This is accomplished by limiting the footprint and height of the allowable storage area and providing separation from surrounding combustibles. (…)
The limitations for incidental storage of lithium-ion batteries are based on this knowledge to limit the fire to a known area, to promote cooling of the batteries and packaging from the sprinkler protection, and to limit the overall hazard.

2.3.2.5 Treat the storage and production of lithium-ion batteries in sprinklered HC-3 occupancies as incidental if the following criteria are met:

A. Limit storage area to no more than 200 ft2 (20 m2).
B. Limit storage height to 6 ft (1.8 m).
C. Separate multiple storage areas by aisles not less than 10 ft (3.0 m) wide.
D. Maintain a battery state of charge ≤ 60%.

Fire protection techniques BESS



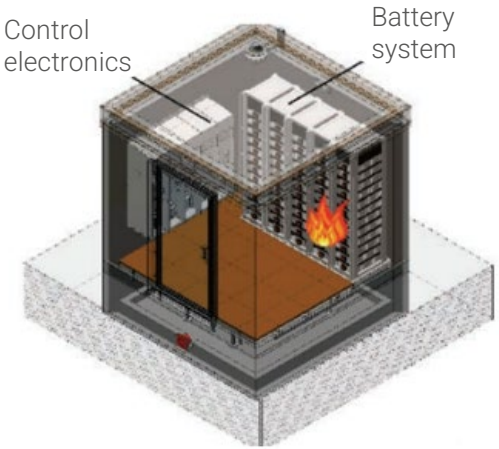
Fire protection measures are considered at the cell, battery, module, pack, system and enclosure levels. The fire protection plan must take into account hazards from outside the battery system and compartment producing more complications to the design of systems.

Enclosed figure depicts various levels of fire protection from cell components to system and compartment designs.

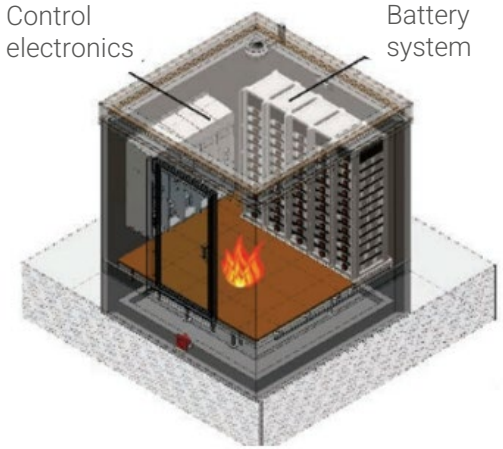
The job for the water mist fire suppression system: cooling & fire suppression

Fire scenarios

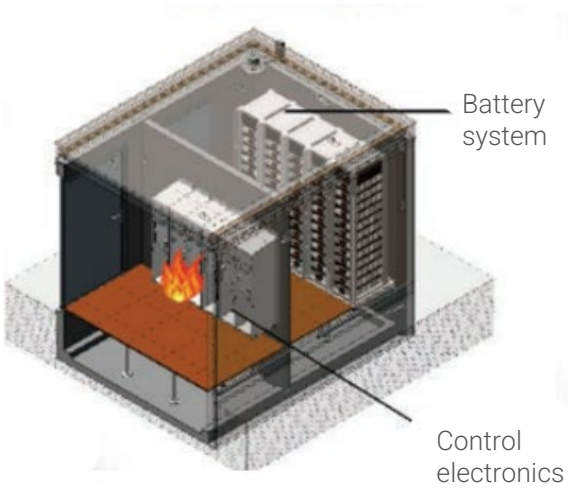
Fire scenarios defined by one ESS enclosure manufacturer.



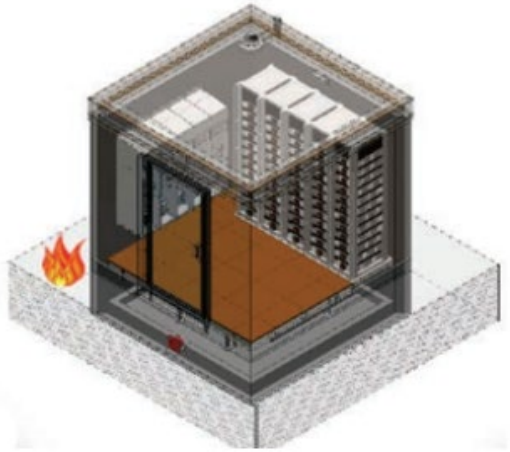
Scenario 1: Fire inside a storage system at cell level



Scenario 2: Fire inside the enclosure where it's impossible to determine with certainty whether the fire is in the Li-ion batteries or the power electronics



Scenario 3: Fire inside the enclosure where there is a structural fire separator from the battery system

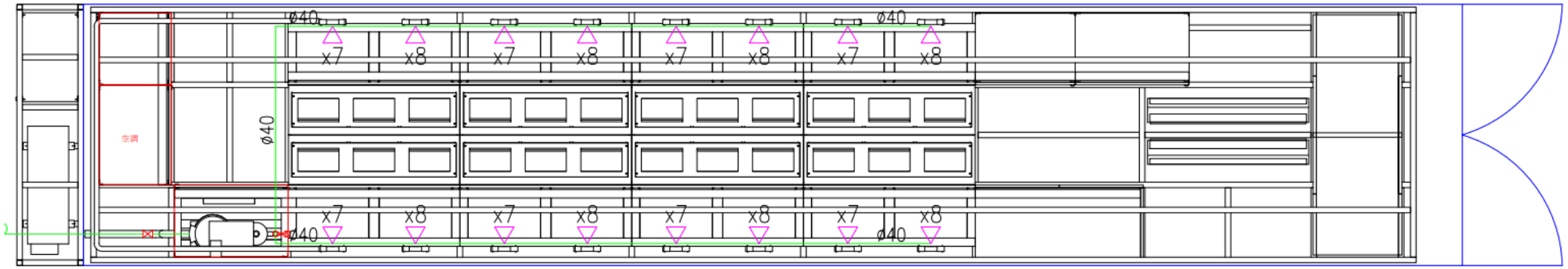


Scenario 4: External fire

Case study Energy storage system

Each enclosure contained 16 racks, 8 racks on each side of the enclosure. Each rack has space for 8 or 7 battery modules. Totally 120 battery modules can be fitted into the rack system.

Additionally there is space for installing control electronic cabinets as well as the pump unit for the suppression system.



From cell to large scale ESS

Main water feed line in the ceiling with pipe branches and F1 nozzles behind each battery rack ensuring 100% coverage of the fire hazard.

From cell to large scale ESS

Pump unit installed in a separate enclosed space.

Two nozzles installed in the ceiling for protection of the entrance of the enclosure.

ESS - Cold discharge demonstration

Thank you

www.vidfirekill.com

VID FIREKILL®
LOW PRESSURE WATERMIST