

Case Study: Water Mist in a historic Place

‘Het Loo Palace’, Apeldoorn, NL

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Agenda

1. About DGMR
2. The project
3. Why Water mist
4. 'How-to' select a water mist system
5. Water mist and monumental ceilings



The Hague: Ministry of the Interior and Kingdom Relations and Ministry of Security and Justice



About DGMR

DGMR is an independent consultancy firm in the Netherlands.

We like to offer our customers the best protection, this can be:

- Sprinkler
- Gaseous fire protection
- Low-pressure water mist
- High pressure water mist
- Something else...

All depends on the situation and needs of our clients.

This presentation is based on our experience with fire protection consultancy/engineering and water mist protection.



Building physics



Fire safety



Industry and environment



Sustainable building and energy



Vibration control

The Project - some impressions (1)



The Project - some impressions (2)



The Project - a short history

- 1684: bought by governor William III & Mary Stuart
- 1806: owned by Luigi Napoleone Buonaparte, named king of Holland by Napoleon Bonaparte
- 1815: summer stay of the king (William I), and his successors
- 1911: expansion with 'Corps de Logis'
- 1948: residence of former Queen Wilhelmina (after her abdication till her passing in 1962)
- 1970: plans for a museum
- 1977: start transformation to a museum
- 1984: opened as museum
- 2018: start of a thorough restoration and expansion



Why (water based) fire protection?

Building code:

- No requirements (for any functions) for a sprinkler- or watermist protection. Building code is only based on preventing fire spread to other buildings and life safety.
- Building is divided in fire compartments $< 1.000 \text{ m}^2$ with 60 minutes fire rating, or 2.000 m^2 with 20 minutes for existing buildings.

Owner + other stakeholders (Dutch State, museum, Cultural Heritage Agency of the Netherlands):

- Active fire suppression system in certain parts of the building.
- To prevent damage due to fire (inreplacable building/collection).
- Should be High pressure (HPWM).

Water based fire protection: sprinkler?

Concerns regarding the application of sprinklers:

- Practical: piping needs to be installed in concealed areas between the ceiling and the floor. Which already needs to be opened due to other installations and removal of asbestos
- Practical: limited water supply
- Visual: nozzle size
- Damage to the building: maintaining monumental ceiling
- Water damage in case of fire: limited water damage by failure of a nozzle

Watermist ?

Water based fire protection: watermist?

Concerns regarding the application of sprinklers:

- Practical: smaller piping
- Practical: limited water supply
- Visual: nozzle size, more subtle
- Damage to the building: maintaining monumental ceiling
- Water damage in case of fire/limited water damage by failure of a nozzle



Selecting a water mist system (1) - general requirements

Selecting a water mist system supplier is in general the first step when engineering a water mist system.

For this project there were no opportunities for a pre-selection of the contractor: a public tender is required.

Consequence: the system that will be used is unknown in the engineering phase of the project.

The engineers mission: Design a water mist system

- 1) Spacing and place of heads is possible with all 'brands'
- 2) Watersupply is possible with all brands
- 3) At least 3 different installation contractors should be able to make a offer.

Selecting a water mist system - market survey (1)



* impression, we have examined all brands available on the market in NL

Selecting a water mist system - market survey (2)

- Design code selection, based on EU principles (OH1) or USA (FM HC-1)
- We did a market survey of systems approved and suitable for this building:

Euro standards	FM standards
3 'brands' with multiple contractors*	2 'brands' with multiple contractors.
Based on VDS OH1 and specific testing for high spaces.	Based on FM approvals and specific testing for high spaces (based on Euro protocols).
Less code mixing	Code mixing

* There are ~30 sprinkler contractors in NL (not all do water mist)

Selecting a water mist system - market survey (3)

A design with the position of the heads was made, based on the possibility of the different brands for OH1 protection.

Should be a 'open system design' suitable for all 'brands'.

Brand	Spacing
Brand X	4.0 x 4.0 m (max. 16 m ²)
Brand Y	4.3 x 4.3 m (max. 18.5 m ²)
Brand Z	4.8 x 4.8 m (max 23 m ²)
Used in the principle design	4.0 x 4.0 m (max. 16 m²)

Making a design (1)

For all important rooms we made principle designs:

80 mm hoge obstructieranden

WITTELIJNEN		BESCHRIJVING	
NO	OMSCHRIJVING	NO	OMSCHRIJVING
1	WITTELIJNEN	1	WITTELIJNEN
2	WITTELIJNEN	2	WITTELIJNEN

Project: Paleis het Loo (Waterschap polderwoning) Projectnummer: 2016-0001
 Bestemming: Schiedamsche wijkwoning
 Bestaande: In verhoging - Binnentoe 110

dGm^R Bouw B.V.

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Making a design - example (2)



No nozzles in parts with paint

No nozzles in stucco ornaments (or close, to prevent damage)



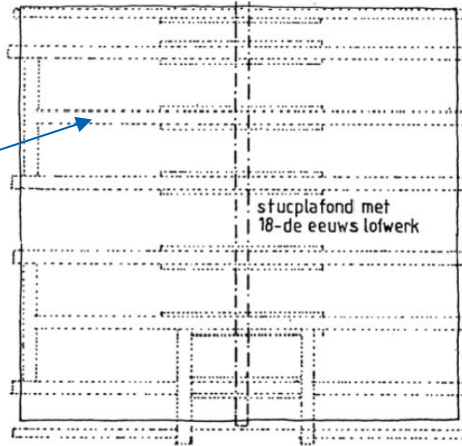
Only nozzles in certain flat area's
(easy restauration possible when
nozzles are removed)

Making a design - example (3)

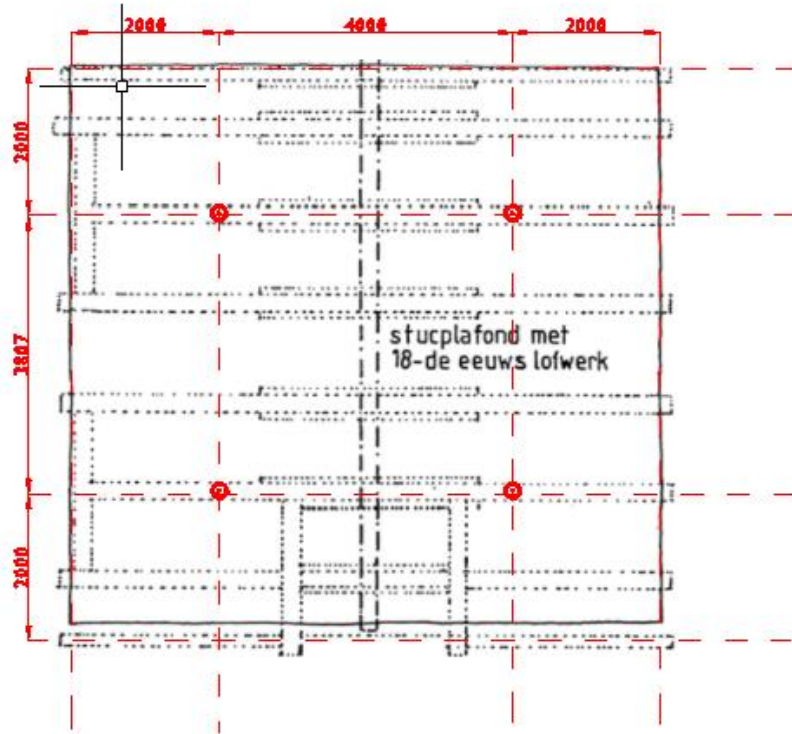
Uncertain: What is above the ceiling?

Not possible to look between floors where the beams or other structural members are. Only limited drawings:

Beams?



Making a design - example (4)

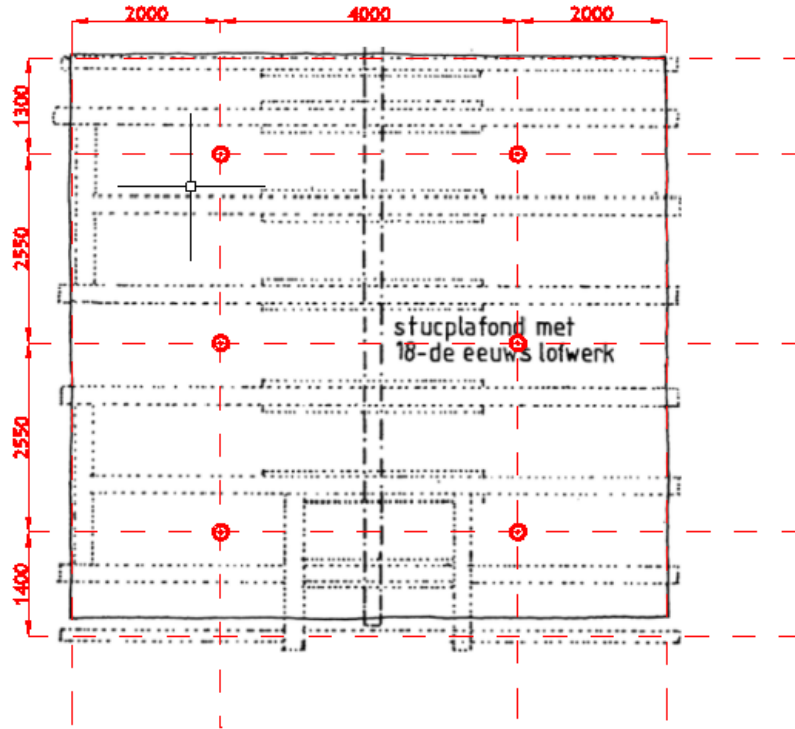


Technical minimum requires 4 nozzles in this room.

Challenges:

- nozzles direct / close to beams
- nozzles in paintwork / stucco

Making a design - example (5)



- Final design: 6 nozzles required
- 50% more nozzles than technical minimum:
 - Costs
 - Installation time
 - More 'holes' in de ceiling
 - Water supply and pump sizing

Conclusion of the design and used principles (1)

All brands have different spacing requirements. For the 'open design' the most unfavorable spacing is used.

In theory this is not the most favourable method to make a plan. You don't use the best there is on the market (max. spacing, less heads).

Is this true?

Conclusion of the design and used principles (2)



No, in most rooms the ceiling design determines the number of nozzles required. The maximum allowed spacing is almost never used.

Yes, in some rooms using nozzles with a larger allowed spacing can save on the number of nozzles

Solution → in contract specification:

- All based on the same nozzle spacing and amount
- In quotation, price for alternative is allowed and (promoted)

Clients questions:

Concealed nozzles

- Real concealed nozzles not possible

Nozzles in color

- Different colors desirable
- Not possible for every brand

Escutcheon

- Do we really need those?
- Can they be smaller?
- Can they be in colour?



Questions?

Questions?

