

Integrated fire safety solutions for data centers

These days, data centers hold information that is absolutely crucial to the daily operation and smooth running of many companies, large and small. In the event of a fire taking hold in such a center, the damage that might be caused would be far greater than the costs involved in the simple destruction and loss of property. Therefore, when it comes to the protection of data centers, an integrated solution for fire safety and security is absolutely vital.

Data, be it corporate, customer, employee or personal information, is the lifeblood of any commercial organization and needs to be protected from both external and internal threat. Ongoing and reliable access to information allows companies to conduct their daily operations, selling their products, systems and services, responding to customers' enquiries, collaborating with business partners and keeping employees informed. With the amount of stored data continuing to grow daily, it is not surprising that data centers are equipped with systems to secure data against increasingly sophisticated internal and external attack and to combat physical intrusion and even sabotage. For no organization can afford breaches of information security, disruption of its network or the loss of irreplaceable data. For some, even one or two hours of downtime can be crippling. But, while external security threats and data breaches are well guarded against, the threat of fire within data centers is not always fully covered.

According to the leading German industrial insurer and security systems consultants, HDI-Gerling, manufacturers operating a 'just-in-time' supply service often suffer a complete breakdown in their ability to carry on operating within 24 hours of losing all their data processing function. Banks and similar commercial organizations statistically last just one and a half days longer.

So it is ironic that as the most likely cause of a catastrophic failure – for themselves and their clients – the threat of fire is underestimated. Housing as they do such sensitive, vital information and systems essential to the survival of their clients, data centers present a greater need for absolute protection whilst paradoxically demonstrating a greater level of risk of fire. The electrical power and extensive cabling that drive the computing systems provide a constant source of

potential ignition, particularly under the raised floors – and the many thousands of plastic components supply a plentiful source of combustible materials.

Both preventive and active fire protection is therefore particularly relevant in such vulnerable locations. In ever more densely packed layouts, today's servers necessitate comprehensive air-cooling up to 8600watts/m². The resulting, higher, air exchange will partly remove any smoke with the airflow, making early detection by traditional systems even more difficult, as well as increasing the risk of the fast spread of fire to other areas. Even a smoldering fire without flames can damage hardware through sooting, corrosion and toxic gases - and represent a real threat to the lives of all the occupants of the building. The time between the initial outbreak of fire and its successful extinguishing after detection, is the critical factor when attempting to prevent operational failure of a data center.

Perfect interaction

The perfect interaction between fire detection and extinguishing is a basic requirement for ensuring effective fire safety and minimum downtime. Analyses by VdS, one of Germany's leading independent testing institutions in fire protection and security for many decades, show that the prime cause for fire safety system failure is the interface between detection, alarming, control and extinguishing. Early, reliable detection of a fire and the initiation of appropriate extinguishing measures are critical factors in an effective protection concept. Fire detection, evacuation and extinguishing systems must therefore be fully compatible with each other. Systems with real interoperability from a single source would therefore be preferable, requiring a partner with competence not only in the detection and extinguishing technologies but in the interoperability processes themselves.

Siemens offers comprehensive, one-stop solutions selecting the most appropriate system for individual installations covering every phase of a project, be it prevention (consulting, planning), detection, response (alarming and evacuation, voice alarm and extinguishing) and recovery (recovery of system functionality).

Prevention – risk analysis and beyond

The role of risk analysis is a vital one in many different fire safety scenarios – none more so than in data centers. From the outset, Siemens partners with architects, planners and data center operators to analyze risk and provide real planning and project management. Beyond this initial consultancy role to identify and plan for the specific risks, it is important to recognize the ongoing need for maintenance and modernization throughout the life of the center. Lifecycle management services provided by Siemens ensure the initial investment in a fire safety system is protected in the long term.

Early warning improves opportunity for swift intervention

Heavy power loads or a defective piece of equipment in data center equipment can quickly lead to overheating or a short circuit. A typical fire will start slowly with a long period of overheating and smoldering before erupting into flames. To detect the overheating and avoid the onset of flames, very early smoke detection is required. If smoke is greatly diluted by high ventilation, aspirating smoke detection will provide the earliest possible warning even when the smoke is barely discernible to people. Air samples are continuously taken at the danger spots, usually in the circular airflow as well as amongst the server racks and carried to the sampling device. As soon as smoke particles are detected by the air sampler, a pre-alarm or an alarm is triggered, depending on the smoke concentration. The response characteristic is determined according to the application. Sensitivity ranges from normal to high, allowing even a minimal smoke concentration to be identified unequivocally at an early stage. This saves valuable time needed in clarifying the cause and in taking counter-measures such as turning off the cooling system, gentle shut-down, data export and selective shut-down.

Shutting down equipment at the earliest indication of fire will stop even corrosive combustion gases developing further. In a 'gentle' shutdown, an intelligent server management is activated to divert valuable data to neighboring server racks. This can only be achieved by the combination of an appropriate software/hardware environment with the earliest possible fire detection. The final shutdown of power only takes place when the transfer of data is complete.

If such a 'gentle' shutdown is considered too risky, then there is the alternative method of aspirating smoke detection with verification by point-type detectors. In this system, the cooling system is shut down after pre-alarm, the point-type detectors verify the presence of combustion and trigger the extinguishing system.

Verification of alarm

In order to prevent false alarms driving the equipment, two separate detectors should sound an alarm before the extinguishing system is activated – a single detector causes the system only to go into a state of pre-alarm. The Siemens detection concept integrates two technologies – via aspirating smoke detection combined with Sinteso S-LINE detection – on a single loop. As soon as the aspirating smoke detection system triggers an alarm, the ventilation system is shut down in order to facilitate verification by the S-LINE detectors.

Sinteso S-LINE detectors offer a complex and unrivalled signal evaluation delivering unmatched detection accuracy and quick notification thanks to their ASA technology (Advanced Signal Analysis). Even under the most difficult conditions, Sinteso S-LINE detectors distinguish between genuine danger and deceptive phenomena, and signal alarm only when threat is imminent. Only when the alarm is reconfirmed, the extinguishing system is activated.

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In case of fire, standard alarm sounders and sounder beacons are used to alert the building's occupants. To ensure more precise information and instructions for action, Siemens recommends the voice alarm system E100 with automatic voice messages and live announcements, which are automatically activated by the fire detection system. After the data center and neighboring areas are evacuated, all openings are closed so that the room is airtight for the discharge of the extinguishing agent.

Extinguishing

The method of delivering the extinguishing agent and selecting the correct agent for the given application is a very important factor in optimizing protection. In critical applications, a dry extinguishing system is essential because of the sensitivity of the IT infrastructure. Water is generally not used as an extinguishing agent in data centers, the only exception being in generator rooms in which gas/water-combined solutions are used because of the thermal risk. Two types of gas extinguishing solutions are especially suited for data centers: solutions with inert gas and solutions with chemical extinguishing agents.

Even though dry extinguishing systems are the best choice for the protection of data centers, latest technological findings show that in very rare cases computers and HDDs can face problems after the extinguishing process has been triggered. These problems may range from automatic shut down of a HDD with no damage after restarting to more severe disturbances. It was found that the main cause of these problems was the high noise level caused by the discharge of the agent during the extinguishing process. To answer this challenge, Siemens specially developed its own silent discharge nozzle technology, which is at the core of the new Sinorix Silent Nozzle (patent application has been filed). It ensures comparatively quiet and effective extinguishing in data centers and server rooms. The Sinorix Silent Nozzles can be used both with natural gases and chemical agents with the same discharge time as standard nozzles.

For medium- to large-sized data centers, Sinorix CDT (Constant Discharge Technology) from Siemens is recommended. This solution with inert gas enables efficient extinguishing without pressure peaks. Thanks to the unique, by Siemens patented valve technology, nitrogen is discharged with constant pressure during flooding. Thanks to the constant flooding, the piping network can be dimensioned smaller compared to conventional extinguishing systems and the overpressure flaps can be reduced by up to 70 percent. Thus, Sinorix CDT is especially suited for interior rooms where large overpressure flaps are hard to realize due to structural circumstances. For small to medium data centers, Siemens recommends Sinorix 1230, based on 3M Novec 1230 Fire Protection Fluid. It floods the room within seconds and starts extinguishing the fire before any electronic equipment is severely damaged.

In critical applications such as generator rooms, uninterrupted power supply (UPS) systems ensure continuity in case of power cuts. For those systems which represent a thermal risk, Siemens offers

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Sinorix H₂O Gas based on nitrogen and water. This combines highly efficient nitrogen extinguishing with a cooling water mist. Fires are reliably extinguished and reignitions effectively eliminated.

Important preconditions for reliable extinguishing

Besides the quality of individual components, competent planning, installation and implementation are all important to ensure the reliability of an extinguishing system. The following conditions should also be implemented:

Minimal nozzle pressure 10 bar: when extinguishing with Novec-Systems, a minimal pressure of 10 bar ensures the best evaporation and even distribution of the extinguishing agent. This is an essential factor because Novec is stored in liquid form, but extinguishing takes place in the gas phase. It is therefore recommended that even the nozzles, which are the furthest apart (with the lowest pressure) work with a minimal nozzle pressure of 10 bar. This ensures that the extinguishing concentration is soon reached and that the fire is extinguished as quickly as possible. A minimal nozzle pressure of 10 bar is also recommended when extinguishing with inert gases. This leads to the ideal mixture of the extinguishing agent with the surrounding air and thereby to fast and reliable extinguishing.

Maximum nozzle height 5 meters: if a room is higher than five meters, installing a second pipe layer with nozzles recommended (obligatory according to VdS). This ensures a fast and even distribution of the extinguishing agent so that the extinguishing concentration can develop everywhere.

Maximum flooding duration 10 seconds (Novec)/60 seconds for nitrogen (120 seconds (according to VdS): by reaching the flooding saturation time within ten seconds, the effective concentration of chemical extinguishing systems is reached quickly and the fire is efficiently extinguished. Reaching the extinguishing concentration quickly additionally minimizes the creation of harmful hydrofluoric acid in the event of an open fire.

Openings that cannot be sealed and ventilation systems: openings have to be configured in such a way that they close automatically when flooding begins. Small openings are permissible as long as they do not exceed certain parameters. Ventilation systems have to be turned off, if possible, before the beginning of the flooding or at the same time. If this is not possible, compensating for the losses must be calculated.

Max. recommended coverage of nozzles 30 square meters: If the area covered by the nozzles is greater than 30 square meters, then this will lead to more swirling. A larger area of nozzles also means that more extinguishing agent is released. When extinguishing with chemical substances, a very high discharge volume per nozzle prevents the complete evaporation of the extinguishing agent. Furthermore, the danger exists that the extinguishing agent concentration cannot be reached within ten seconds.

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Integrated solutions for a safe and efficient data center

The data center is critical as the heart of many companies' information infrastructures. That is why it is important to provide data centers with the highest level of safety. The high technical effort linked with different special disciplines requires great expertise. Including one-stop-shop providers is of great advantage for the co-ordination of individual trades and systems in the planning and creation phase up to the After-Sales Service. The complete fire safety solutions from Siemens are tailored exactly to each data center's requirements, offering maximum security against all risks of fire. In addition to fire safety, Siemens offers the necessary modules for a data center's complete security and building-control related infrastructure. The overall concept trusts in fire detection technology with point type detectors, very early fire detection, alarming and evacuation as well as extinguishing solutions and integrates air conditioning – and ventilation units, access control, video surveillance and intrusion detection as well as flaps for pressure balance.

For the integration of the various disciplines and for centralized supervision and alarm management Siemens offers a danger management system. This ensures full functional interaction between the different systems and optimized emergency procedures enabling highest possible reaction speed. With the seamless interaction of the different systems, Siemens makes an important contribution to the safety and security in data centers.

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power distribution and electrical installation technology. With around 42,000 employees worldwide (September 30), Building Technologies achieved a turnover of €6.9 billion in fiscal year 2010. www.siemens.com/buildingtechnologies

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