



## Evaluating a range of airflow conditions with high-pressure water mist activation in data centres

### Design requirements for the protection of data centres

The complexity of data centre design nowadays means that a fire risk analysis is commonly adopted to examine those specific areas and fire hazards.

As defined in Chapter 3 of NFPA 75, a fire risk analysis is “a process to characterize the risk associated with fire that addresses the fire scenario or fire scenarios of concern, their probability, and their potential consequences.”

Therefore, for the high-pressure water mist system to be effective during design, it should be incorporated in the fire risk analysis as an integral part of the design process, where specific fire scenarios and corresponding hazards are identified. For example, the probability and the potential consequences of personnel injuries, equipment loss, delays in accessing information, liability costs, disrupted revenue growth and other expenses incurred as a result.

What happens once a SEM-SAFE® high-pressure water mist system is installed, and operation of the data centre needs to be optimized?

### Operation of data centres: safeguarding protection objectives

Maintaining the desired temperature (and humidity level) is a key challenge in all optimization strategies for data centres. Different strategies for achieving this are normally considered, and so we integrate them early in our SEM-SAFE® designs.

We work closely with clients to ensure SEM-SAFE® designs respond to a variety of different airflow environments and meet their operational targets regarding efficiency and maximum uptime.

In a fire incident we aim to control and suppress the fire, which limits the spread of heat and smoke to other areas of the data hall / facility. This prevents damage to servers and other sensitive equipment that would be affected by heat and smoke from a fire. The airflow conditions in data centres are critical to keep operations running, and SEM-SAFE® systems can perform around those conditions.

FM 5560 recommended forced ventilation to be included in the fire tests, to a nominal upward velocity of 1 m/s through perforated floor openings and 1.2 m/s horizontal airflow from server cabinets.

#### **CFD validation with SEM-SAFE® fire tests**

SEM-SAFE® systems have been fire tested to allow the data halls to run at higher temperatures, saving costs on additional cooling, and so protecting areas from accidental activation. SEM-SAFE® fire tests include a range of temperature-rated nozzles to suit the ambient temperature in the data hall.

Detailed verification and validation assessments on CFD (Computational Fluid Dynamics) models have been based on SEM-SAFE® fire tests. We have been investigating fire scenarios designed to verify that the basic physics within CFD models have been correctly implemented from our fire tests. The models are used to evaluate the performance of SEM-SAFE® over a range of performance indicators.

We have assessed the performance of SEM-SAFE® for a range of airflows in our data centre design, with validated CFD models and a range of airflows, allowing operators more freedom in their design / cooling strategy without compromising the protection objectives.

#### **Who we are?**

Danfoss Fire Safety A/S, part of the Danfoss Group, is a global leader in fire-fighting systems. Under the brand name SEM-SAFE®, numerous data centre solutions have been installed worldwide, such as Verne Global and VIRTUS, to name a few.

At Danfoss, our fire safety engineering team understands the local regulatory regime just as much as we understand the realities and uncertainties inherent in fire safety in data centres. We therefore work with clients to provide comprehensive support from the design stage, spatial coordination, technical design, installation, rigorous testing and commissioning, handover, maintenance and repair services through our regional offices, associates, and agents worldwide. We develop water mist systems to meet sustainable, aesthetic, and functional needs of our clients, while ensuring compliance with all applicable local and national requirements.