

The Elb-Philharmony in Hamburg - A Challenging Project with an Unique Water Mist Fire Protection Approach

Webinar, October 2021



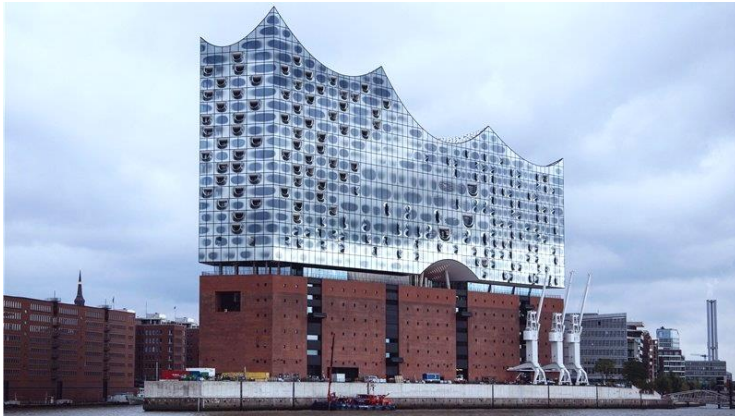
Dipl.-Ing. Ruediger Kopp

Ruediger Kopp completed his studies of Chemical Engineering and Safety Engineering at the University of Dortmund as Diploma-Engineer. Since 24 years he is involved in development, fire testing, approval and marketing of high pressure water mist systems.

Ruediger is Managing Director for fixed water mist systems at the company FOGTEC Fire Protection based in Cologne, Germany.

He is member of various international water mist guideline working groups (e.g. NFPA 750, CEN 14972) as well as co-founder of the International Water Mist Association (IWMA).

Elb-Philharmony in Hamburg



- City of Hamburg aimed to build one of the world's best concert houses
- Outstanding location at the Elbe river in the harbour of Hamburg
- New landmark of the city
- Extraordinary design by architects Herzog & de Meuron combining a brick stone building with glass facades
- Project funded by an investor, the city of Hamburg and donations by citizens of Hamburg

Elb-Philharmony in Hamburg



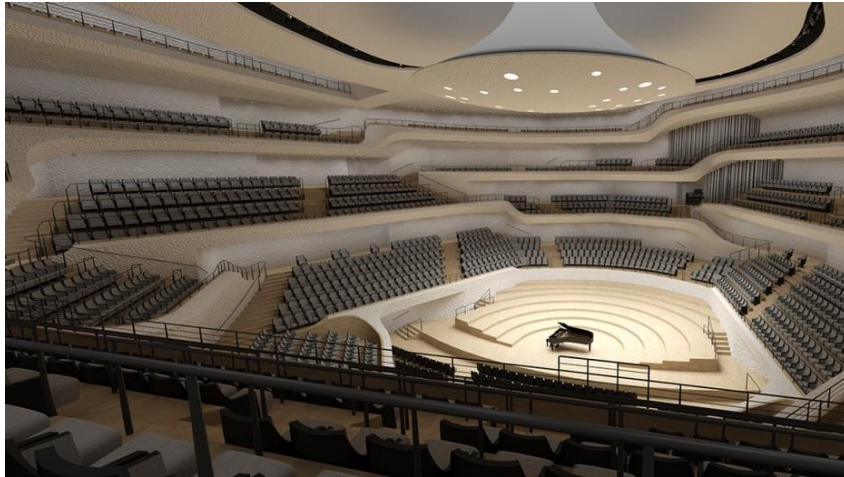
Image: Herzog de Meuron Bloomimages

- Overall building floor area is 120.000 m² with an overall height of 110 m
- Beside the philharmonic concert hall the building houses a 5-star hotel, restaurants, bars, a plaza, residential apartments and parking areas
- Concert hall has 2200 seats and an overall height of 25 m
- Hotel, restaurants, bars, plaza, residential apartments and parking areas are protected by a conventional sprinkler system



- Concert hall was a fire protection challenge

Protection of the Concert Hall



- A conventional sprinkler system could not be used due to the height of the area and due to the potential water damage when the system is activated
- A gas fire fighting system could also not be used due to evacuation time of the audience



- Development of an innovative fire protection concept based on high pressure water mist technology

Fire Protection Concept



Image: Bertold Fabricius

- Since the fire load is concentrated to the floor and seating area the fire fighting agent preferably shall be present in this area
- Instead of overcoming the concert hall height of 25 m, a floor mounted system would be advantageous
- An rapid activation of the system after fire detection would increase the safety level
- Fire detection and fire fighting system must be jointly evaluated



- Development of a protection concept in conjunction with fire consultants (HHP and DEKRA)

System Acceptance Process

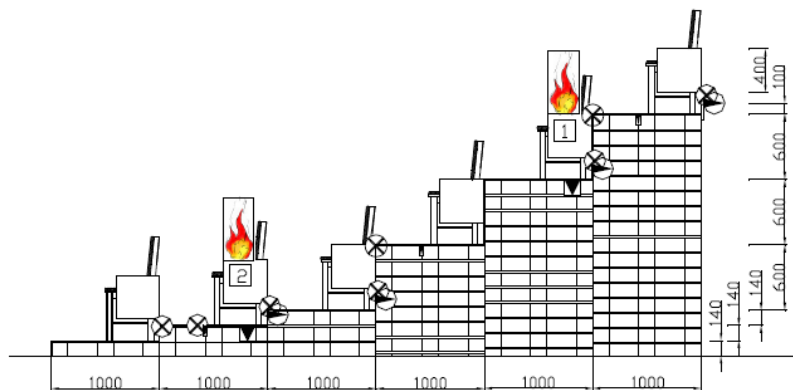


- Legislation requests for an automatic fire fighting system
- Full scale fire test scenario was developed by the fire consultants based on NFPA 750 and CEN/TS 14972 standards
- Fire tests were defined as close to reality as possible including
 - Fire load
 - Arrangement of fire load
 - Ventilation conditions
 - Fire detection

Fire Test for Concert Hall



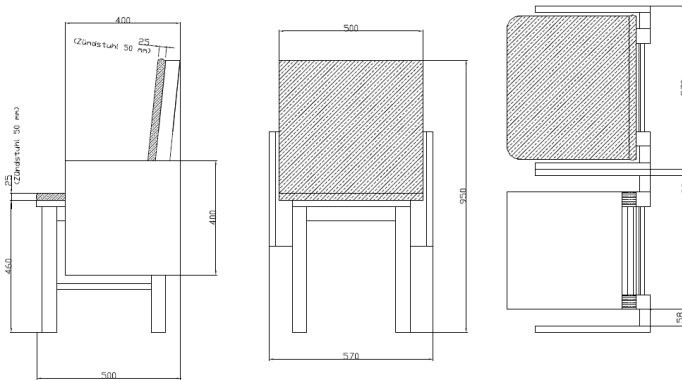
- Test field of 6 m x 6 m (6 rows of each 8 seats) in a test hall of 10 m x 15 m floor area
- Steps between 14 cm and 60 cm height / stage height of 2,4 m
- Ceiling at 5,5 m height with 1 m distance to wall
- Original ventilation conditions (6 ventilation openings with 60 m³/h)
- Two fire scenarios (low [2] and high level [1]) each between 4 nozzles



Fire Load



- Seat as specified in EN 14972 for office areas, but modified to represent the original seat of the concert hall
- Paper cushion as specified in DIN 5510-2 lying on the seat, lighted in all four corners as igniter



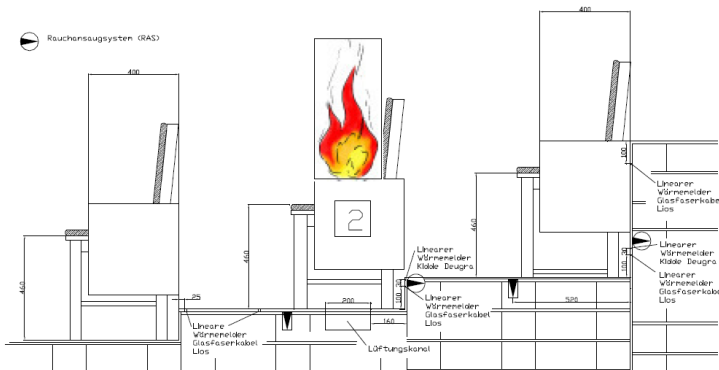
Detection System Fire Tests



- Different detection systems were tested at the low scenario [2], being more difficult to detect
- Smoke Aspirating System (aspiration pipe above each step)
- Linear Heat Detection System (cable above each step)



- Decision was made for the Linear Heat Detection System, since it detected the fire rapidly and can localise the fire precisely
- Fire consultants defined the pre-burn time for all water mist fire tests to 3 min to ensure sufficient safety margin

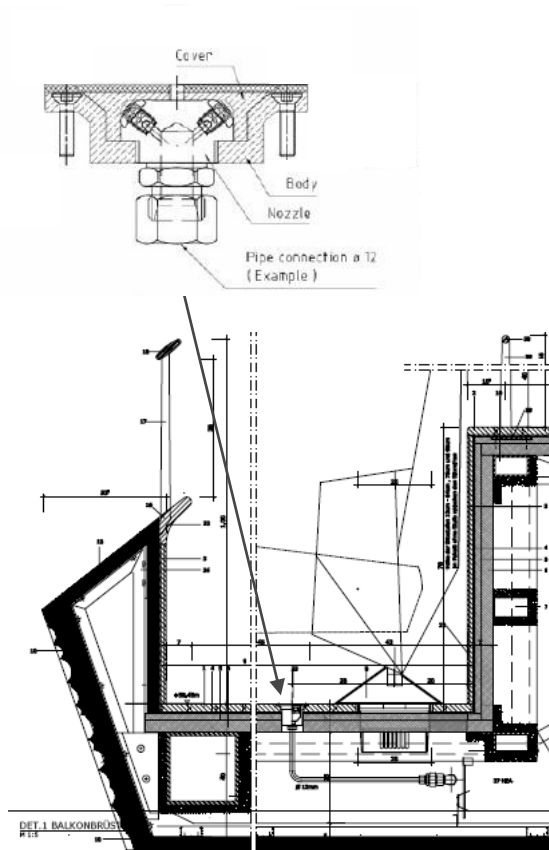


Water Mist System Results



- Temperatures in direct vicinity of the fire were effectively controlled
- Fire spread was limited
- Ventilation system had minor influence on the effectiveness of the water mist system
- Fire damage was concentrated on the ignition area

Water Mist System Implementation



- Fire tests have determined the position of nozzles and the flow rate
 - Nozzle installation in the floor with a cover, having the same appearance as the floor
 - Nozzles zoned in sections
 - Pump capacity designed to operate 3 adjacent sections
 - Small bore pipework for installation
- ↓
- Minimal disturbance of the building's architecture

Nozzle Operation Reliability



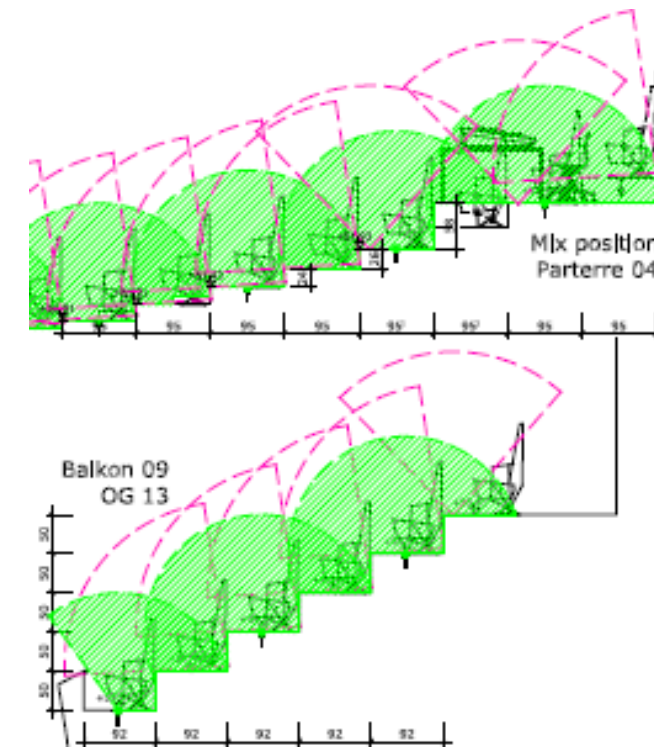
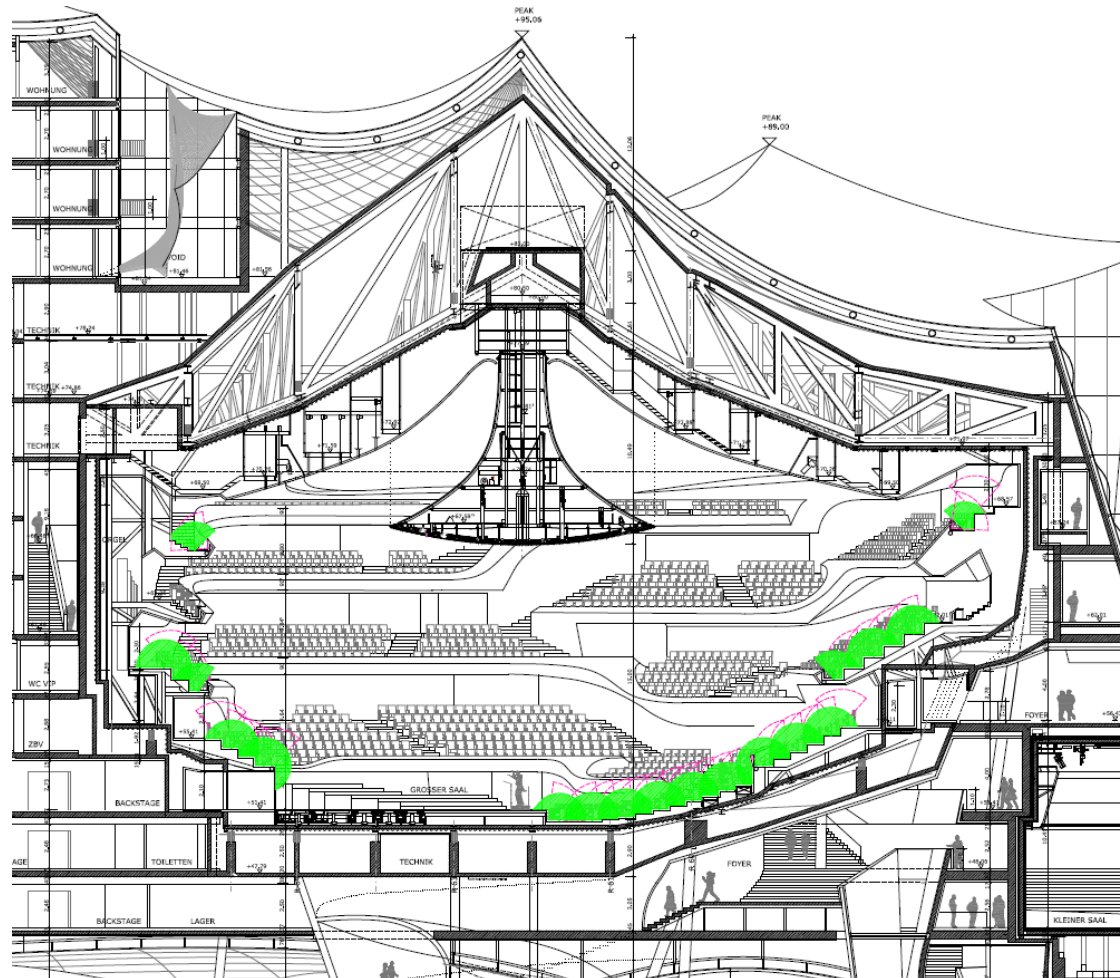
- Reliable lift-off of the cover was analysed



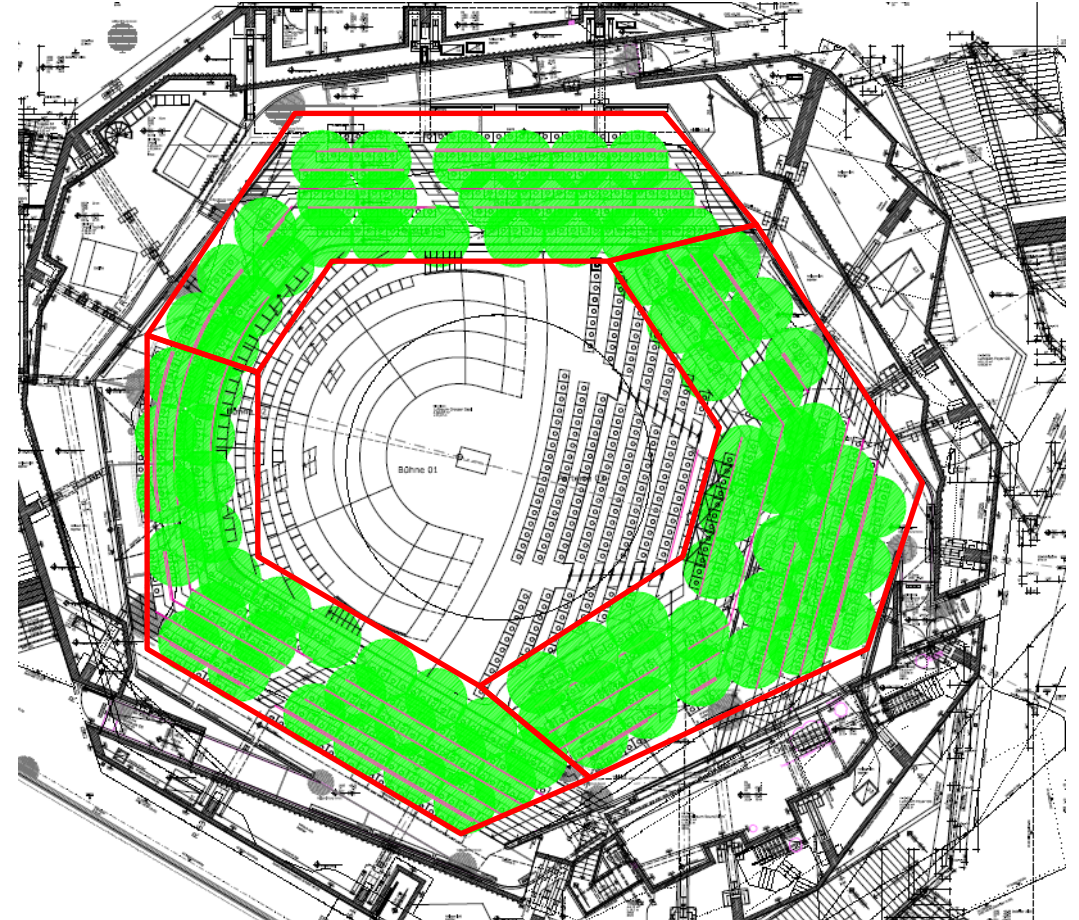
- No danger for audience by the cover
- Cover removes even if obstructed by an object, e.g. a bag



Nozzle Arrangement in the Concert Hall



Water Mist Activation Sections



Protection Concept Transfer - German Theatre in Hamburg



- Largest spoken-word theatre in Germany with around 1200 seats
- Heritage listed building opened in 1900
- Water mist system protects the stage area and the theatre hall with a combination of ceiling mounted nozzles and floor mounted nozzles in areas with great height
- Water mist was selected as fire fighting system due to the high cooling efficiency and reduced water consumption in case of activation

Protection Concept Transfer - Spanish Congress Building in Madrid



- Spanish parliament congress building was erected in 1850
- Heritage building had to be equipped with an active fire fighting system due to increase of fire safety regulations
- Water mist system protects the entire building including offices, corridors, public spaces, auditoriums and the attic
- Congress hall protected with a combination of open sidewall nozzles and floor mounted nozzles

Protection Concept Transfer - Town Hall Cibeles in Madrid



- Building erected in 1909 as headquarter of the postal services
- Today the building is the town hall of Madrid and contains a museum as well as an auditorium for public events
- Total protection area of 15.000 m²
- Compensation of missing structural fire compartmentation by a water mist system
- Large open volumes with 19 m ceiling height protected with a combination of open sidewall nozzles and floor mounted nozzles

Summary



- The presented protection concept for concert halls and other spaces with great ceiling height brings along a safe and architecturally pleasant solution for this special environment
- Smallest water amounts ensure minimal harms to the building in case of system activation
- Enhanced cooling eases evacuation by providing safe escape routes
- Compact system components eases its integration in retrofit projects as well as to new buildings
- System design must be included in the overall fire safety concept of a building and be evaluated by authorities having jurisdiction

Thank You for Your Attention



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