
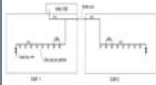
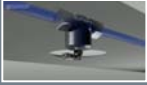




Revolutionary HI-FOG® -Innovation

Pop-out sprinkler for Rolling Stock

| | | | | |
|---|--|---|--|---|
| PART 1  Marioff Group | PART 2  HI-FOG® design example | PART 3  Pop-out sprinkler animation | PART 4  Comparison of solutions | PART 5  Conclusions |
|---|--|---|--|---|



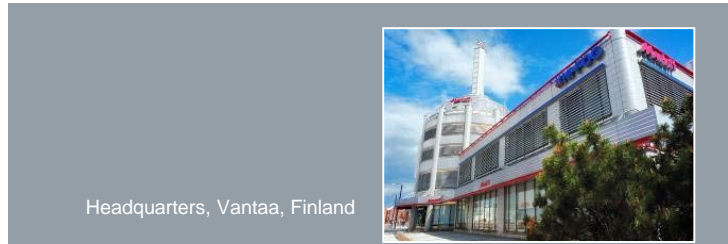
Mr. Petteri Valkohaapa
Manager, Stations & Rolling Stock
Global Business Development

17.11.2010



Marioff Group business

- **Activity** Fire protection system manufacturer and supplier
- **Product** HI-FOG® Water Mist Fire Protection System
- **Mission** Protecting people, property & business continuity from fire
- **Core benefits**
 - Reduced fire, smoke and water damage
 - Minimal business interruption
 - Environmentally friendly



Headquarters, Vantaa, Finland



Marioff Group background

| | |
|--------------|---|
| 1985 | Company founded |
| 1991 | HI-FOG® launched |
| 1995 | More focus on land business, especially in Spain |
| 2000 | First rolling stock project (Madrid Metro) |
| 2007 | Acquired by United Technologies Corporation |
| Today | World's leading company within the water mist segment 226 Metros (over 1,300 cars) protected in Madrid |

Net sales over €100 Millionen
Personnel ~440





HI-FOG® - Pop-out sprinkler for Rolling Stock

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MARIOFF BACKGROUND>

- 1985 initially specialized in marine and offshore hydraulics (flushing hydraulic and lube oil piping systems)
- 1991 The HI-FOG water Mist Fire Protection System was launched in response to a clear need in the marine market – shipyards building large passenger cruise ships – for a water-based system that offered excellent fire suppression performance with a low total system weight (weight of the system itself + the weight of water in the pipes and reservoir). Weight is a basic design constraint in ship design. It took six months to develop HI-FOG = four months for first units, additional two months for weight reduction. First installation abroad the M/S Frans Suell passenger ferry of Euroway.
- 1995 Land business started to grow, mostly in Spain (Madrid Metro)

WATER MIST BACKGROUND

- In the early 1990s the International Maritime Organization (IMO) issued a directive requiring shipyards to protect passenger cruise ships with a water-based system by 1997. This was the breakthrough for HI-FOG. In a few years HI-FOG was being installed by almost every shipyard building large passenger cruise ships. (Halon phased out and increased awareness of the safety hazard that CO2 represents + marine engineers dislike the stability problems created by the weight of large-diameter sprinkler piping & potential to flood compartments and alter ship stability. FIRE RISKS in marine machinery spaces are high, because hydrocarbon fires develop fast, are very hot and have the potential to destroy a ship.) [1]

Revolutionary HI-FOG® -Innovation

Pop-out sprinkler for Rolling Stock

PART 1



Marioff Group

PART 2



HI-FOG® design example

PART 3



Pop-out sprinkler animation

PART 4



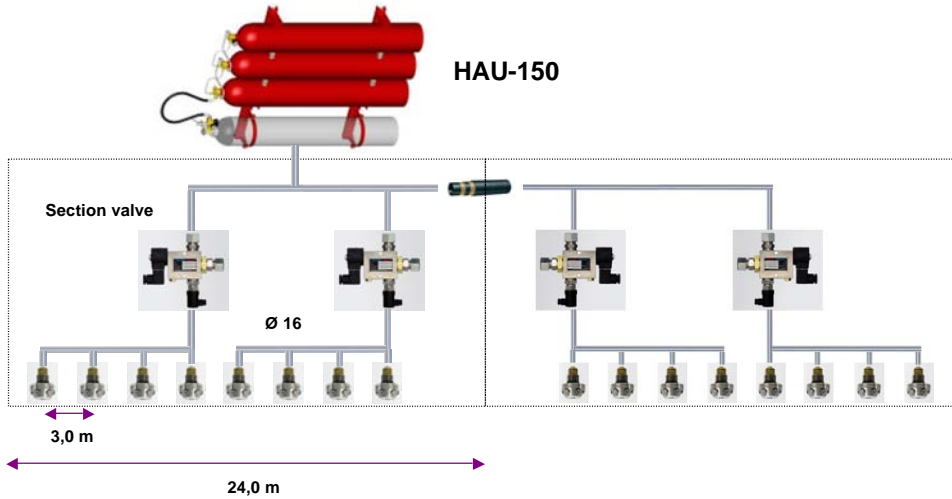
Comparison of solutions

PART 5

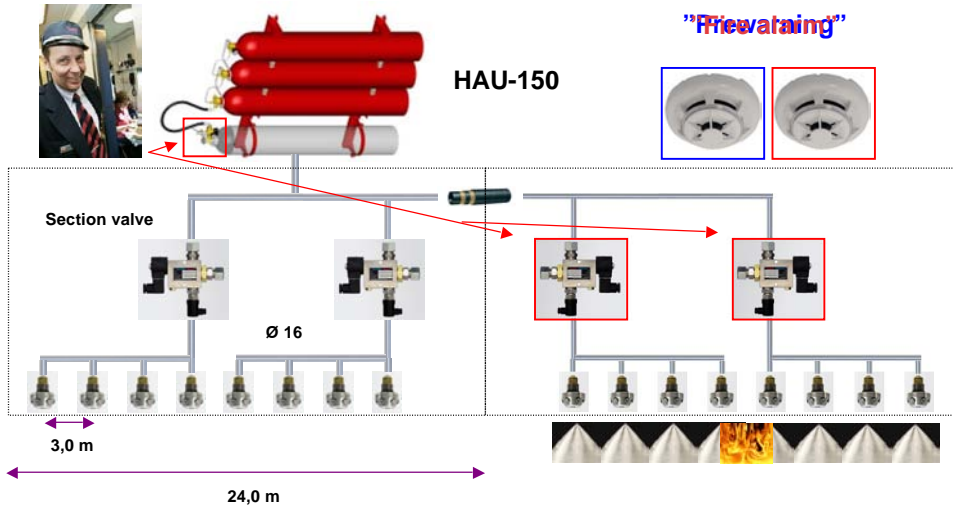


Conclusions

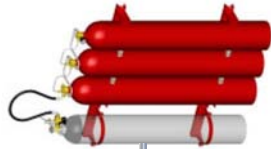
Example 1: HI-FOG® Spray head system



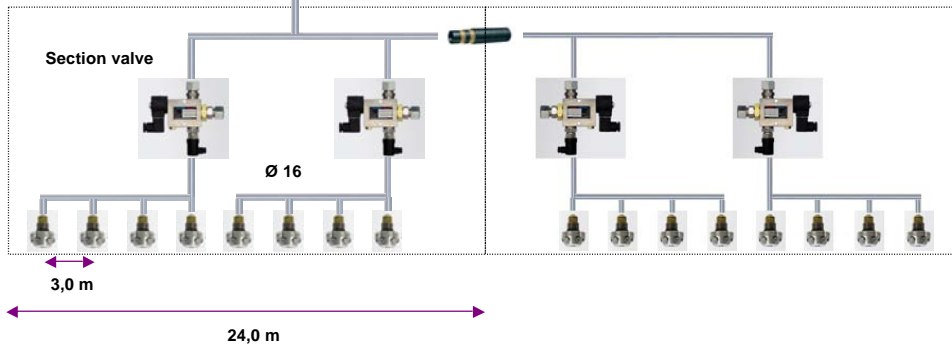
Example 1: HI-FOG® Spray head solution (operation)



Example 1 → Example 2



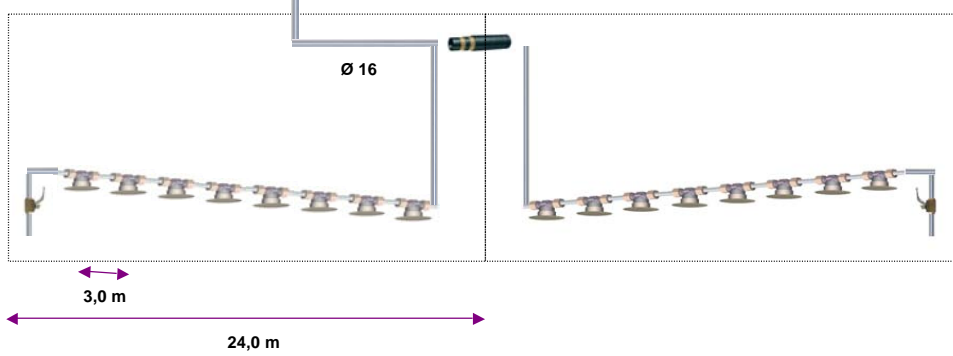
HAU-150



Example 2: HI-FOG® Pop-out sprinkler system



HAU-100



Revolutionary HI-FOG® -Innovation

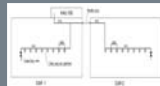
Pop-out sprinkler for Rolling Stock

PART 1



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PART 2



HI-FOG® design example

PART 3



Pop-out sprinkler animation

PART 4



Comparison of solutions

PART 5



Conclusions

Revolutionary HI-FOG® -Innovation

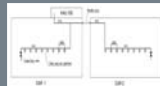
Pop-out sprinkler for Rolling Stock

PART 1



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PART 2



HI-FOG® design example

PART 3



Pop-out sprinkler animation

PART 4



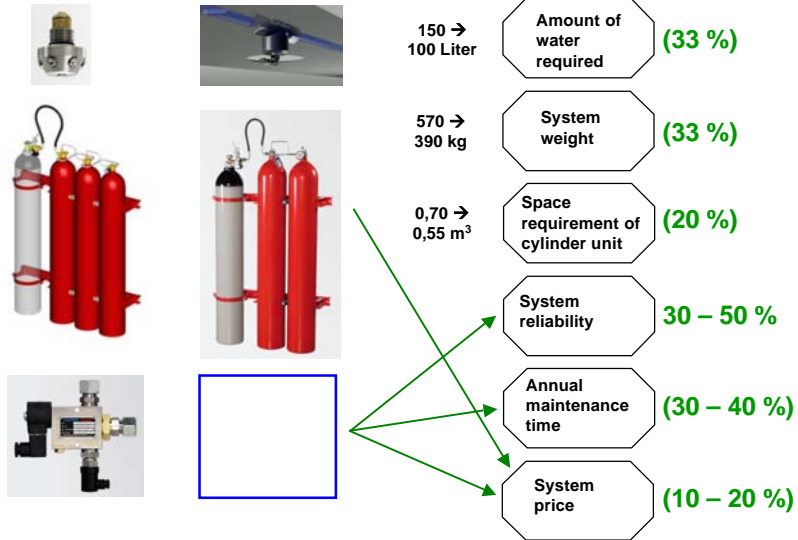
Comparison of solutions

PART 5

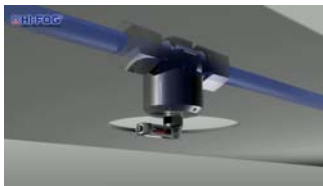


Conclusions

Comparison of Spray head and Pop-out sprinkler systems (1/2)



Comparison of Spray head and Pop-out sprinkler systems (2/2)



140 →
190 bar

Initial
pressure

35 %

Operation
time

Risk of false
discharge

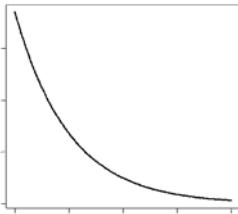
Response
time

Number of
active nozzles

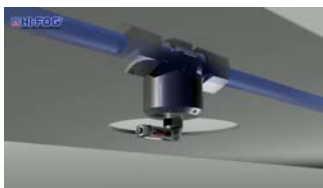
Aesthetics

Interdependency of droplet size to number of droplets and surface area in 1 liter of water

| | Droplet size (mm) | Number of droplets | Surface area (m ²) |
|-------------------------|-------------------|----------------------|--------------------------------|
| Conventional sprinklers | 10 | 1.9×10^3 | 0.6 |
| | 1 | 1.9×10^6 | 6 |
| HI-FOG® | 0.1 | 1.9×10^9 | 60 |
| | 0.01 | 1.9×10^{12} | 600 |
| | 0.1 x | 1000 x | 10 x |



Comparison of Spray head and Pop-out sprinkler systems (2/2)



140 →
190 bar

Initial
pressure

35 %

Operation
time

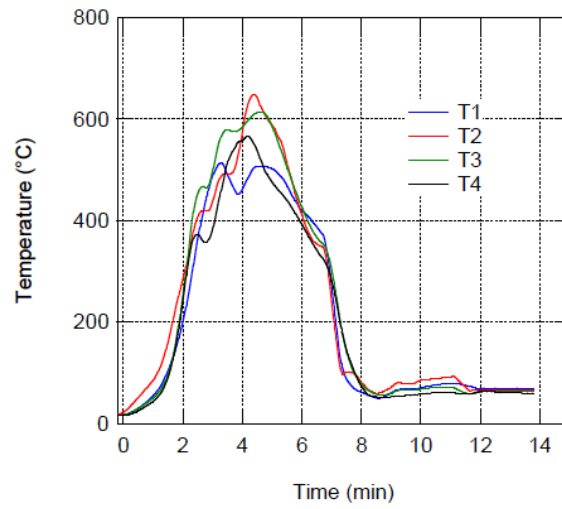
Risk of false
discharge

Response
time

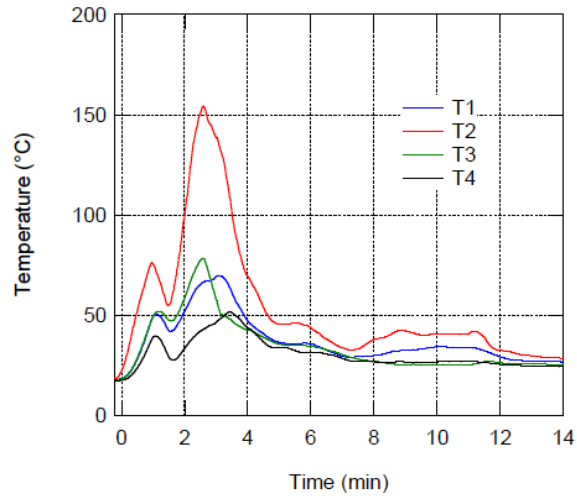
Number of
active nozzles

Aesthetics

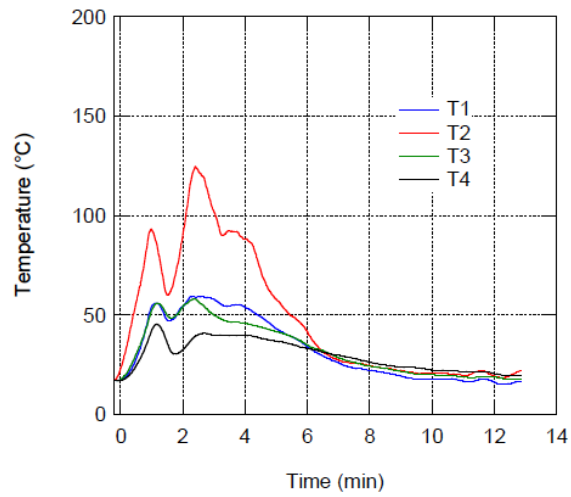
Temperatures at ceiling level (Free-Burn)



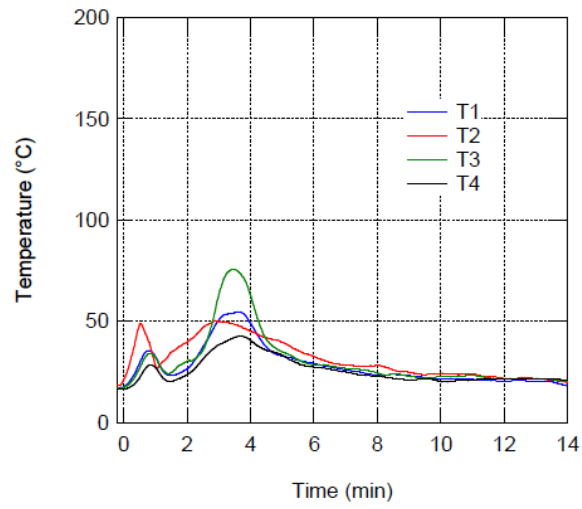
4 spray heads



2 sprinklers



1 sprinkler



HI-FOG®
water mist fire protection

Fuel package in the train setup

~ ARGE compatible

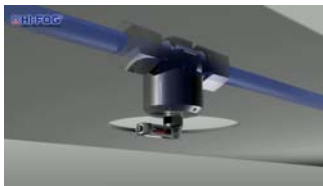
3.66 m
50 cm
95 cm
50 cm
5 cm
1.9 m
2.4 m
40 cm
10 cm
40 cm

HI-FOG® - Pop-out sprinkler for Rolling Stock

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Marioff
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Comparison of Spray head and Pop-out sprinkler systems (2/2)



140 →
190 bar

Initial
pressure

35 %

5 → 14
minutes

Operation
time

~ 200 %



Risk of false
discharge

Avoided

Response
time

20 seconds

8 → 1-2
(58 → 14 m²)

Number of
active nozzles

75 %

Aesthetics

+++

Revolutionary HI-FOG® -Innovation

Pop-out sprinkler for Rolling Stock

PART 1



Marioff Group

PART 2



HI-FOG® design example

PART 3



Pop-out sprinkler animation

PART 4



Comparison of solutions

PART 5



Conclusions

Conclusions

There is no reason to claim spray heads wouldn't satisfy their primary need in suppressing the fires in passenger cars.

BUT...

On the other hand for many aspects illustrated in this presentation, they can be evaluated as an oversized system and better suitable for protection of technical areas.

THEREFORE...

For all retrofit and new train projects where active fire protection system for passenger areas is required or thought, a Pop-out sprinkler system should be drawn into a serious consideration as an alternative in bringing the passenger on-board fire safety protection into a new era.



Thank you for your attention!

