ENGINEERING
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Fire Protection of Data Centres

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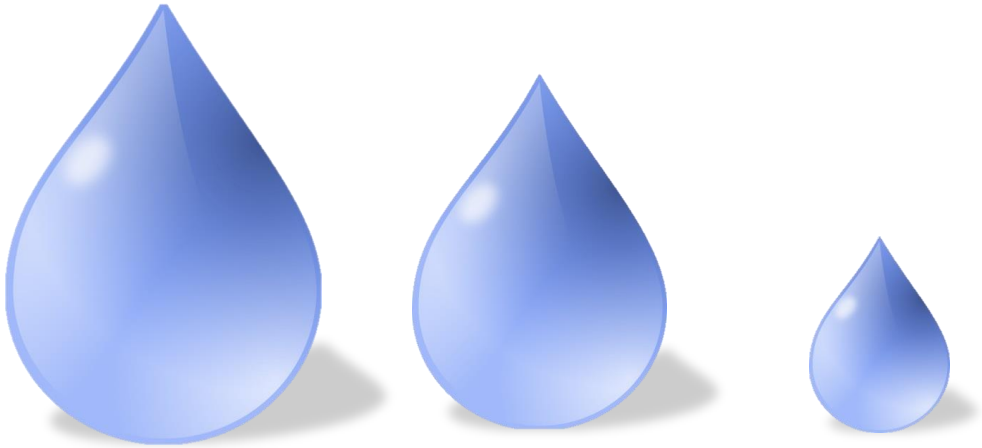
Date
2024 For Taanfire

Pressure **definitions**



12.1 bar

34.5 bar

120 bar

0 bar

Low-pressure

Medium pressure

High-pressure

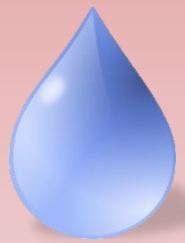
Characteristics of droplet sizes

Sprinkler

1000-1200 µm

Low-pressure water mist

200-700 µm



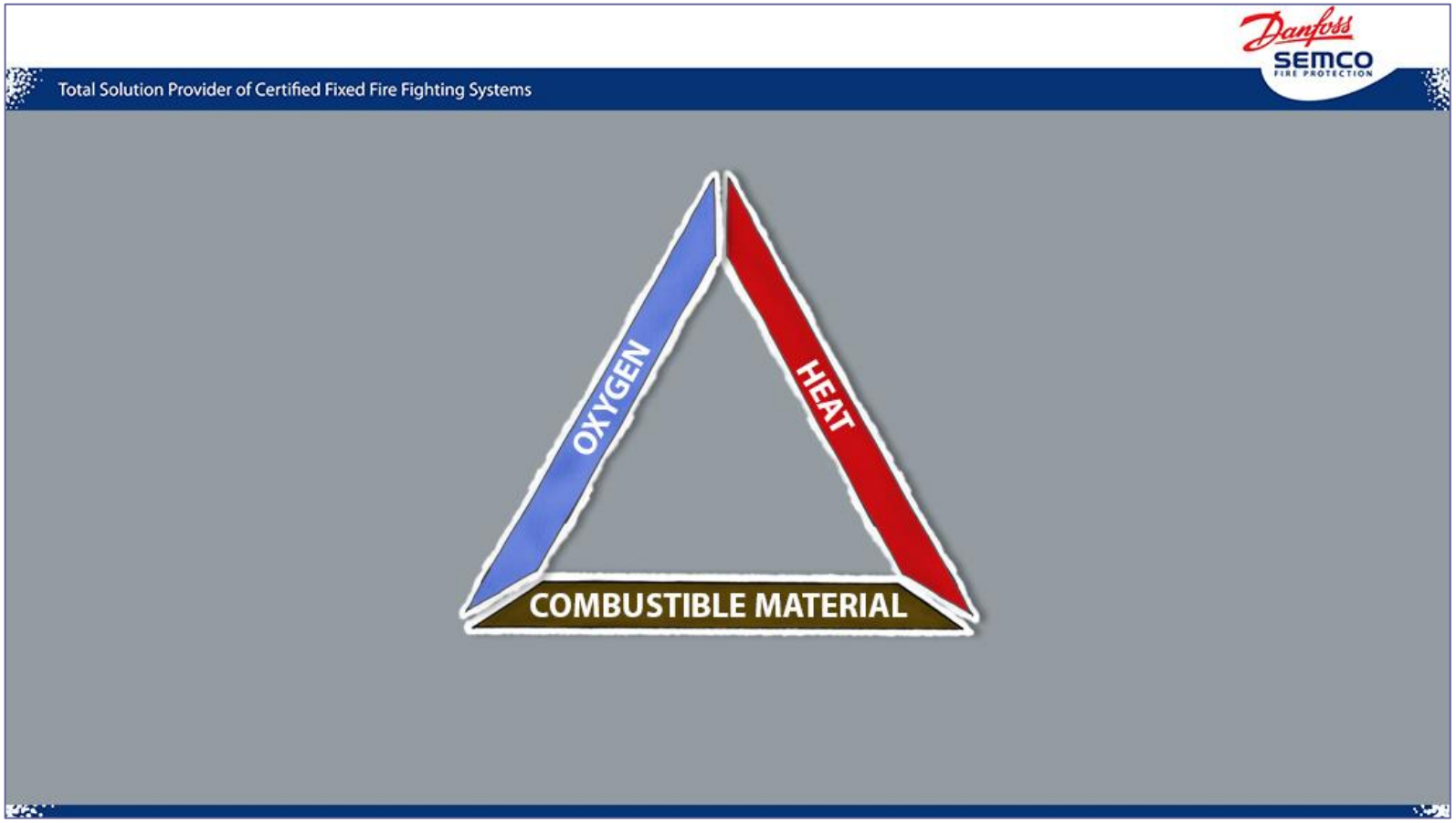
High-pressure water mist

40-100 µm

Which solution covers which fire class…?

	Colours						
Types		Fires involving wood, paper, textiles etc.	Fires involving flammable liquids, petrols & spirits etc.	Fires involving flammable gases, butane, propane etc.	Fires involving burning metals, e.g. magnesium	Fires involving electrical equipment	fires involving cooking oils and fats
Water Mist		✓	✓	✓	✗	✓	✓
Water		✓	✗	✗	✗	✗	✗
Foam		✓	✓	✗	✗	✗	✗
Dry Powder		✓	✓	✓	✗	✓	✗
M28 / L2		✗	✗	✗	✓	✗	✗
Co2		✗	✓	✗	✗	✓	✗
Wet Chemical		✓	✗	✗	✗	✗	✓

SEM-SAFE® in short



SEM-SAFE® in short- **unique components**

Click to start video

- Compact pump
- Highly-corrosion proof valves
- Unique nozzle design

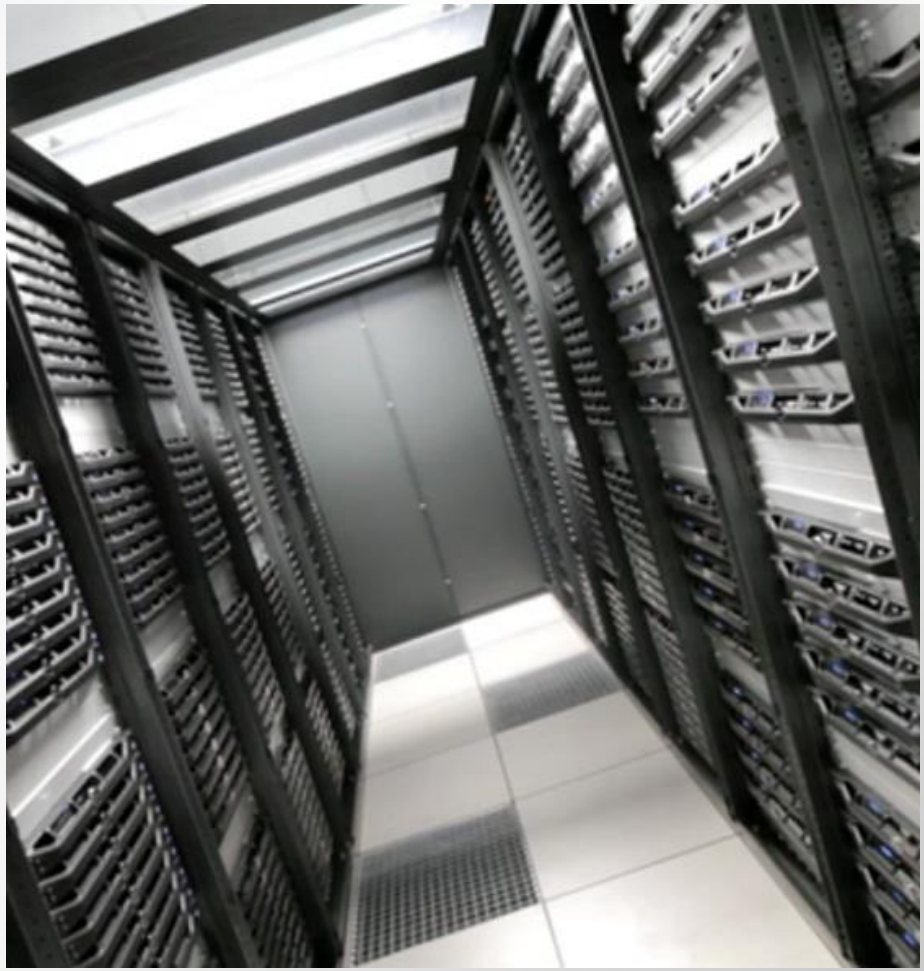
Click to start video

SEM-SAFE® The **fire fighting solution** for any data centre

Need a fire fighting system that:

- Allows you to keep your data centre running while suppressing a fire?
- Provides instant cooling in the fire zone?
- Allows you to keep ventilation running?
- Has no need for shutting fire dampers?
- Permits you to keep doors to protected space open?
- Is not harmful to people?

SEM-SAFE® is up for the challenge



Benefits of SEM-SAFE®

Tackles fire swiftly and efficiently

- No need to seal off and/or evacuate the area
- Immediately cools the fire
- Harmless to electrical equipment
- No over-pressurization of the fire-affected area when the SEM-SAFE® system is activated

Money-saving solution

- Fewer nozzles required and only one system for all applications=>installation cost is reduced
- The pumps are lubricated by water=> virtually maintenance free
- Water droplets evaporate immediately=>minimal water damage=>reduced operational down-time

Data Centre fire protection

Specific for data centres	Objective HPWM	Principle of protection
• **One could consider three major areas of protection of the Data Room/POD:** ❑ Floor void ❑ Ceiling void ❑ Room	• **Data Rooms :** ❑ Suppress and control the fire ❑ Minimum duration of the system 30 minutes • **Technical Rooms :** ❑ Suppress and control the fire ❑ Minimum duration of the system 30 minutes • **Generators :** ❑ Extinguish a fire and cool the surrounding machinery ❑ Minimum duration of the system 20 minutes	• **Public Spaces :** ❑ Offices ❑ Corridors • **Data Rooms :** ❑ Pre-action system with a smoke detection system. • **Technical Rooms :** ❑ Wet or pre-action system with a smoke detection system. • **Generators :** ❑ Total flooding or local application system with a flame detection and heat detection

Why is SEM-SAFE® so **efficient** in data centre?

- ✓ **Minimal downtime:**

- Water damage is minimal
- Data centre can function even while extinguishing the fire

- ✓ **Safety:**

- No threat to human safety
- Double knock pre-action system

- ✓ **Reliability:**

- Investments in R&D and approvals are made, in order to ensure efficiency and reliability

- ✓ **Scalable:**

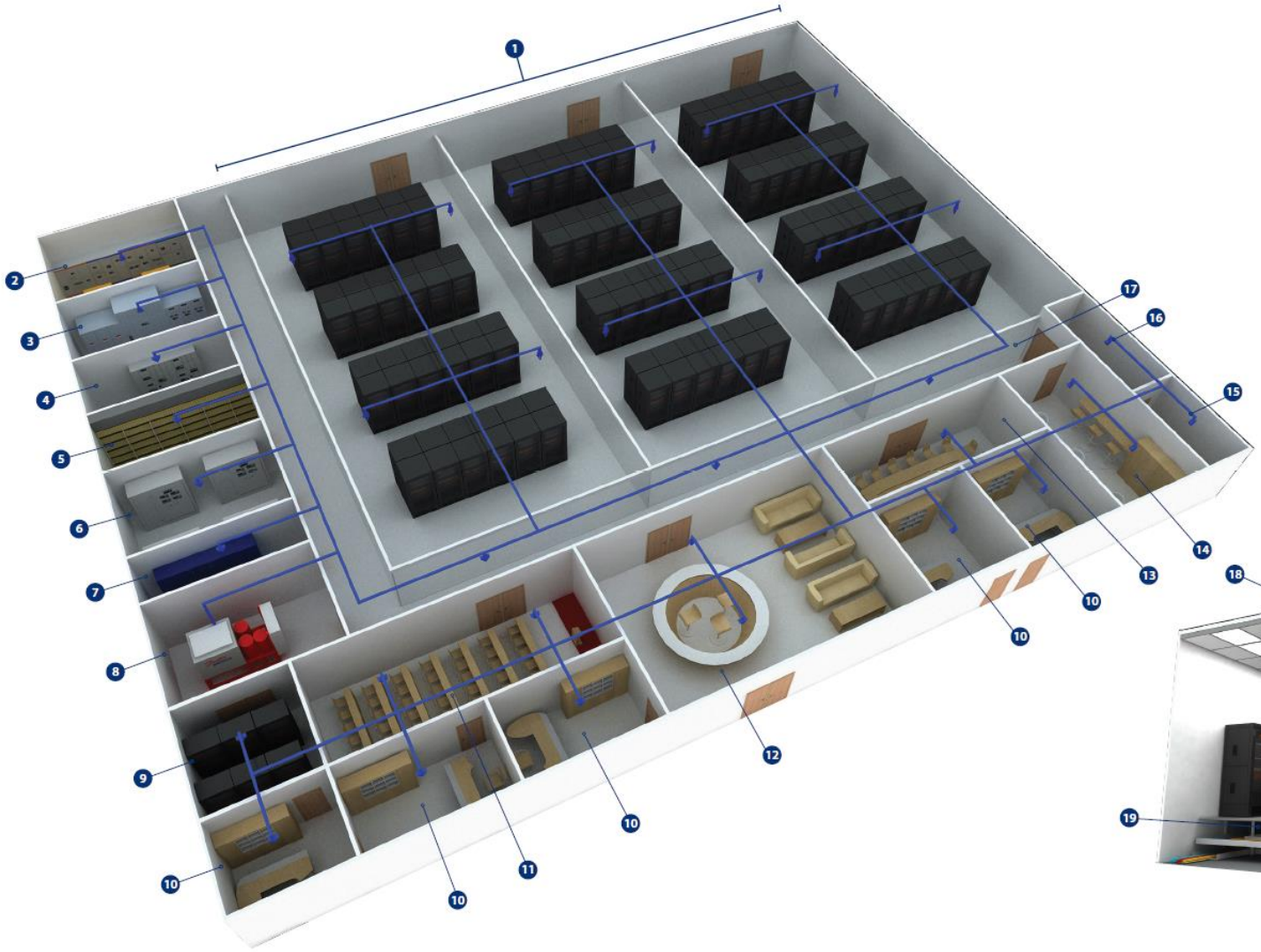
- Compact, modular, small footprint
- Easy to extend to cover more sections

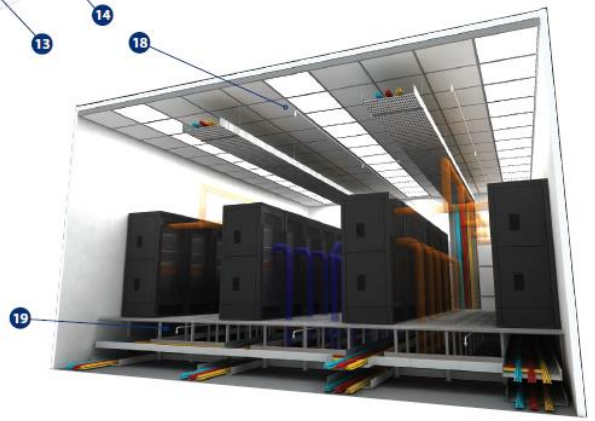
- ✓ **Simplicity**

- No need to shut-off ventilation before releasing the system

Danfoss Semco provides fire fighting solutions for areas such as:

1. DATA HALL
2. TRANSFORMER ROOM
3. GENERATOR SPACE
4. SWITCHGEAR ROOM
5. BATTERY ROOM
6. UPS ROOM
7. TECHNICAL ROOM
8. WATER MIST PUMP ROOM
9. DATA CENTRE ROOM
10. OFFICES
11. AUDITORIUM
12. RECEPTION AREA
13. CONFERENCE ROOM
14. CANTEEN
15. KITCHEN
16. STORAGE ROOM
17. CORRIDOR
18. ABOVE FLOOR APPLICATION
19. BELOW FLOOR APPLICATION





Cross section – a zoom on a part of the data hall

Protect all areas in a data centre with SEM-SAFE®

Danfoss Semco has a complete portfolio of FM tested nozzles to protect any area in the data centre

- FM closed nozzle for data processing equipment rooms/halls above raised floor
- FM closed nozzle for data processing equipment rooms/halls below raised floor
- FM closed nozzle for adjacent spaces in a data centre, such as offices and corridors
- FM open nozzle for machinery spaces, such as transformers and generators

FM tests conclusions

Above floor
All fires extinguished
Maximum two nozzles activated
Two rated temperature glass bulb approved : 57°C / 68°C

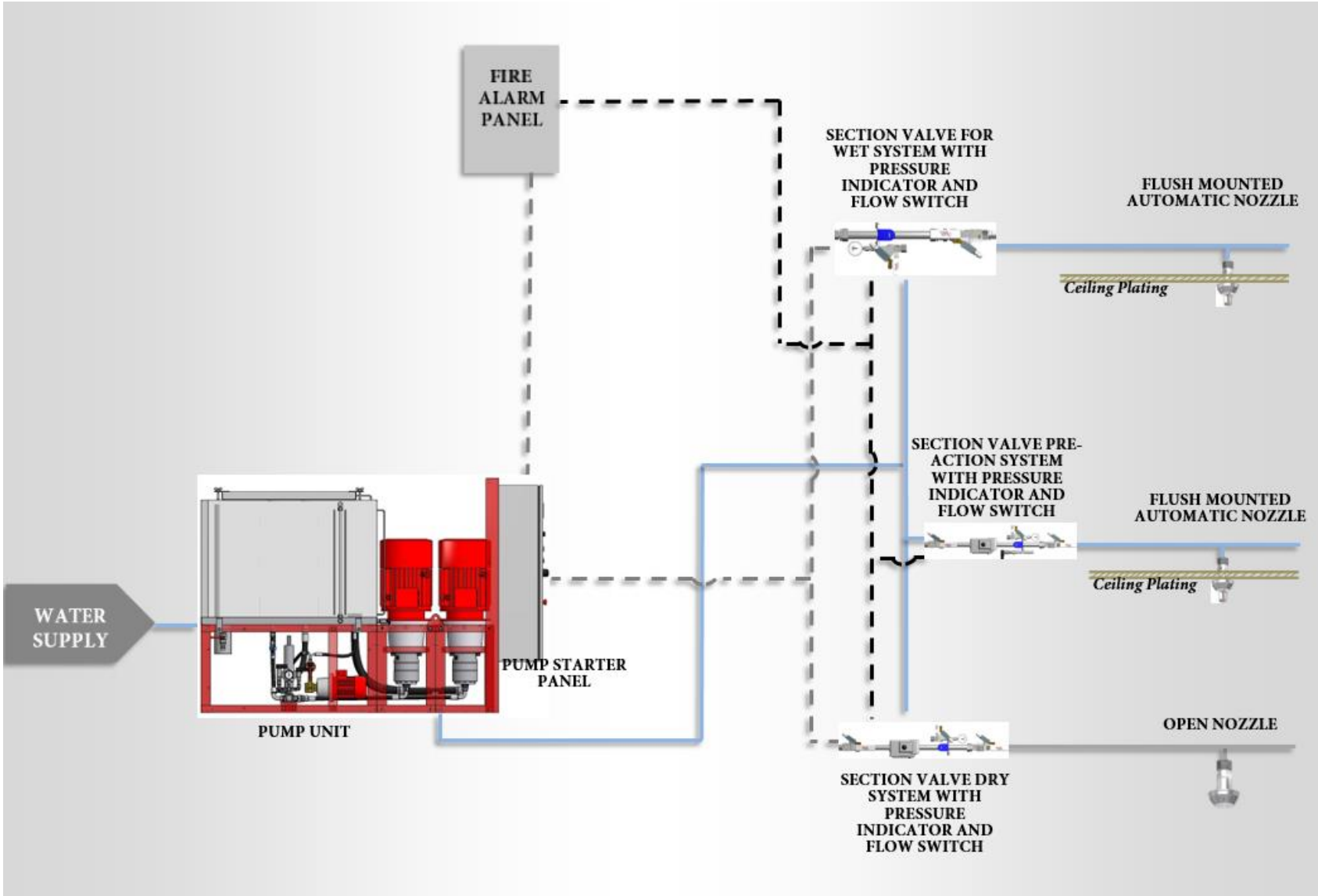
Below floor
All fires extinguished
Maximum two nozzles activated
Two rated temperature glass bulb approved : 57°C / 68°C

FM tests conclusions

FM Machinery spaces FM5560 E With CN-Nozzle, K-Factor 4,44
All fires extinguished
Maximum 8 m. height
Open nozzle with minimum 66 bar pressure

FM Machnery spaces FM5560 E With CM-Nozzle, K-Factor 3,65
All fires extinguished
Maximum 6 m. height
Open nozzle with minimum 60 bar pressure

Principle **diagram**



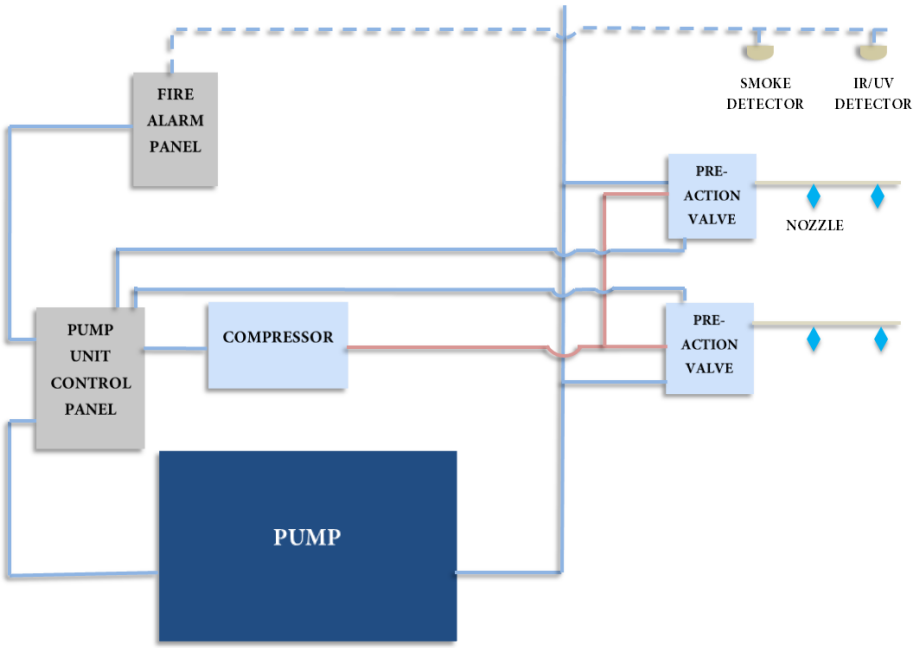
- Offices
- Corridors

- Data Rooms single or double interlock preaction system

- Machinery spaces Total flooding or local application system with a detection system

Added safety for your data centre

- Double knock pre-action system
- Piping is wet from pump unit up to the section valve, all pipe work down stream of the section valve is dry and system integrity is monitored by air.
- How does it work:
  - Fire is detected by the fire alarm system:
    - One detector operates alarm only
    - Two detectors operate:
      - Section valve opens
      - Pumps start and flood pipework
      - Manual intervention can still take place!



Data hall overview

Expected fire risks

- Digital Equipment
- Wire and Cable Containment
- HVAC Equipment
- Cable trays

Challenges for HPWM[1]

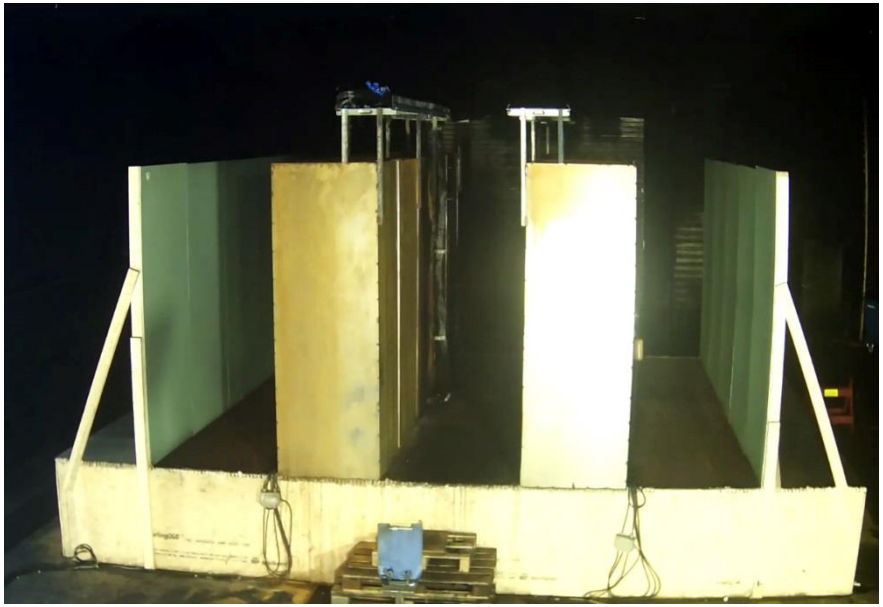
- Keep forced ventilation during discharge
- Pre-action : water delivery time delay
- Extinguish fires

[1]. HPWM = High-Pressure Water Mist

FM test above floor

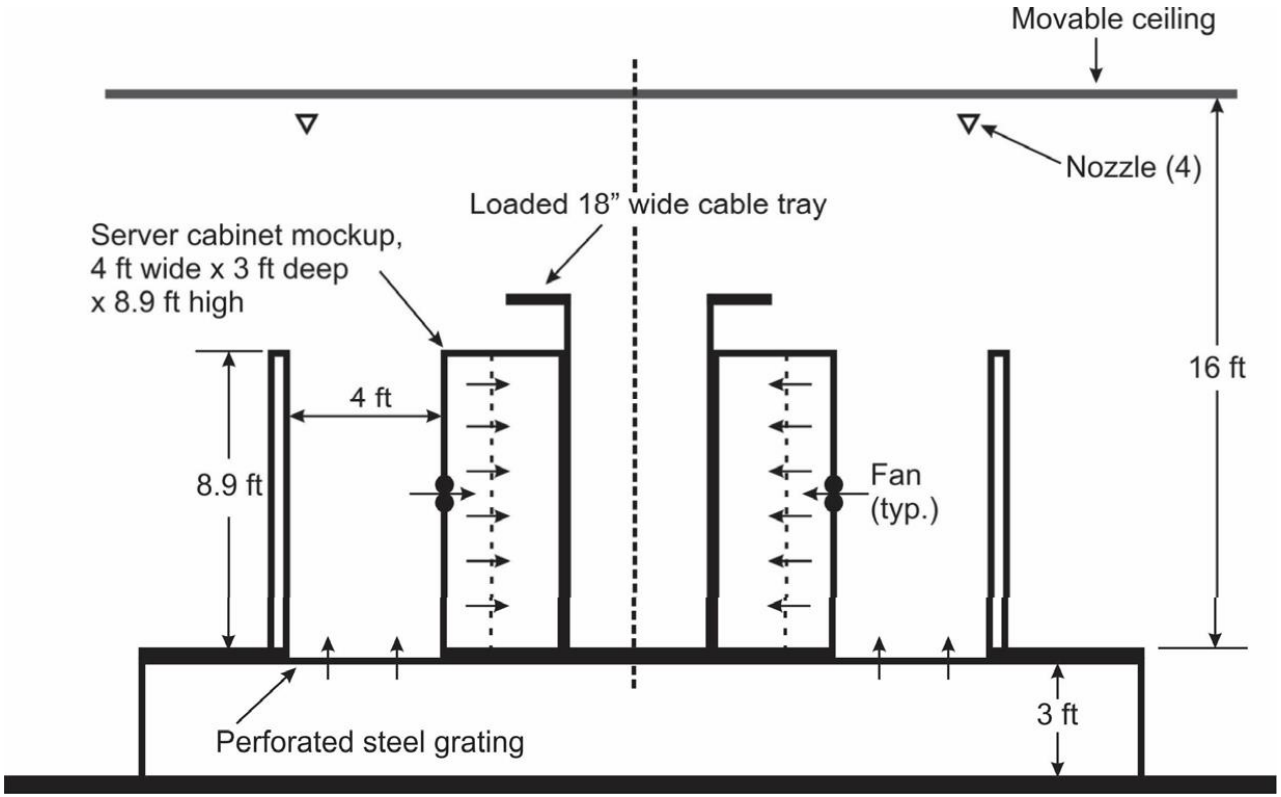
Acceptance criteria:

- Fire does not reach end of cable tray
- Fires extinguished in 30 minutes
- Steel angle at ceiling: not to exceed 538°C



FM test above floor

Section view

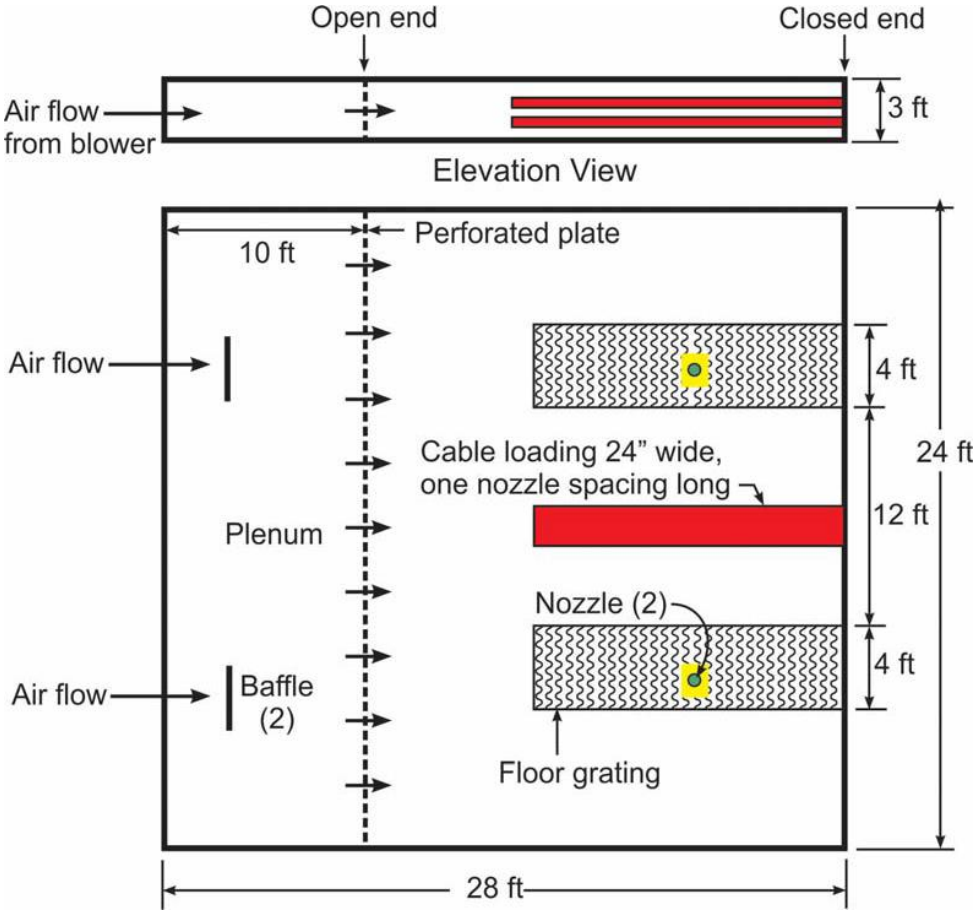


FM test below floor

Acceptance criteria:

- Fire does not reach end of cable tray
- Fires extinguished in 30 minutes
- Steel angle at ceiling: not to exceed 538°C

FM test below floor



Video test FM data halls above floor

https://www.youtube.com/watch?v=OyOYyJxidLM&t=41s

Video test FM data halls blow floor

https://www.youtube.com/watch?v=w5UVsRhhJDA

Complete nozzle portfolio tested according to FM 5560

- Closed nozzles for data processing equipment rooms/halls above raised floor
- Closed nozzles for data processing equipment rooms/halls below raised floor
- Closed nozzles for adjacent spaces in a data centre
- Open nozzle for machinery spaces

SEM-SAFE® **benefits**

- Keep the ventilation running during discharge ➔ time and money saving
- No risk of false discharge with pre action system ➔ added safety
- Save up to 59% water storage compared to low pressure systems➔ space saving
- The only solution approved for two cable trays protection below floor ➔ protect any area in the data centre with SEM-SAFE®
- Local protection ➔ activation only in the areas where fire is detected
- No expensive refill costs in comparison with gas systems ➔ money saving
- Compact pumps ➔ space saving compared to gas systems

Key reference list

Fire Risk	Protected Area	Project Name	Partner	Country	Year
OH3	Data centre	SONATECH DGA CF15-0041	SONATECH	France	2015
OH1	Beijing BaiDu Data Center Phase 1	NDN-2015-004-EUR. Beijing BaiDu Data Center Phase 1	Nan Di Noer International	China	2015
OH1	Data halls, Floor Voids, Technical Rooms	ATOS DATACENTER HURK	Unica	Holland	2015
OH1	Data halls, Floor Voids, Technical Rooms	IBO Ecocenter	Profog S.A	France	2014
OH1	Data halls	Tour esplanande	Profog S.A	France	2014
LA	Emergency Generator i Data Center	Corromatic	Dafo Brand AB	Sweden	2014
OH1/TF	Emergency Generator i Data Center, Technical Rooms	Telecity Aubervilliers	DEF/PROFOG	France	2014
LA	Emergency Generator i Data Center	IntrXion	Dafo Brand AB	Sweden	2014
OH1	Data Hall	DATA CENTER (PYRONOVA S.R.O.)	PYRONOVA S.R.O.	Slovakia	2014
TF	Emergency Generator i Data Center, Technical Rooms	Telecity Aubervilliers	DEF/PROFOG	France	2014
OH1	Emergency Generator i Data Center, Technical Rooms	Telecity Aubervilliers	DEF/PROFOG	France	2014
LA	Nødstrømsgenerator I Data Center	P1005 IntroXion	Dafo Brand AB	Sweden	2014
OH1	Data hall	DATA CENTER (PYRONOVA S.R.O.)	PYRONOVA S.R.O.	Slovakia	2014
OH1	Hardvare	Telecity Amsterdam	Profog S.A.	Holland	2014
OH1	Server rooms	Wuhan Commercial Bank Data Center	ICAN	China	2014
OH1	Data halls, Floor Voids, Technical Rooms	Datacenter Curacao "CETEX"	Unica	Holland	2013
OH1	Floor voids, data halls	GMF	DEF	France	2013
OH1	Data halls	CFI Civrieux	DEF	France	2013
OH1	Data halls	INFOMANIAC	VIANSONE	Switzerland	2013
TF	Emergency generators	Banque de France	Profog S.A	France	2013
OH1	Floor voids, data halls	SAS Free Online	Profog S.A.	France	2012
OH1	Floor voids, data halls	Telecity Data Centre, Frankfurt	Total Walther	Germany	2012
OH1	Data halls, emergency generators	Equinix Data Centre	Unica	Holland	2012
TF	Emergency generators	Global Switch	AI Group	France	2012
OH1	Floor voids, Data Hall	Equinix Data Centre	Unica	Holland	2010
OH1	Floor voids, data halls	Data centre Verizon, Rotterdam	Unica	Holland	2010
OH1	Floor void, data halls, UPS/generator switch board room	Redhill Data Centre	Tyco	UK	2009
OH1	Floor voids, data halls	Telecity, St. Denis		France	2009
OH1	Generators and offices	Barclays Bank - project Spear	Tyco	UK	2008
OH1	Floor void, data halls, UPS/generator switch board room	Digital Realty Trust	Tyco	France	2008
OH1	Data halls	Aéroport de Paris	Tyco	France	2007
TF	UPS / Generator Switch Board room	Den Danske Bank	Bravida Danmark	Denmark	2006
LA	Generator - UPS	SAP Neagebäude		Germany	2003

Equinix AM3 Data Centre, The Netherlands

Saint Dennis Data Centre, France

Redhill, Digital Reality Trust, UK

Approval

- Approvals from the European guideline **CEN/TS 14973** and approvals from **DIFT, VdS and FM**
- For data centres in particular, we have carried out our "**false floor/false ceiling" test** according to **VdS 2344:2005-12.**
- FM Approved for 5 m ceiling height for 57°C and 68°C
- Successfully passed FM fire test for below floor application for both single and double-tier cable trays.

Approvals

- For data centres: **FM Approvals** Class 5560, App. ID 3058726
- FM HC-1 approval, can be used in corridors & offices approved for **5 m ceiling height** for **57°C and 68°C**
- FM approval for **machinery spaces**

FM APPROVED

Certificate of Compliance

This certificate is issued for the following:

Water Mist System

System Designation:	SEM-SAFE® Water Mist Systems for the Protection of Data Processing Equipment Rooms/Halls
Design, Installation, Operation and Maintenance Manual:	SEM-SAFE® Water Mist Fire Fighting Systems for Protection of Data Processing Equipment Rooms/Halls Design, Installation, Operation, and Maintenance Manual, Document ID: 46-0001-511-04, Revision: 4, Date of Issue: June 2018

Prepared for:
DANFOSS SEMCO A/S
MIDDELFARTVEJ 9
ODENSE C
DK-5000 DENMARK

Manufactured at:
DANFOSS SEMCO A/S
MIDDELFARTVEJ 9
ODENSE C
DK-5000 DENMARK

FM Approvals Class: 5560

Approval Identification: 3058726 Approval Granted: July 11, 2018

To verify the availability of the Approved product, please refer to www.approvalguide.com

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

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