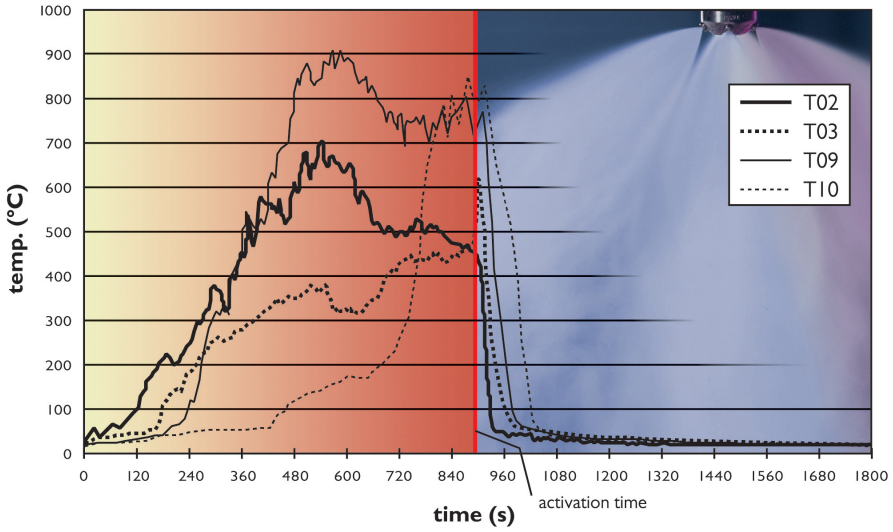
Future-proofing tall towers

Ruediger Kopp, Managing Director of FOGTEC Brandschutz GmbH, explores how high-pressure water mist technology is safeguarding icons like the Mecca Royal Clock Tower while shaping the future of sustainable, efficient fire protection in the region's most ambitious structures

High-rise architecture has come to define the skylines of the Middle East – and with it, entirely new fire safety challenges. Densification, multifunctional use and increasingly complex building geometries present architects, engineers and operators with new challenges. Fire protection is particularly important in densely built-up and populated areas. Today's fire protection systems must not only reliably protect people, property and infrastructure, but also combine sustainability, architectural quality and economic efficiency.

In this area of conflict, high-pressure water mist has established itself as one of the most forward-looking technologies: it is effective, resource-efficient and architecturally flexible. The full potential of this technology is particularly evident in high-rise buildings, where space, weight and integrability play a decisive role. Examples of this include the Mecca Royal Clock Tower in Saudi Arabia and the Gasometer in Berlin. These stunning buildings showcase how a fire protection system incorporating high-pressure water mist can be seamlessly integrated into architecturally sophisticated high-rise buildings.



Small droplets, big impact

The principle of high-pressure water mist is as simple as it is effective: water is forced through special nozzles at a pressure of around 100 bar, atomising it into droplets, some of which are microscopically small. This increases the reaction surface of the water more than a hundredfold. Upon contact with the source of the fire or the hot fire gases, the droplets evaporate in a fraction of a second; the resulting water vapour extracts heat from the environment and simultaneously displaces the oxygen.

The high cooling capacity of the water mist and the binding of smoke quickly lower the ambient temperature and improve visibility. This creates optimal conditions for evacuation and access for the fire services. At the same time, the building and adjacent areas are protected.

Compared to conventional sprinkler systems, a fire protection system with high-pressure water mist requires up to 90 percent less extinguishing water. The reduced water consumption minimises secondary damage and operational downtime after a fire. The effectiveness of the technology has been proven for every application through full scale fire tests under real conditions.

Technical and planning advantages

High-pressure water mist combines technical efficiency with planning freedom. Due to the low water volume, only small pipe sizes with a diameter of 12 millimetres to a maximum of 60 millimetres are required for main risers. This saves space, simplifies installation and allows integration even in filigree or listed structures. The high pressure enables stable system performance even across large building heights – a crucial aspect in high-rise buildings over 100 metres.

Modern high-pressure water mist systems have redundant pump modules and separate power supplies. This means that protection remains fully intact even in the event of partial failures or maintenance.

In addition, the systems utilise very compact pumps and significantly smaller water tanks. This is particularly important in high-rise buildings, as it means less static load, less space requirements and thus more usable space.

Another important aspect that is becoming increasingly significant is sustainability. High-pressure water mist works without chemical additives and is therefore harmless to humans and nature. The low water consumption also means that only a small amount of contaminated extinguishing water is produced. In addition, almost exclusively stainless steel components with a long service life are used. The technology thus meets today's environmental, social and governance (ESG) requirements and contributes to environmentally conscious building operations.

Standards and test procedures as a guarantee of quality

The reliability of a high-pressure water mist fire protection system is based on extensive full scale fire tests that demonstrate fire suppression, temperature control and damage limitation. The basis for the consistently performance-oriented testing approach are fire test protocols for office and residential areas, raised floors and suspended ceilings, as well as storage and technical rooms (VdS 3883-1/3/5 and EN 14972-2/3/6). The requirements for high-rise buildings with a height of more than 45 metres are described in the VdS 3188 standard.

Independent testing institutes such as VdS, FM, CNPP, IFAB and TÜV

are testing and certifying high-pressure water mist systems. These tests ensure that each system not only meets regulatory requirements but also demonstrates its real performance in demanding applications – from office high-rises to car parks with electric vehicles.

High-pressure water mist as a future technology in high-rise construction

With its combination of efficiency, sustainability and architectural flexibility, high-pressure water mist meets the key requirements of modern high-rise planning. The technology makes it possible to control fire risks without compromising on design or ecology.

In the wake of increasing ESG requirements, sustainable urban development and the digitalisation of buildings, high-pressure water mist is becoming even more important. **fogtec.com**

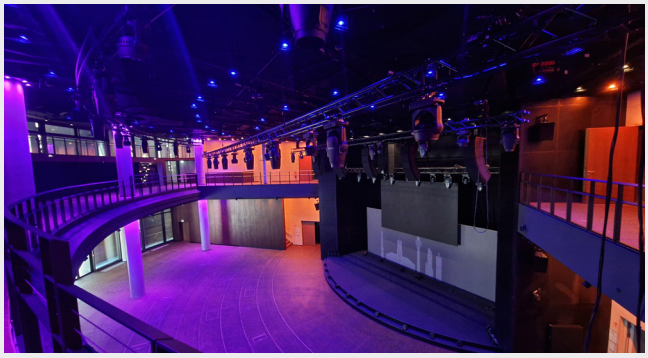
Case studies

Whether it's a historic conversion like the Gasometer in Berlin or a technical masterpiece like the Mecca Clock Tower, these projects show that high-pressure water mist isn't just a fire protection system, but an integral part of future-proof architecture.

The Gasometer in Berlin – sustainable fire protection in a listed steel structure

Few projects combine history and the future as impressively as the Gasometer in Berlin. Built in 1913 as a gas storage tank for a power plant, it has been converted in recent years into a modern 18-storey office tower. The characteristic steel structure and appearance of the building had to be preserved during the conversion, so the listed building was given a fully glazed façade behind the historic steel framework. In addition to offices, the Gasometer also houses event rooms, technical floors and a car park.

With a diameter of 60 metres and a height of 78 metres, the Gasometer is one of the three largest gas domes in Europe. The listed building placed the highest demands on fire protection. Exposed steel structures, a fully glazed façade and high ceilings called for a system that combined safety, aesthetics and technical feasibility. The engineering firm HHP therefore designed a VdS-approved high-pressure water mist system.



The entire fire suppression system was planned in Revit 3D so that spray obstacles could be taken into account. The building complex was equipped with a so-called automatic wet system with glass bulb nozzles. Around 5,000 nozzles and 34 section valves were installed on the 18 floors. Redundant pump units and two water tanks in a pump room measuring just 25 square metres ensure an operating time of at least 60 minutes.

The effectiveness of the system was validated in fire tests in accredited fire laboratories and witnessed by France's National Centre for Prevention and Protection (Centre National de Prévention et de Protection — CNPP) and Germany's Institute for Applied Fire Safety Research (IFAB).

The scenarios in the event area with a room height of 12 metres and in the car park with electric vehicles were particularly challenging. In both cases, the high-pressure water mist reduced the temperature and heat radiation to a safe level within a few minutes. In the case of the electric vehicles, the propagation of fire to neighbouring vehicles was prevented.

Thanks to the small pipe diameters, the system could be seamlessly integrated into the historic steel structure. The Gasometer thus exemplifies how modern fire protection, monument preservation and sustainability merge into a holistic solution with high-pressure water mist.

The Mecca Royal Clock Tower – fire protection at a height of 600 metres

Another exceptional example of the use of a high-pressure water mist fire suppression system is the Mecca Royal Clock Tower in Saudi Arabia. At 600 metres, the structure is one of the tallest buildings in the world and combines a hotel, museum, observatory and the world's largest clock.

The special fire protection requirements arose from the combination of steel construction in the upper part of the building, high fire loads and limited load-bearing reserves. A conventional sprinkler system is installed in the lower 400 metres of the hotel. However, for static and hydraulic reasons, a sprinkler system was not an option for the upper part of the Mecca Royal Clock Tower.

In close consultation with architects and fire protection consultants, a high-pressure water mist system was therefore installed in the upper 200 metres – including the Royal Clock, the Islamic Museum and the observatory. The fixed system was supplemented by manual firefighting stations operated with water mist lances.

Full scale fire tests proved the high efficiency of the technology even in exhibition rooms over 10 metres high. The result: reliable, resource-saving and space-saving fire protection in a building that is regarded worldwide as a symbol of technical and architectural excellence.