

Compensation of Missing Fire Partitions with High Pressure Water Mist

Dipl.-Ing. Rüdiger Kopp
FOGTEC Fire Protection
ruediger.kopp@fogtec.com

Modern Building Structures



Background

- Modern buildings are often designed openly and transparent with preference of exposed glass and steel structures
- Fire protection becomes a challenge due to wide spread open connections between parts of the building
- Though conventional sprinkler systems are used to compensate missing fire partitions, water mist technology is valued to offer extended cooling, thus preventing fire propagation and securing escape conditions

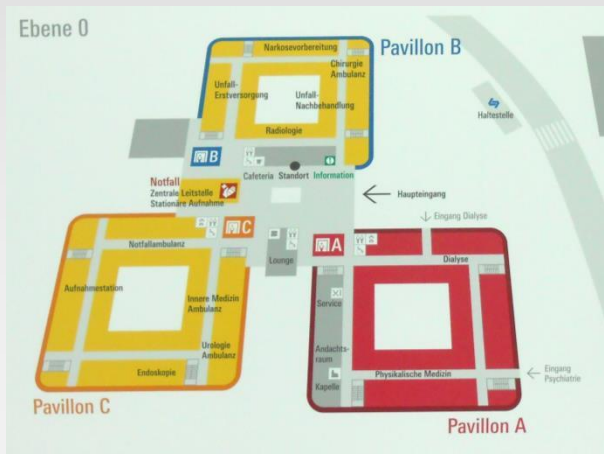


Case Study Hospital LKT Baden



Some Facts

- One of the most modern and advanced hospitals in Europe located next to Vienna
- 6 operation rooms, 450 beds
- Overall hospital floor area is 60.000 m²
- 3 connected buildings (pavilions) each having 3 levels
- 6 years construction time with completion in 2016
- 190 Mio. Euro investment



Case Study Hospital LKT Baden



Fire Protection Requirements

- Missing compartmentation between entrance hall and pavilions to be compensated by an automatic fire fighting system to prevent fire propagation
- Control and suppression of fires in the entrance hall (e.g. cafeteria, meeting areas)
- Protection of exposed glass facades and steel structures to avoid structural fire protection measures

Case Study Hospital LKT Baden

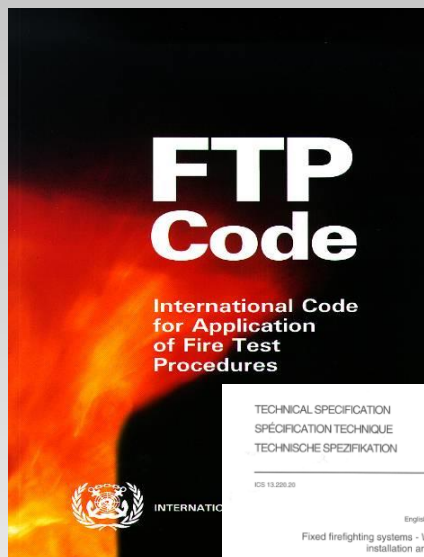


Fire Protection Concept

- Protection concept based on a wet high pressure water mist system for all areas adjacent to the entrance hall
 - System design based on OH1 risk classification with 72 m² operational area (room + ceiling void) for 60 minutes operation time
 - Challenge due to ceiling height up to 12 m in the entrance hall
- ➔ Requirement for fire tests for heights up to 12 m ceiling height



System Testing and Acceptance Process



Definition of Fire Scenario

- Full scale fire test scenario developed based on requirements of CEN TS 14972 standard Annex B
- Fire test defined based on public spaces test of IMO A800 concerning
 - Fire load
 - Arrangement of fire load
 - Ventilation conditions

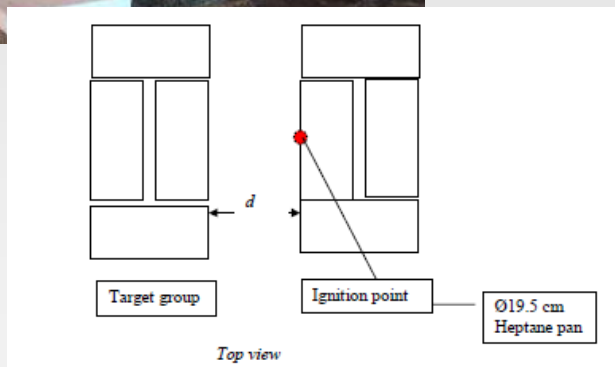
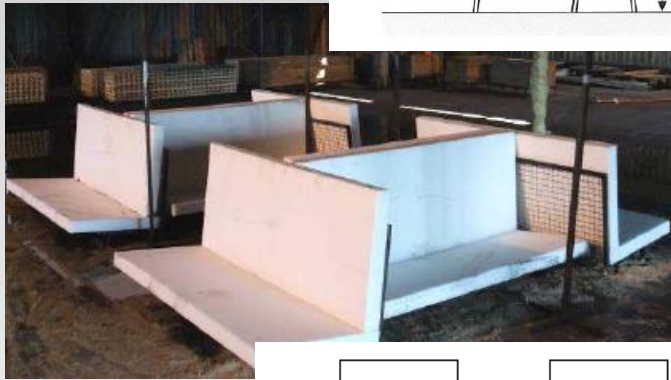
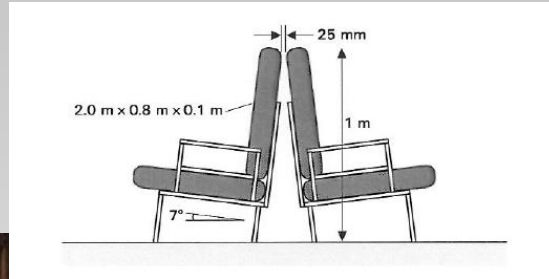
Fire Tests for Greater Ceiling Heights

Fire Test Arrangement and Scenarios

- Test hall of 30 m x 20 m floor area with 24 m height
- Ceiling at 12 m height with open perimeters
- Natural ventilation conditions / No enclosure effect
- Fire tests under one and between four nozzles
- Automatic glass bulb water mist nozzles
- Fire test duration 30 minutes



Fire Tests for Greater Ceiling Heights



Fire Load

- Fuel package adapted from IMO A800 with 2 groups of 4 sofas each made of polyether foam
- One sofa group used as ignition source, one as target
- 50 cl Heptane as igniter, being placed under the centre sofa

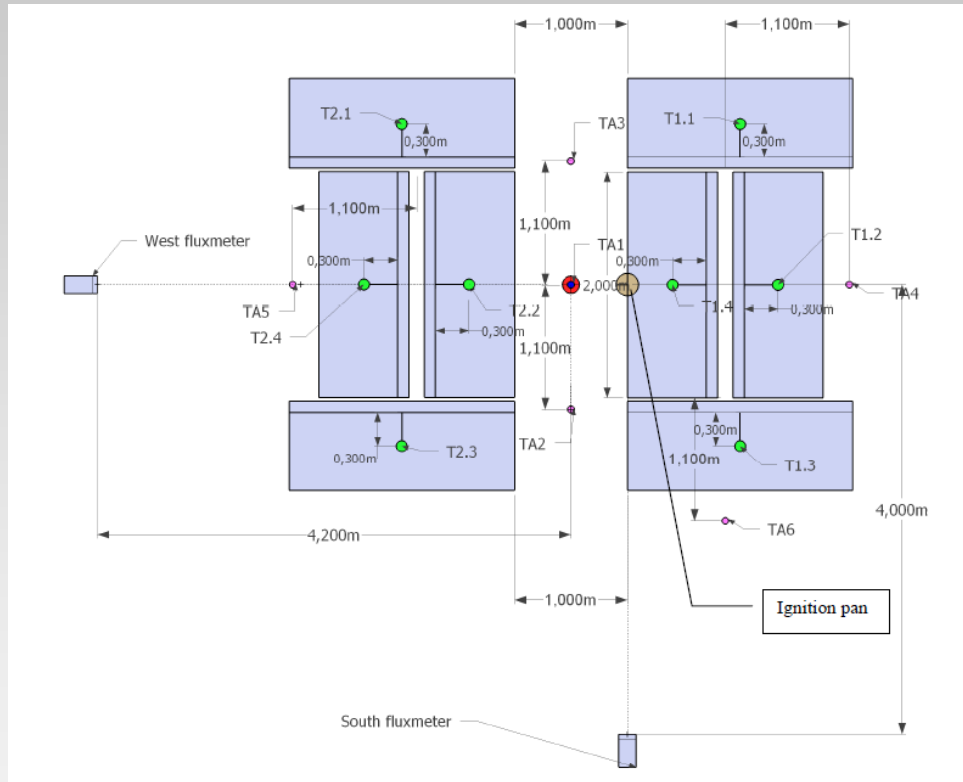
Fire Tests for Greater Ceiling Heights



Evaluation Criteria

- Temperature reduction at ceiling and in the vicinity of the fire
- Reduction of heat radiation
- Fire control and suppression to avoid fire propagation to the target sofa group

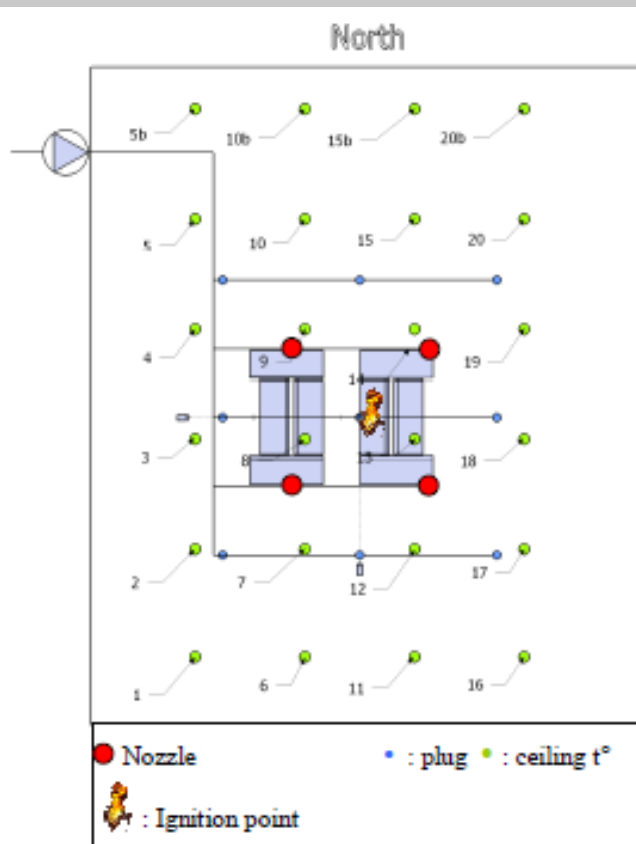
Fire Tests for Greater Ceiling Heights



Measurements

- Temperature at sofas (T1.1 to T1.4 and T2.1 to T2.4)
- Ambient temperature at 1,5 m Height above floor (TA1 to TA6)
- Heat flux











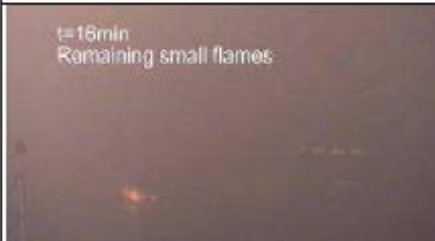
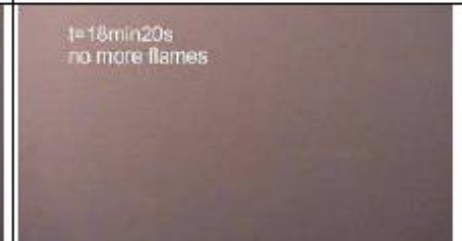
Fire Tests for Greater Ceiling Heights



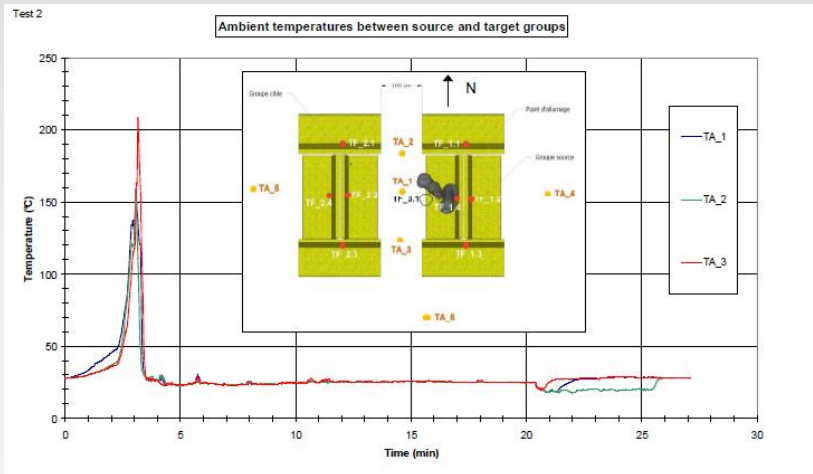
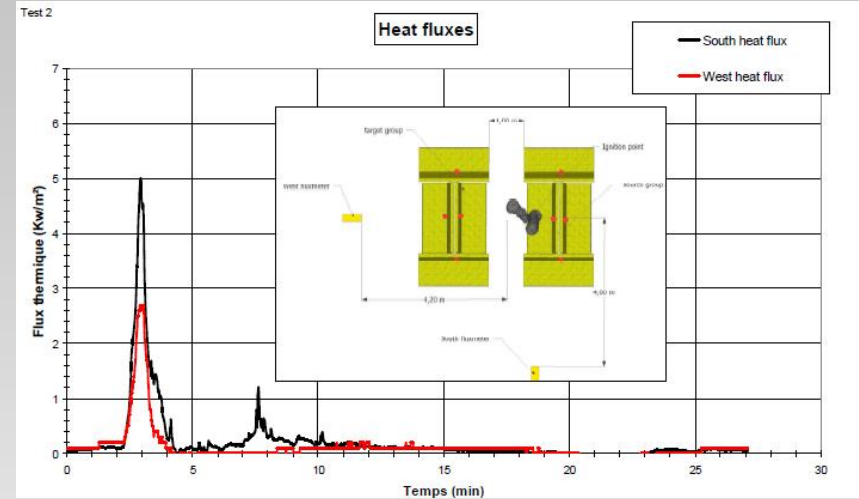
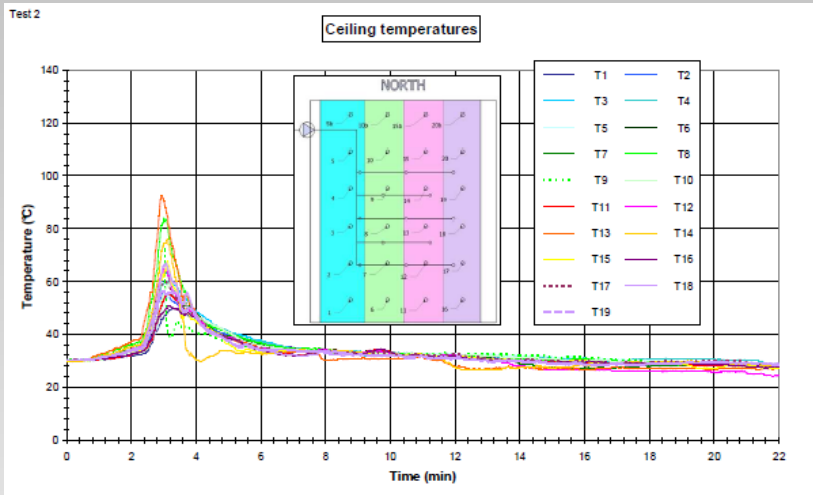
Fire Test Results under 4 Nozzles

- Activation of 4 nozzles within 2 min 50 sec
- Rapid temperature and heat radiation reduction
- Fire is controlled / No propagation to target sofas

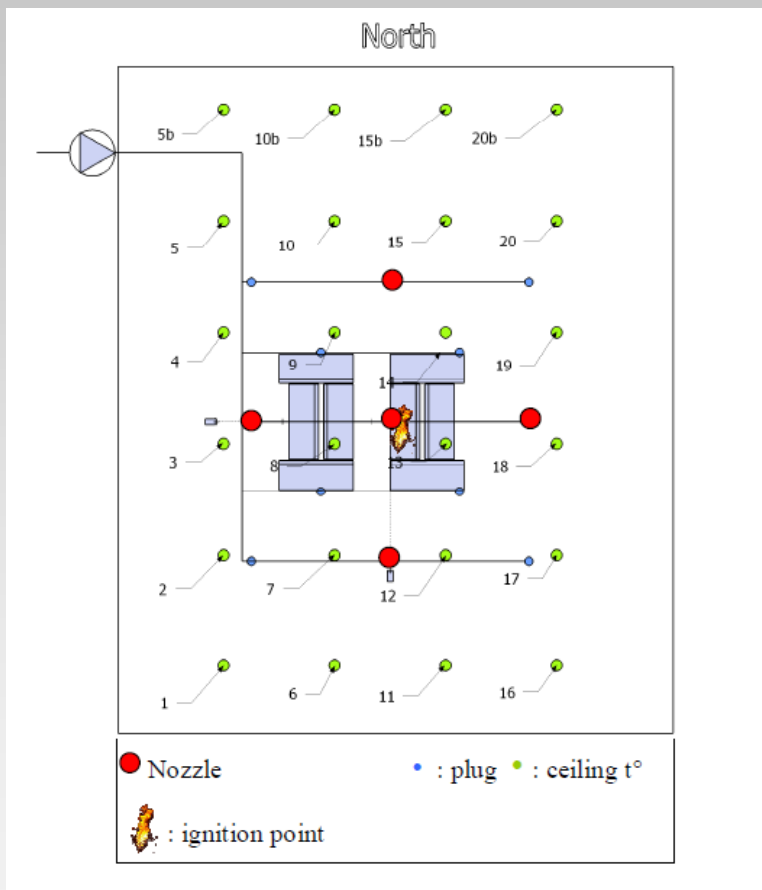
Fire Tests for Greater Ceiling Heights

 <p>t=0s Start of fire test</p>	 <p>t=1min</p>	 <p>t=3min53s Remaining flames at floor level</p>	 <p>t=4min</p>
T0 : ignition of the heptane pan	T0+1 min: propagation on mattress surface	T0+3 min 53 s	T0+4 min: mattresses continue to burn slowly
 <p>t=2min</p>	 <p>t=2min15s Flames height : 2m</p>	 <p>t=6min</p>	 <p>t=10min</p>
T0+2 min: fire is spreading on the top of ignition mattress.	T0+2 min 15 s: HRR is increasing rapidly	T0+6 min	T0+10 min
 <p>t=2min44s 1st nozzle operates</p>	 <p>t=3min07s</p>	 <p>t=16min Remaining small flames</p>	 <p>t=18min20s no more flames</p>
T0+2 min 44 s: operation of first nozzle. Right hand mattress starts to pyrolyse. T0+ 2 min 45 s: 2 nd nozzle operates T0+2 min 48 s: 3 rd nozzle operates	T0+2 min 51 s: 4 th nozzle operates. Water mist reaches floor level T0+3 min 07 s: fire control with slight suppression.	T0+16 min	T0+18 min 20 s: no more flames. End of test

Fire Tests for Greater Ceiling Heights



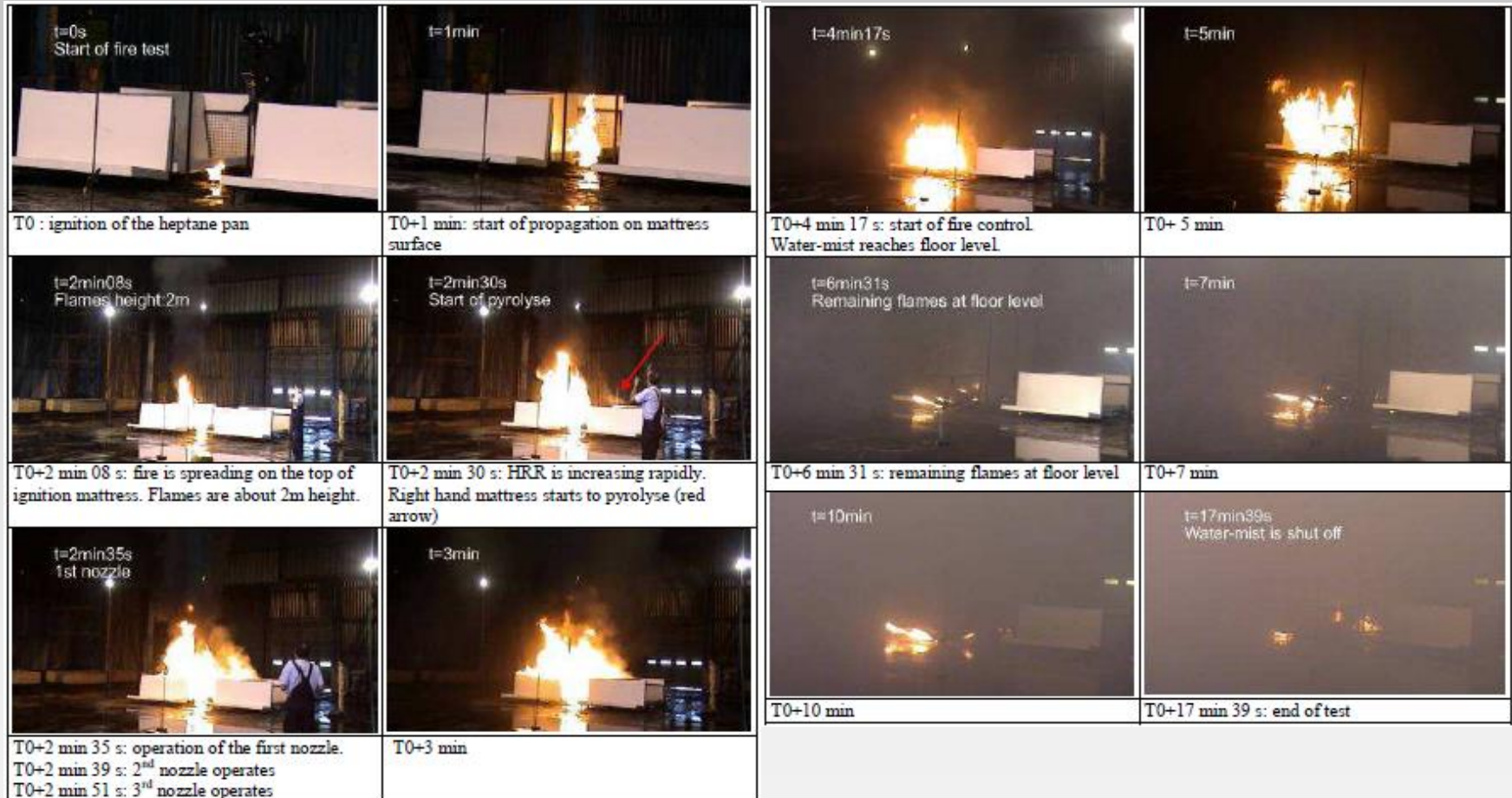
Fire Tests for Greater Ceiling Heights



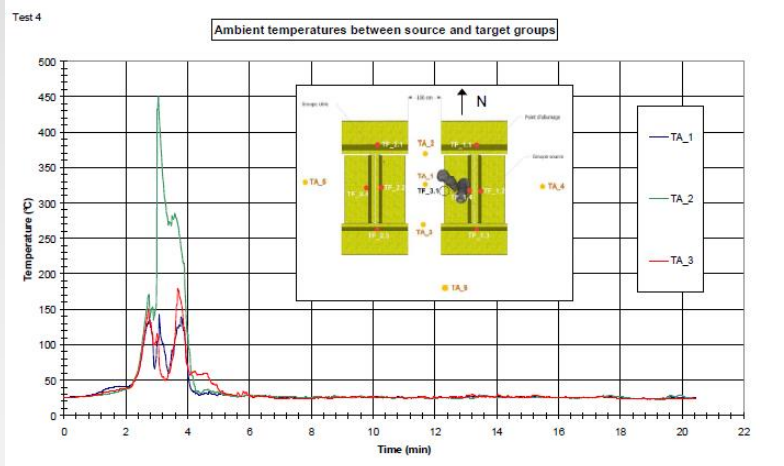
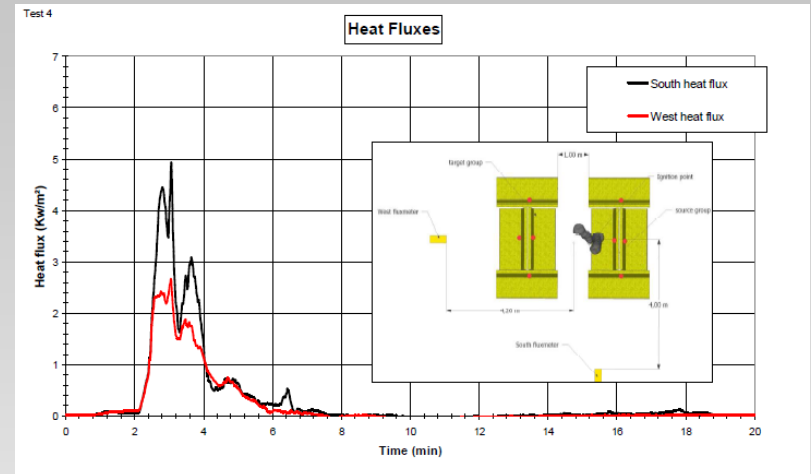
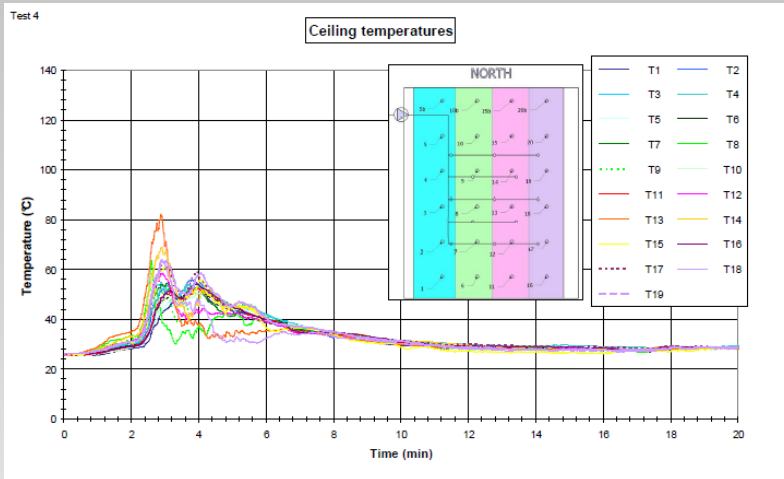
Fire Test Results under 1 Nozzle

- Activation of 3 nozzles within 2 min 50 sec
- Rapid temperature and heat radiation reduction
- Fire is controlled / No propagation to target sofas

Fire Tests for Greater Ceiling Heights



Fire Tests for Greater Ceiling Heights



Fire Tests for Greater Ceiling Heights



Reference free-burn test without water mist

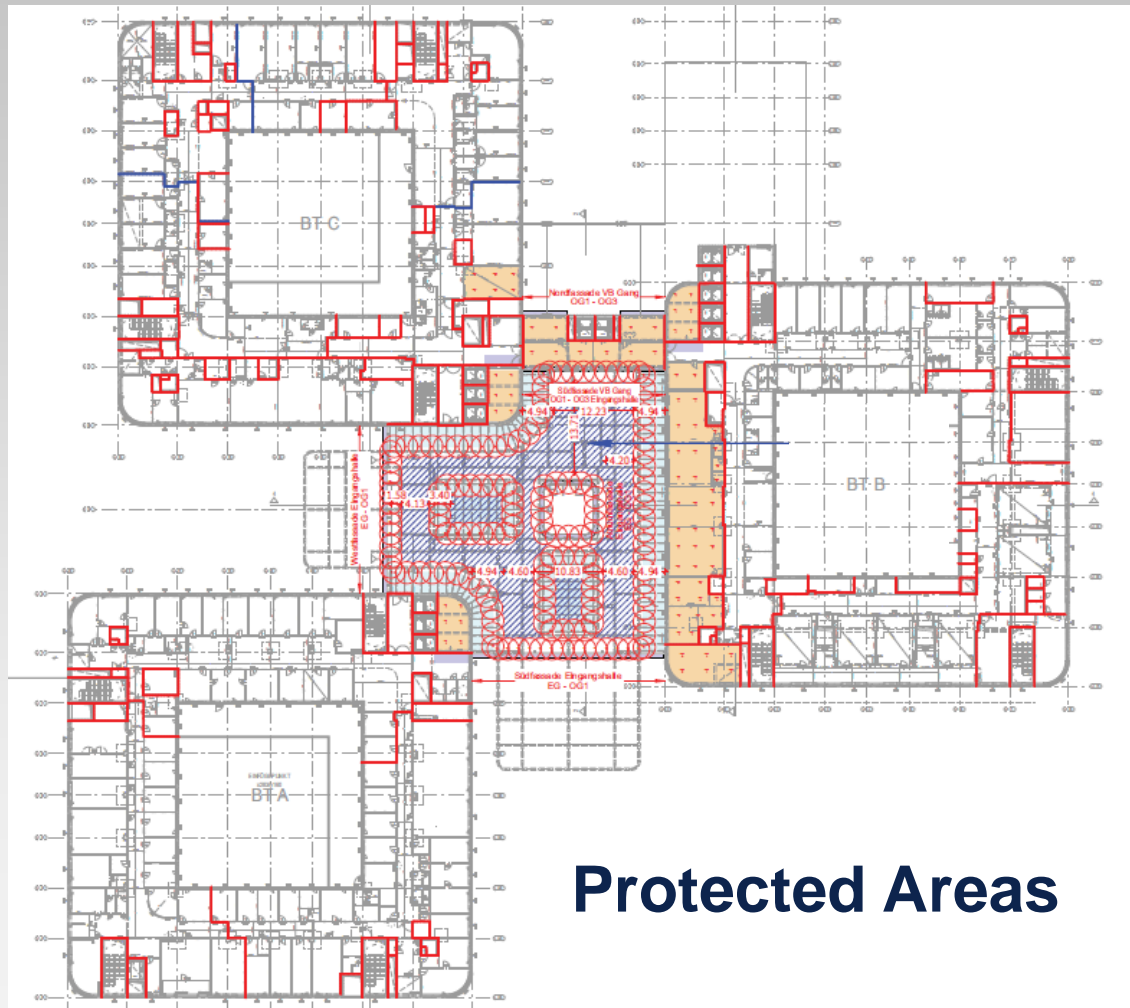
Case Study Hospital LKT Baden



Protection Concept

- Nozzle layout based on sprinkler alternative fire test results up to 5 m ceiling height
- For ceiling heights up to 12 m, specific fire tests have determined the nozzle layout
- Wet system in the entrance hall ceiling with reduced nozzle spacing along all glass facades
- Wet system in all rooms and false ceilings (3 levels) adjacent to the entrance hall in the 3 pavilion buildings

Case Study Hospital LKT Baden



Protected Areas

Case Study Hospital LKT Baden



Protection Concept

- System design to operate up to 14 nozzles along glass facades (26 m) in the entrance hall respectively 72 m² operational areas in the adjacent buildings
- High pressure pump with 4+1 x 120 l/min at 120 bar (one redundant pump unit)
- 2 x 2000 l break tank with infill from town's main water supply for 60 minutes system operation
- 1 alarm valve and 10 zone valves

Conclusion

High pressure water mist allows for architecturally pleasant solutions for buildings with extended cooling potential to prevent fire propagation and additional protection of exposed glass and steel structures to secure safe escape routes for people

System design must be part of the overall fire safety concept of the building and be evaluated by authorities having jurisdiction



**Thank You for Your
Attention**