

Mists of time

Heritage buildings require a challenging combination of effective fire protection performance and aesthetics – which is where high-pressure water mist comes in, writes Ruediger Kopp.

The fire protection challenge for heritage sites of unquantifiable societal value is to combine an effective system with an aesthetic appeal. Effectiveness here means reliable fire fighting coupled with an extinguishing agent that does not destroy the building's structure or the housed objects.

Damage from the use of too much water can in some circumstances be even more devastating than the fire itself, which is the disadvantage of a conventional sprinkler system. In addition, the space required by a sprinkler system is often just not available in existing heritage buildings.

While gas extinguishing systems are reliable in closed rooms and not that dangerous for the objects they are protecting, in many cases they are hazardous for human beings. They, therefore, cannot be used in public areas prior to their evacuation.

High-pressure water-mist systems are a staunch alternative and quite often they are the only solution for heritage buildings. Firstly, they use pure water so they are completely safe for people in enclosed areas. Secondly, as the high pressure of up to 140 bar and special nozzles produce a fine water mist these systems can operate with only around 10% of the water amount of conventional sprinkler systems, considerably minimising any water damage.

In addition, immediately after system discharge, there is a strong cooling effect that protects people and property from the effects of radiated heat. The droplets' shielding effect

reduces heat radiation and generates an effective water mist shield for any persons escaping from the fire and for rescue teams as well as for exposed building components, wall openings, facades etc.

Another significant factor is the oxygen displacement effect. The rapid vaporisation of water droplets withdraws energy from the fire. The water vapour, which has a volume 1,640 times greater than liquid water, displaces the oxygen directly at the fire source, thereby creating a suffocation effect similar to an extinguishing gas. Moreover, as this only occurs directly at the fire source there is no danger to people escaping from the fire.

Such a system was installed in Grafschafter Castle in the town of Moers, north of the city of Dusseldorf in Germany.

The castle, located in the middle of the town centre, is one of the oldest preserved late-Middle Age ring forts in the Rhineland and is an important tourist attraction with a museum that has been open to the public since 1901.

Due to substantial shortcomings in the castle's fire safety the city council to completely refurbish all the electrical installations and to integrate a fire detection and fire fighting system. Conventional sprinkler technology was ruled out because of the valuable exhibits, the wooden floors and other structures.

An automatic high-pressure water-mist system was identified as the most advantageous solution due both to the highly restricted space available for pipe-work, pump and water storage installation, and also to the limited water damage that would ensue in the case of system activation. The system design was based on full-scale fire test results which were independently evaluated by a fire consultant and approved by a certification body.

The entire pump unit including a water break tank was installed in a small room measuring only 10m² and, today glass bulb nozzles protect all six floors of the castle. Fitting the pipe-work in the building was a challenge with ceiling and wall structures hundreds of years old, greatly varying in their stability. The small-bore, lightweight pipes of the high-pressure water mist system worked well due to their slight load.

The city council of Moers appreciated the benefits of water-mist technology and have since approved the technology for other applications including a retirement home sited within a hospital.

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Right and top: Grafschafter Castle in the town of Moers, Germany is now protected by a high-pressure water-mist system.

