

# Højtryksvandtågesystemer til brandsikring af hospitalsbyggerier

FSTA seminar, Middelfart

Danfoss Semco A/S

2. Februar 2017

Lasse Sørensen Laustsen



## Hvad er forskellen på højtryksvandtåge & traditionel sprinkling (OH risikoklasse)

Traditionel Sprinkler



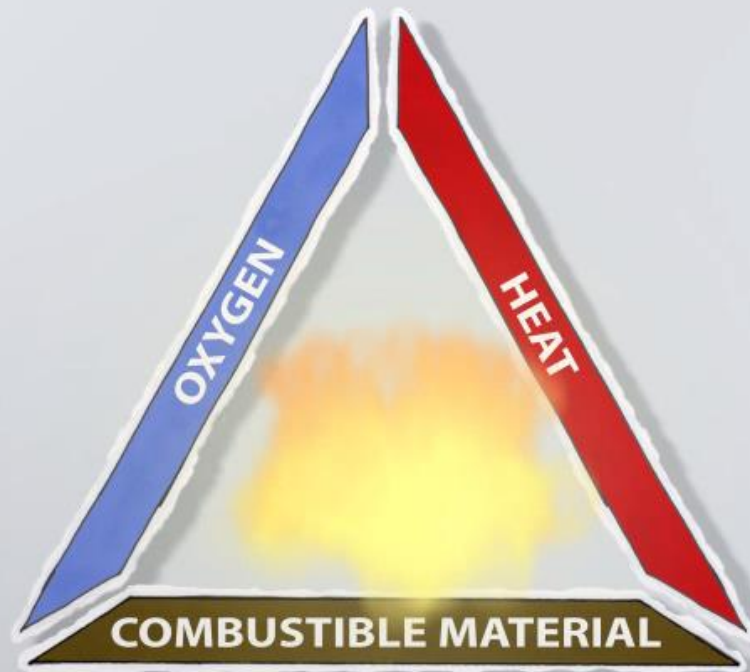
Højtryksvandtåge



## Hvad er forskellen på højtryksvandtåge & traditionel sprinkling (OH risikoklasse)

### AGENDA

- Teknologibeskrivelse
- Godkendelsesproces
- Valg af systemtype - Vandtåge & Sprinkler
- Projektering & Installation – Forskelle, fordele & ulemper
- Pålidelighed – Vandtåge & Sprinkler



For a fire to survive it requires the presence of 3 elements

[Click to see video](#)

## Godkendelsesproces Produkter til Normal risikoklasse (OH)

### Traditionel Sprinkling

- Baselinetest udført af sprinkler producenter
- Skalering fra baselinetest
- Præskriptive retningslinjer for produktgodkendelser & design(FM, VdS, DBI m.fl.)
- Valideret ved erfaring (Præskriptive retningslinjer justeret)

### Vandtåge

- 100% realistiske brandtest udført hos akkrediteret test bureau(SP, VTT, DBI m.fl.)
- Test bevidnet og godkendt af akkrediteret tredjepart(SP, VTT, DBI m.fl.)
- Specifik designmanual supplere DBI254
- Valideret af akkrediteret test body i henhold til godkendte testprotokoller (CEN, VdS, FM Global, UL m.fl.)



# Sprinkler design

Risiko-klasse	Dimensionerende vandtæthed (minimum) mm/min	Dækningsområde m <sup>2</sup>	
		Vådt anlæg eller pre-action anlæg	Tørt anlæg eller alternativt anlæg
LH	2,25	84	Ikke tilladt: Anvend OH1
RH1	2,05	1-4 sprinklere <sup>1) 5)</sup>	Ikke tilladt <sup>4)</sup>
RH2	2,05	1-4 sprinklere <sup>2) 5)</sup>	Ikke tilladt <sup>4)</sup>
RH3	4,1	4 sprinklere <sup>3) 5)</sup>	Ikke tilladt <sup>4)</sup>
OH1	5,0	72	90
OH2	5,0	144	180
OH3	5,0	216	270
OH4	5,0	360	Ikke tilladt: Anvend HHP1
HHP1	7,5	260	325
HHP2	10,0	260	325
HHP3	12,5	260	325
HHP4	Særlige overvejelser skal kræves		

*Note 1: Ugunstigste sprinkler og ugunstigste rum, op til 4 sprinklere i samme rum.  
 Note 2: Ugunstigste sprinkler og ugunstigste rum, op til 4 sprinklere i samme rum.  
 Note 3: 4 sprinklere i det hydraulisk mest ugunstige område.  
 Note 4: Det er Ikke tilladt at installere tørt- og type B pre-action anlæg i RH-klasse.  
 Note 5: I rum over 46 m<sup>2</sup> øges dimensioneringsområdet til hele rummets størrelse.*

Tabel 6.1 fra DBI retningslinje 251/4001

## Godkendelse i henhold til CEN (TS14972)

Test udført hos DBI

Certifikat udstedt af DBI

Reference sprinklertest

Vandtåge klassifikationstest



### CERTIFICATE

This is to certify that:

DBI - Danish Institute of Fire and Security Technology did undertake the relevant test for the equipment identified below which was found to be in compliance with the standards described in the annex attached hereto.

**Applicant** Danfoss-Semco A/S Fire Protection  
**Address** Middelfartvej 9, DK-5000 Odense C  
**Manufacturer** Danfoss-Semco A/S Fire Protection  
**Address** Middelfartvej 9, DK-5000 Odense C  
**Product Type** Water mist fire fighting system designated Sem-Safe  
**Product Description** See sheet 2  
**Specified Standards** prEN14972 : June 2003, Annex A3

**The attached annex forms part of this certificate.**  
**This certificate remains valid unless cancelled or revoked, provided the conditions in the attached annex are complied with and the equipment remains satisfactory in service.**

Date of issue 2012-06-01 Issued by Danish Institute of Fire and Security Technology  
(The certificate supersedes the previous version of this certificate, expired on 2012-04-02.)

Expiry date 2017-06-01

Signed

Name

Dan Bluhme

Tom Nisted

Note:

**This certificate will not be valid if the manufacturer makes any changes or modifications to the equipment, which have not been notified to, and agreed with DBI.**

# Sprinklerækvivalenstest

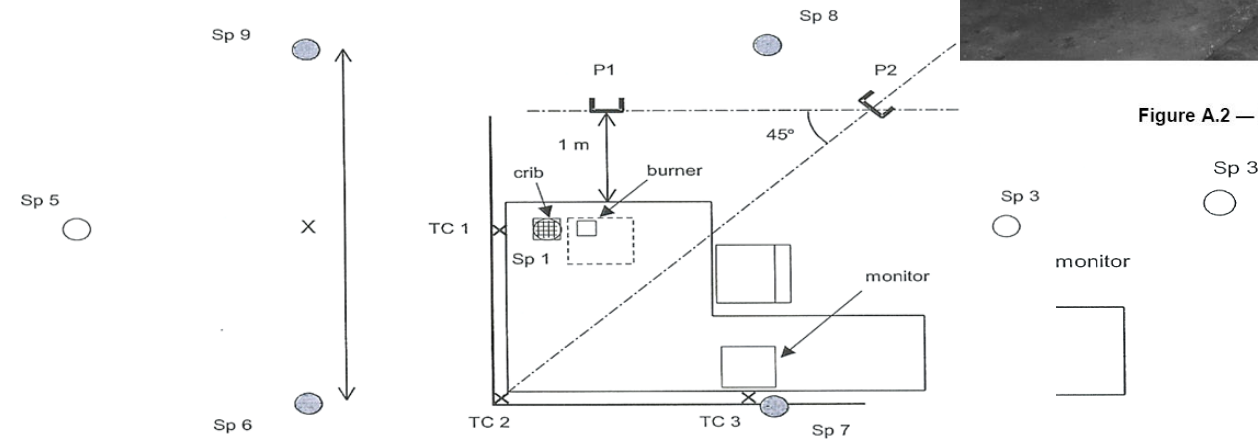
Appendix 1: Nozzle positions.

Appendix 1: Nozzle positions.

- Ignition under 1 nozzle
- Ignition between 4 nozzles
- × Thermocouple locations
- ▭ Plate thermocouple locations



Figure A.2 — An overview of the office fuel package





## Sprinklerækvivalenstest

### SPRINKLERTEST



### VANDTÅGETEST



File No. RE 04199A

2004-12-31

Danish Institute of Fire and Security Technology



Page 16 of 31

File No. RE 04199A

2004-12-31

Danish Institute of Fire and Security Technology



Page 26 of 31

	Sprinkler	Vandtåge	
Appel			
Su	Spacing	3,5 m	5,5 m
-	Temperaturer	273 / 223 / 183 °C	193 / 132 / 116 °C
-	Skader	34%	28%
-	Materialer bortbrændt	53%	35%
Su	Vandforbrug	5 lpm/m <sup>2</sup>	0,91 5 lpm/m <sup>2</sup>

04  
n 17 sec  
in 17 sec  
00 bar  
22°C  
3

Criteria	Measured value
Number of combustible items to suffer fire damages:	34
Extend of consumed material and charring on wall panels:	53 %
Maximum average ceiling temperature measured at TC 1:	273°C
Maximum average ceiling temperature measured at TC 2:	223°C
Maximum average ceiling temperature measured at TC 3:	183°C

Criteria	Measured value
Number of combustible items to suffer fire damages:	28
Extend of consumed material and charring on wall panels:	35 %
Maximum average ceiling temperature measured at TC 1:	193°C
Maximum average ceiling temperature measured at TC 2:	132°C
Maximum average ceiling temperature measured at TC 3:	116°C

## Sprinklerækvivalenstest

### 9 Conclusion

The watermist fire fighting system constructed and installed as described in this report has been subjected to standard fire test procedures complying with prEN 14792, “Fire Fighting Systems, Watermist Systems – Design and Installation”, Annex A3 “Fire test procedure for office occupancies of ordinary hazard group 1”.

The watermist fire fighting system constructed and installed as described in this report has performed better than the reference sprinkler system for both the damage criteria, and the temperature criteria, when compared as specified in prEN 14792, “Fire Fighting Systems, Watermist Systems – Design and Installation”, Annex A3 “Fire test procedure for office occupancies of ordinary hazard group 1”.

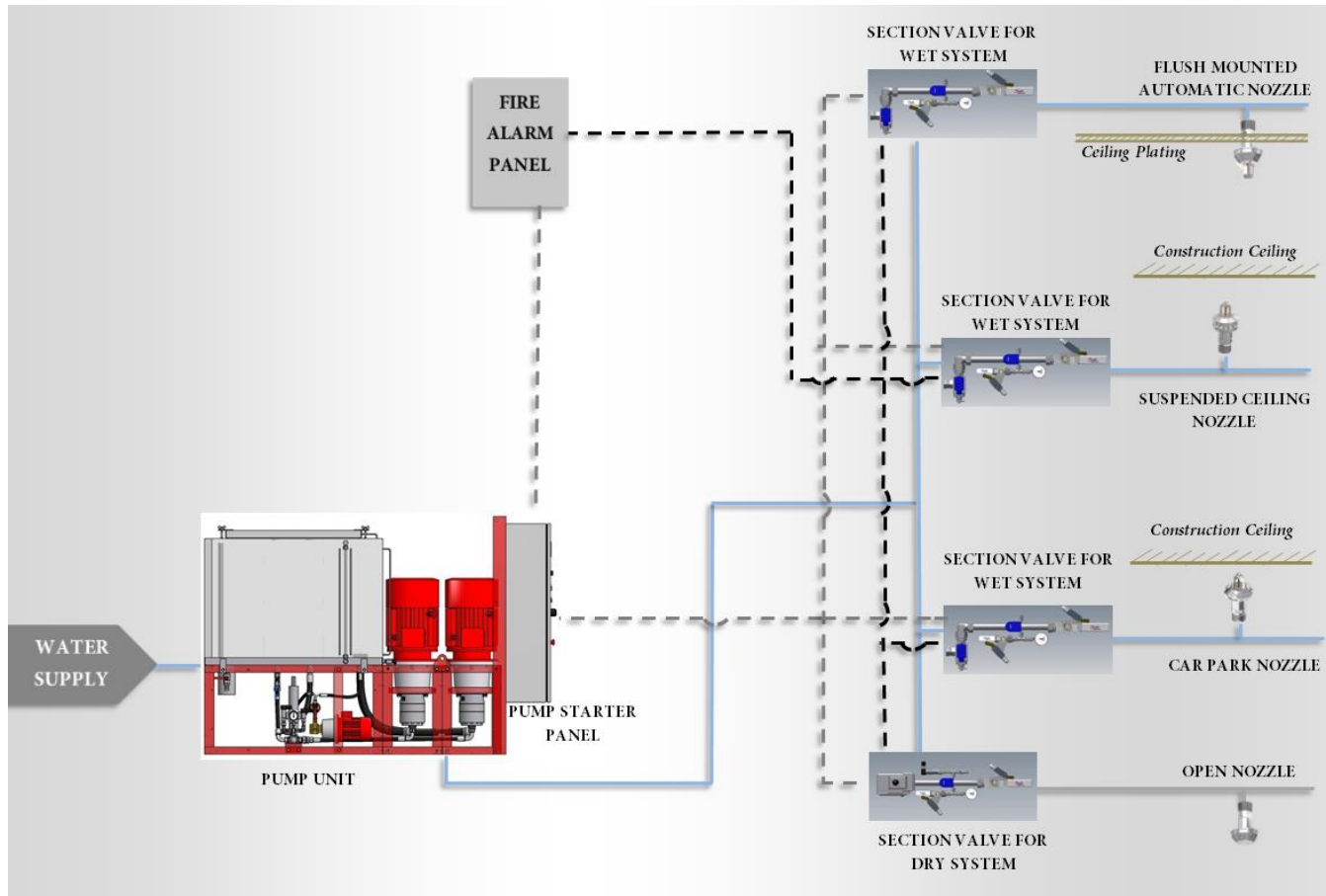
Approval of the system may be obtained on application to the appropriate administration.

## Valg af systemtype



Applikationer		Lavtryks vandtåge	Højtryks vandtåge	Traditional sprinkler
LH	Kontorer	Green	Green	Green
OH1	Hopsitaler m.fl	Green	Green	Green
OH2	Bilgarager	Green	Green	Green
OH3	Lager	Red	Yellow	Green
OH4	Teater	Red	Green	Green
Specials	Atrium	Red	Green	Yellow
Specials	Turbines /Trafos	Red	Green	Yellow
Specials	Datacentre	Red	Green	Yellow
HHP	industrie	Red	Red	Green
HHS	Logistiek	Red	Red	Green
ESFR	Logistiek	Red	Red	Green

## Valg af systemtype - Højtryksvandtåge & Sprinkler





## Hovedkomponenter

DYSER



PUMPE UNITS

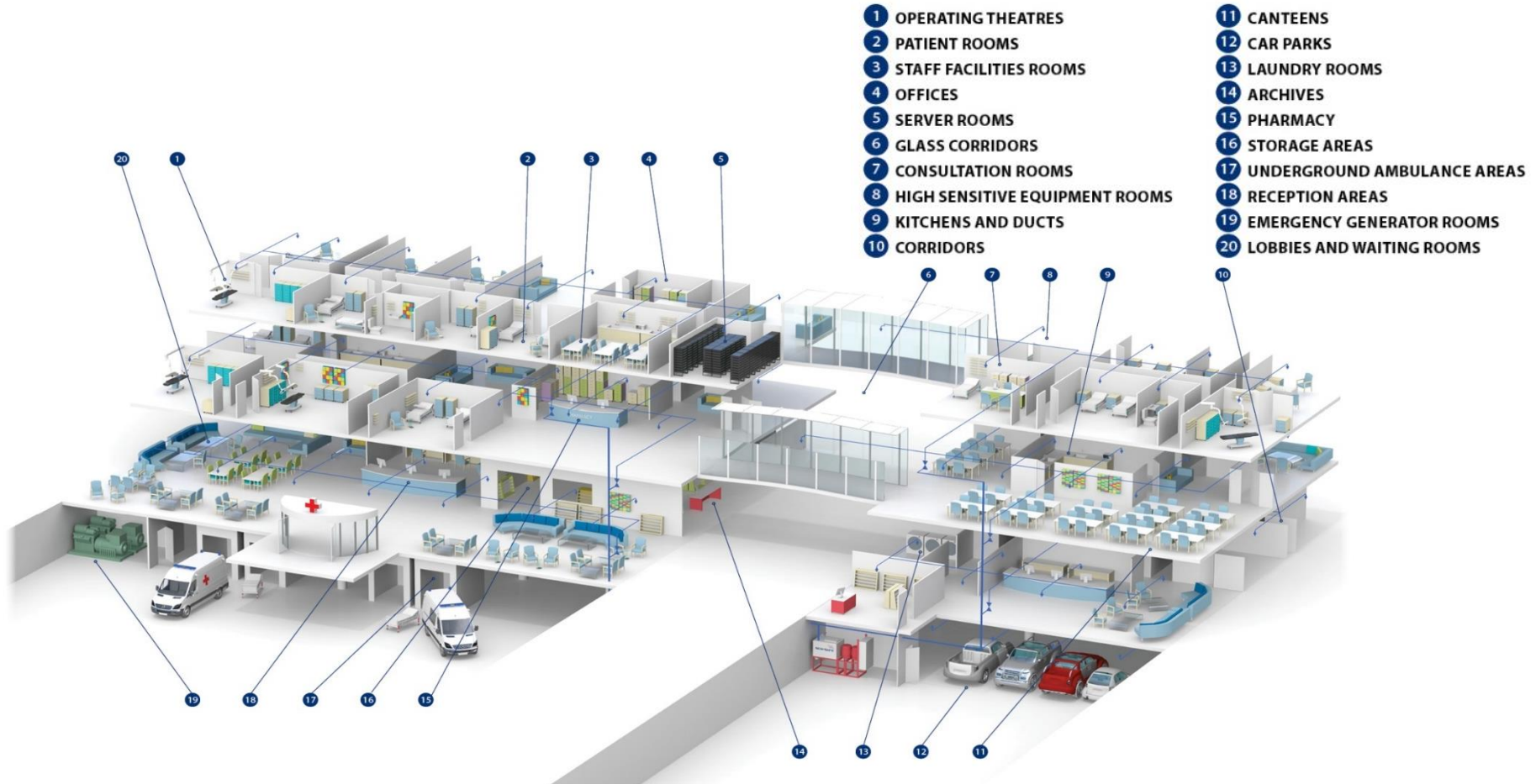


SEKTIONSVENTILER





# Projektering og installation i hospitalsbyggeri



# Vandtågens fordele

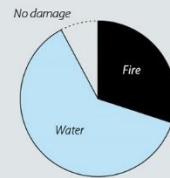
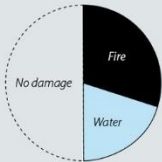
## Water mist

## Traditional sprinkler

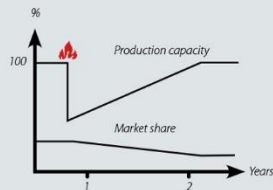
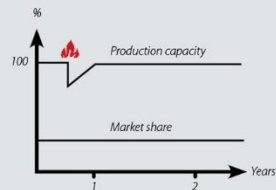
LESS WATER



CAUSE OF DAMAGE



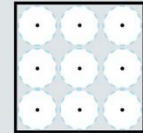
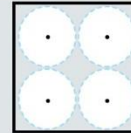
LESS RISK OF LOSING MARKET SHARE



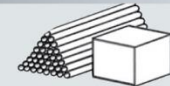
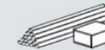
## Water mist

## Traditional sprinkler

FEWER NOZZLES AND PIPES



SMALL STAINLESS STEEL PIPES AND FEWER FITTINGS



EASY TO INTEGRATE INTO BOTH NEW AND RETROFIT INSTALLATIONS



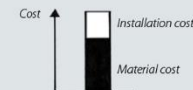
EASY TO HANDLE



QUICK INSTALLATION

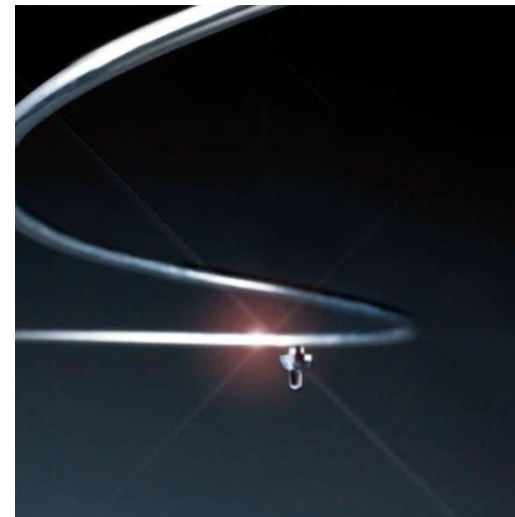


COST-EFFECTIVE SOLUTION



## Fleksibilitet i Rør og fittings

- Rør materiale:
  - Rustfri stål AISI 316
  - Vedligeholdelsesfri



### Typiske rørdimensioner med forskellige teknologier

	HPWM	LPWM	Traditionel sprinkler
Dyse rørsystem	ø10 - 15 mm	ø25 - 40 mm	ø25 - 50 mm
Ring rørledning	ø22 - 33.4 mm	ø50 - 80 mm	ø65 - 100 mm
Hovedledning	ø33.4 - 60.3 mm	ø80-100 mm	ø100 - 200 mm

## Funktionalitet og æstetisk design

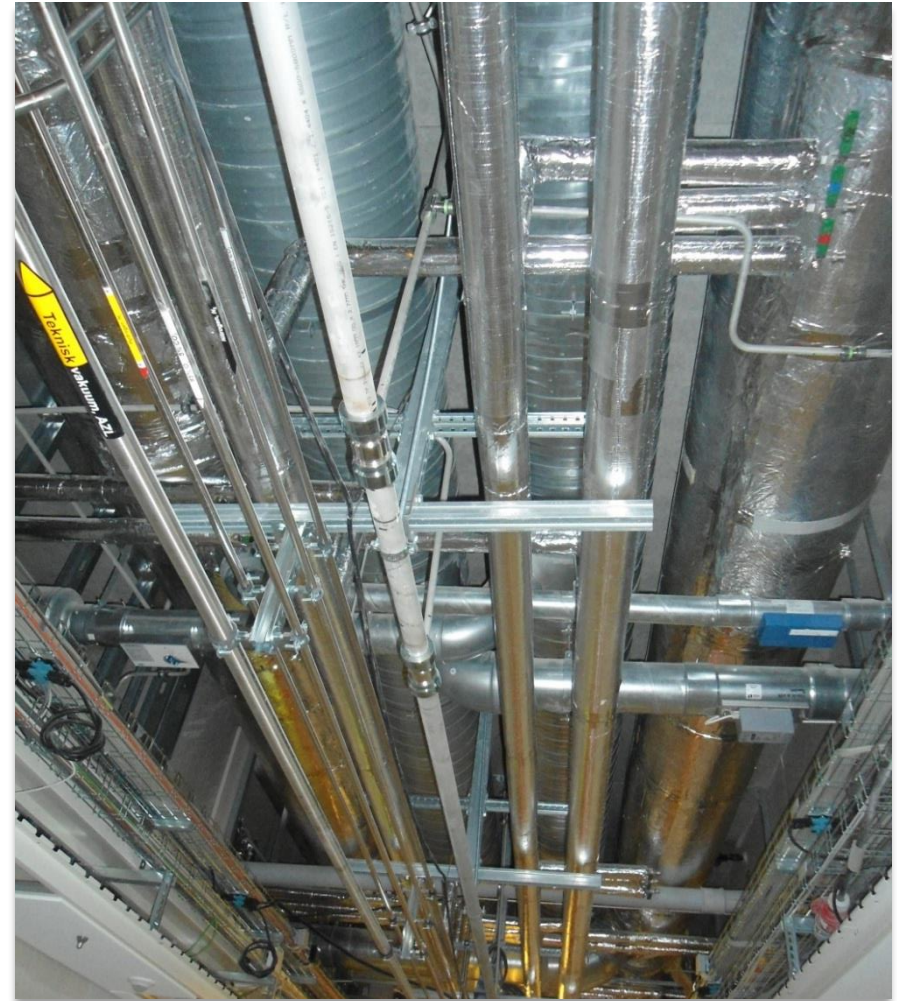
- Fleksibel rørføring
- Enkelt dysedesign





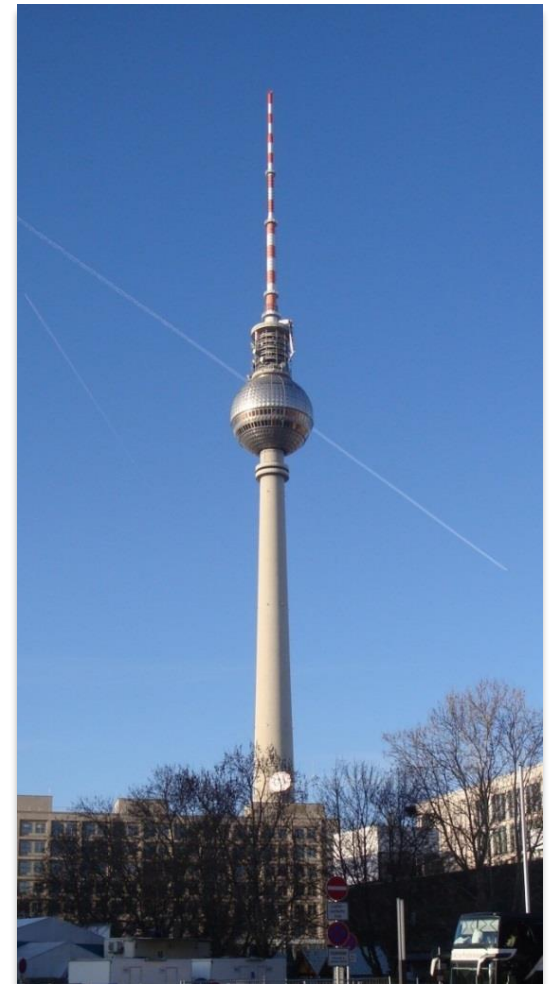
## Design frihed

- Større dyse spacing og færre dyser
- Mulighed for adgang til installationer



## Berlin TV tårn

- Tv-tårn på Alexanderplatz i Mitte i Berlin
- Opført mellem 1965 og 1969 af det tidligere DDR
- 368 meter => højeste bygning i Tyskland
- 203 meters højde til udsigtsplatform
- Roterende restaurant i 207 m
- ~1,2 mio. mennesker besøger tårnet årligt
- Ejers i dag af Deutsche Funkturm (Deutsche Telekom)





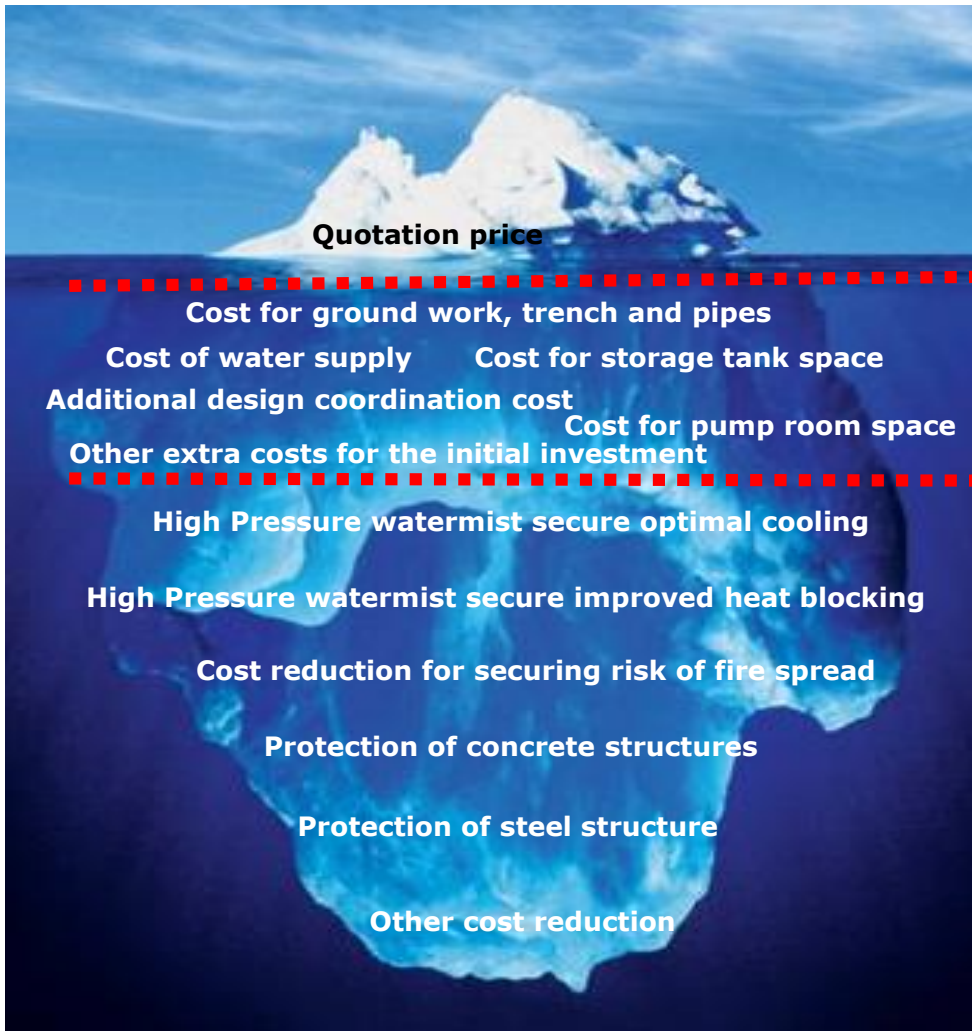
## Installation i et børnehospital i fuld drift

- Skånsom indgriben i dagligdagen
- Ingen støj
- Ingen oplag af materiale og maskiner indendørs

Installationsarbejde fra trojansk hest



Total Solution Provider of Certified Fixed Fire Fighting Systems



Quotation price

Direct savings

Indirect savings

HPWM Price

Savings

Total investment with sprinklers

## Pålidelighed – Vandtåge & Sprinkler

- **SP Undersøgelse SP Rapport 2014:30**  
**Rapporten beskriver to undersøgelser:**



Släcksystem med vattendimma - en förnyad kunskapssammanställning

Brandforsk projekt 500-121

- FM Global analyse(FMEA), baseret på 1 års inspektionsinterval
  - Vandforsyning, herunder mængde og tryk(Gas drevende systemer)
  - Strømforsyning, fire panel(ABA) og transmission fejl
  - Lukket hovedventil
- EU projekt FIREPROFF
  - Projektet undersøgte pålidelighed i forskellige brandbekæmpelsessystemer på skibe herunder traditionel sprinkling og vandtåge
  - Analysen viser at traditionelle sprinkler og vandtåge systemer kan have en høj pålidelighed(Improved system) på samme niveau
  - "Generic" systemer betegnes som systemer med årlig service, disse med ringere pålidelighed end "improved" systemer
  - "Improved" systemer betegnes som systemer med månedlig service, dvs. systemtyper som installeres på moderne skibe(cruiseline m.fl.)

*Moderne systemer installeret i OH byggerier udføres med krav til ugentlig, månedlig og årlig inspektion/service ⇒ "Improved systemer"*

## Pålitelighed – Vandtåge & Sprinkler systemer

### Conclusion

Based on the information given in SP Rapport 2014:30, it can be concluded that there is no support to conclude that an automatic water mist system is less reliable than a traditional automatic sprinkler system. The information is rather an indication that a water mist system can indeed be designed and maintained such that the reliability is comparable or even higher than a traditional sprinkler system.

However, it should be understood that every system is unique, be it a water mist system or a sprinkler system. Therefore, as mentioned in the report, a fault tree analysis only provides an approximation of a system's actual reliability and it is advisable to compare the results of any fault tree analysis with experimental or historical data.

Yours sincerely,

**SP Technical Research Institute of Sweden**  
**Fire Research - Fire Dynamics**



Signed by: Magnus Arvidson  
Reason: I am the author of this document  
Date & Time: 2015-12-04 14:53:48 +01:00

Magnus Arvidson  
Project leader



Reason: I have reviewed this document  
Date & Time: 2015-12-04 14:55

Tommy Hertzberg  
Section Manager Fire Dynamics

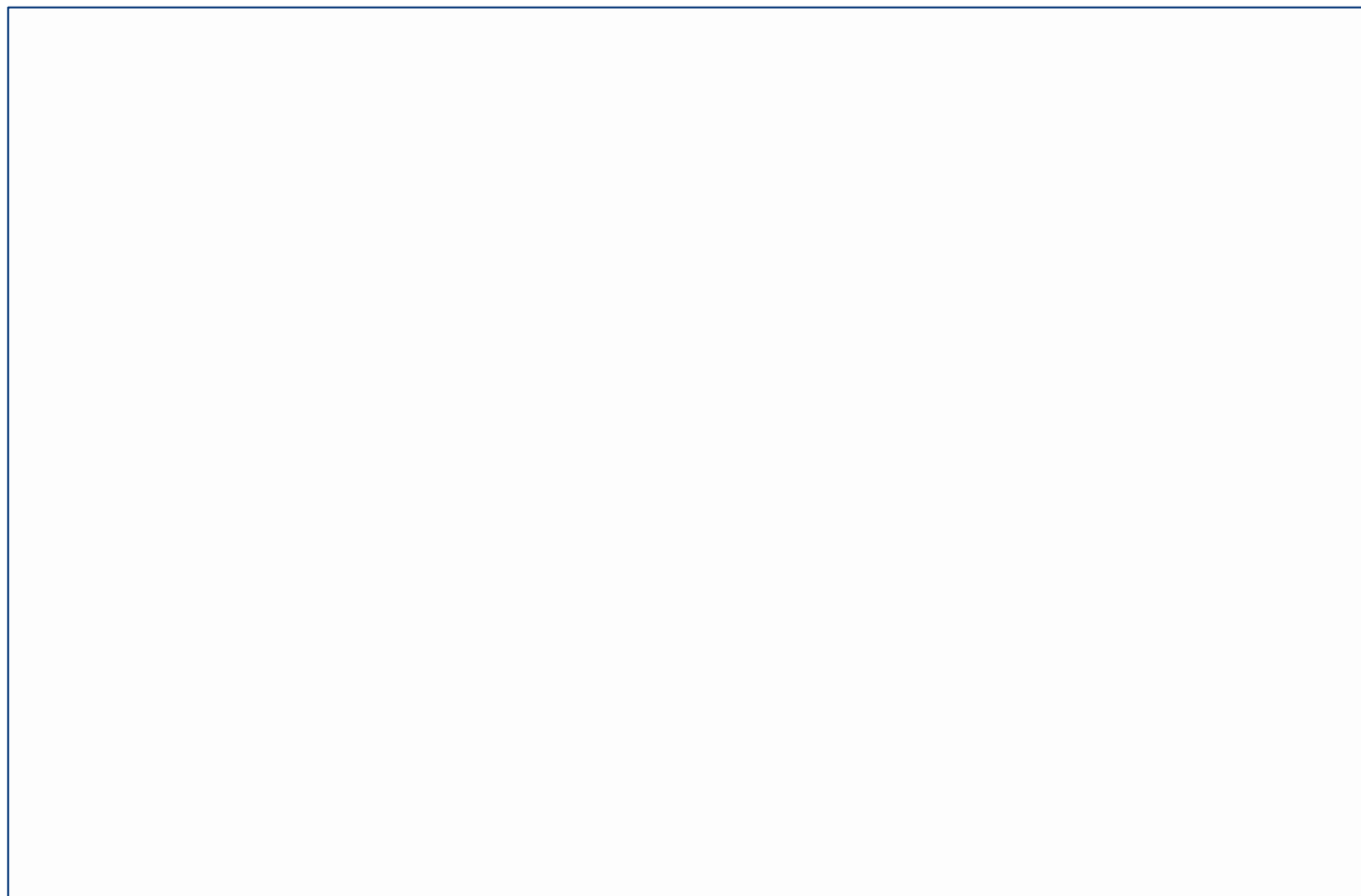
## Pålidelighed – Vandtåge & Sprinkler systemer

**Table 1. Factors affecting the reliability of traditional sprinkler systems and watermist systems.**

Component	Traditional sprinkler	Water mist
Power supply	Similar	
Water supply	Similar	
Pumps	Similar	
Valves	Similar	
Filters		Special filters to provide increased water quality, tested in clogging test
Pipes and fittings		Corrosion resistant, to provide higher water quality
Nozzles		Special nozzles tested in realistic fire tests
Thermo-sensitive element	Similar, glass bulbs	



## Wilhelmina film





## Isala Clinics, Holland

**"Gold awarded hospital"**



- 104.000m<sup>2</sup> hospital
- 10.000 SEM-SAFE<sup>®</sup> dyser (OH1, OH2, OH3)
- Alle områder er beskyttet af SEM-SAFE<sup>®</sup>

## Katriina Hospital, Finland

### Retrofit projekt



- 12.700m<sup>2</sup>
- 1.120 dyser
- Alle områder beskyttet af SEM-SAFE systemet



## PTE PÉCS Hospital, Ungarn



- 28.000m<sup>2</sup>
- 3.300 dyser
- Beskyttelse af hele sygehuset (OH1 og OH3 områder)





# DNU Skejby Universitetshospital, Århus, Danmark

## Den største hospital i Danmark



- 250.000 m<sup>2</sup>
- Mere end 30.000 CEN og VdS dyser installeret
- Komplet brandsikring af alle områder: OH1, OH2 og OH3
- Et sygehusbyggeri efter nyeste standard

