



Fire protection for emergency power supply

Protection of IT infrastructure, data and business continuity

For data centers emergency power supply (e.g. generators or battery/UPS rooms) is mission critical as it ensures business continuity in case of an outage. Therefore, specific attention has to be taken to protect these areas. With the help of fast fire detection, operators can quickly be informed about an event and all required technical and organizational measures can be started immediately. Ideal fire protection is always based on the interaction of different elements, amongst others: fire detection, evacuation, extinguishing and a building management system.

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Introduction

Power quality and reliability for mission critical infrastructures are an ongoing challenge in today's economy. Uninterrupted power is a prerequisite in our economy that some have taken for granted. However, the reality of continuous and clean power is significantly different from that perception. Power provided by the utilities can be poor and unreliable. This is clearly demonstrated by the numerous power outages every year that can damage sensitive equipment, cause financial loss and even endanger lives. Sudden interruptions of power can lead to serious consequences and often irreparable damage. Consider losing data on a bank's computer, dropping a phone network system for a metropolitan area: these are all examples of power interruptions that are unacceptable and need to be avoided.

For critical applications, a continuous power supply is a necessity. The first aim of the data center planner therefore is ensuring the uninterrupted power supply of appropriate quality. Depending on the region, overloading, lack of electricity or network failures can happen. Uninterruptable power supply equipment is therefore a must in practically every data center.

In order to limit fire damage in energy power supply rooms, appropriate measures are required in the area of structural, technical and organizational fire protection.

Highlights

- Backup electricity equipment is a must to ensure business continuity in a data center
- Electricity is the primary energy in a data center and appropriate protection measures are crucial
- UPS units are responsible for 10% of fire incidents in data centers*

* NFPA Fire Analysis and Research, 2012

Basic conditions

Objective

- Detecting an unusual aerosol concentration and informing a technician so that the situation can be assessed and the appropriate measures can be taken (e.g. turning off the device).
- In the event of a significant aerosol development pointing to an incipient fire, damage has to be minimized by shutting down the systems and extinguishing the fire with an automated extinguishing system.
- If there is a fire, the spreading of the fire to other areas must be prevented.
- Early alarming of all people at risk, safety officers and the fire brigade
- Fast and safe extinguishing to ensure business continuity

Typical fire hazards

- Overload or short circuit of electrical components
- Technical fault in a generator, battery unit
- Fuel, plastics or batteries catch fire

Typical development of a fire

In these areas, there is no typical development of a fire – a fire can start with a smoldering phase (e.g. short circuit) or directly with an open flame (e.g. leakage of flammable liquid such as oil):

- Overload or short circuit of an electrical appliance can lead to a fire which starts with a smoldering phase during that smoke is generated that can be seen increasingly. If such an incipient fire is detected in an early phase, it can be extinguished by disconnecting the power supply or extinguishing with water-combined agents in order to cool down hot surfaces.
- If an open fire is detected too late, it can quickly spread to adjacent units and can then be extinguished only by an automated fire extinguishing system and the fire brigade.

Critical points

- Deceiving the fire detectors with smoke (e.g. excessive oil combustion)
- The fire has to be restricted to the area
- Open flames could quickly spread around the area affecting adjacent rooms
- Fire must immediately be quenched not to affect the other back-up units with consequent total power shutdown

Solution

Specific attention has to be taken with regards to the protection of the emergency power supply as it is critical to the availability of the data center. In the following we describe protection concepts for the following two types:

- Rooms with diesel generators**
 If a power outage occurs, diesel generators start up automatically within seconds. While the generators go through a short start-up phase, batteries deliver power so that operations can continue uninterrupted. The diesel generators then take over and provide the complete power supply for the data center.
- Battery rooms (including batteries, electrical switch gear, inverters)**
 Batteries can provide power during short outages. When electricity fails completely, power is delivered via this uninterruptible power supply (UPS) until the emergency standby system is active. The UPS apparatus also compensates for voltage fluctuations and distortions. However, batteries cannot bridge the gap for power outages that last longer than a few hours or days.

Rooms with diesel generators

Details	Comments/Notes
Automatic fire detection: ASA neural fire detectors	Early and reliable detection of fires with: <ul style="list-style-type: none"> Point-type detectors with <i>ASAtechnology</i> Different sensitivity levels can be set Depending on the risk other detectors might be appropriate. The final selection needs to be evaluated with an expert case by case.
Manual fire detector: Manual call point	Manual call points with direct or indirect trigger (depending on local regulations) <ul style="list-style-type: none"> Manual call points (MCP) are used for triggering a general alarm throughout the building.
Alarming: Sounders, beacons, optical signaling	The minimum installation is a fire alarm sounder. Depending on specific needs, different options can be installed: <ul style="list-style-type: none"> Sounders, sounders with additional optical signaling Signaling signs Warning display
Automated extinguishing system: Gas/water-combined system	For the protection of generator rooms we recommend using a gas/water-combined system: <ul style="list-style-type: none"> Sinorix H₂O Gas is ideal because the nitrogen extinguishes the fire and provides additional water mist for cooling. It can be dimensioned as a single- or multi-sector system.
Pressure compensation: Overpressure flap	To prevent structural damage to the room, all gaseous extinguishing systems need pressure relief openings, which reduce the overpressure created by the release of the extinguishing agent. The size can be determined by using the calculation software.
Positioning: (see Figure. 1)	Fire detectors <ul style="list-style-type: none"> At the ceiling throughout the room Below the false floor if containing cables Throughout the false ceiling or below false floor space if used to circulate air to other parts of the building The number and position of the detectors will depend on the size of the room and the ventilation conditions Manual call point <ul style="list-style-type: none"> In the generator room next to the door At a height of 1.4 m ± 0.2 m Sounders / beacons / optical signaling <ul style="list-style-type: none"> In the generator room at the wall (from everywhere in the room visible)

- Warning display
 - Outside generator room, above the door
- Extinguishing control panel
 - In a separate room close by
- Manual release button for extinguishing system
 - In the generator room next to the door
 - At a height of 1.4 m ± 0.2 m
- Extinguishing system
 - Extinguishing agent cylinders in a separate room close by
 - Piping network with extinguishing nozzles
- Overpressure flap
 - Mounted in an outside wall, as the excess air must be able to escape into the atmosphere. If there is no outside wall, then a pressure release duct must be provided to ensure that the excess air can escape.

Integration

A seamless integration into the existing fire alarm system of the building is very important.

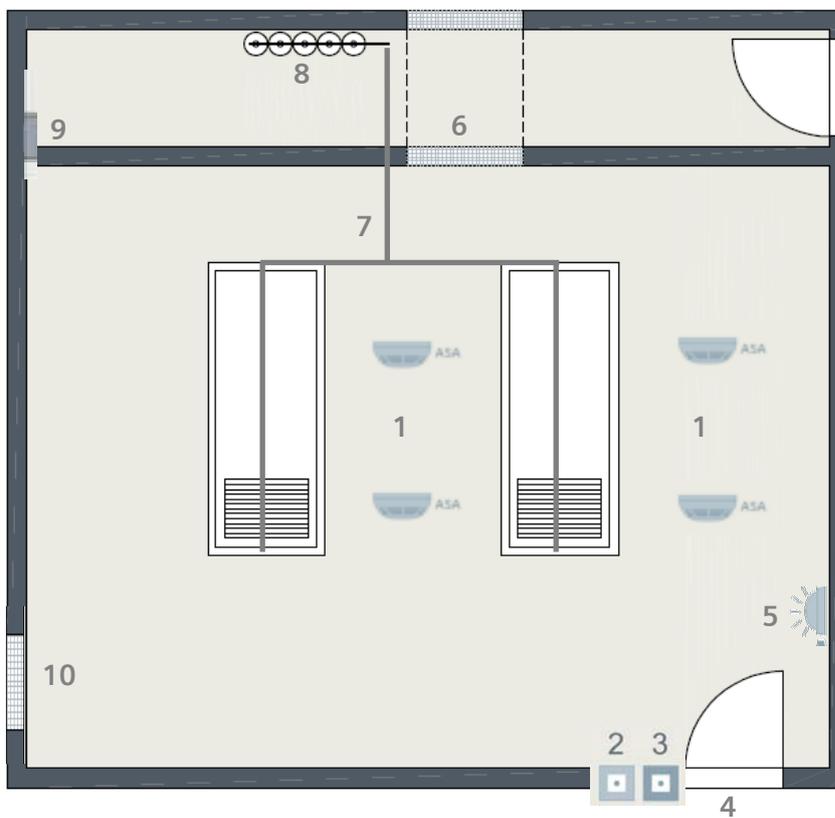


Figure 1: Positioning of the system elements

1	Fire detectors	6	Ventilation duct
2	Manual release button for extinguishing system (yellow)	7	Piping network with extinguishing nozzles
3	Manual call point (red)	8	Extinguishing agent cylinders
4	Extinguishing warning display	9	Extinguishing control panel
5	Alarm sounder with supplementary optical signaling	10	Overpressure flap

Battery rooms (including batteries, electrical switch gear, inverters)

Details	Comments/Notes
Automatic fire detection: ASA neural fire detectors	Early and reliable detection of fires with: <ul style="list-style-type: none"> • Point-type detectors with <i>ASAtechnology</i> • Different sensitivity levels can be set Depending on the risk other detectors might be appropriate. The final selection needs to be evaluated with an expert case by case.
Manual fire detector: Manual call point	Manual call points with direct or indirect trigger (depending on local regulations) <ul style="list-style-type: none"> • Manual call points (MCP) are used for triggering a general alarm throughout the building.
Alarming: Sounders, beacons, optical signaling	The minimum installation is a fire alarm sounder. Depending on specific needs, different options can be installed: <ul style="list-style-type: none"> • Sounders, sounders with additional optical signaling • Signaling signs • Warning display
Automated extinguishing system: gas extinguishing system	Regulated inert gas extinguishing system Sinorix CDT for safe extinguishing. Depending on the risk also systems with Novec 1230 might be appropriate. The final selection of the extinguishing agent needs to be evaluated with an expert case by case.
Pressure compensation: Overpressure flap	To prevent structural damage to the room, all gaseous extinguishing systems need pressure relief openings, which reduce the overpressure created by the release of the extinguishing agent. The size can be determined by using the calculation software.
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Practical experience

Ex-classified zones	Typical ex classified zones in data centers are battery rooms and generator rooms, when the combustible used to supply the electrical generator is gas. Areas in which combustible gases and vapors can occur (e.g. lead-acid batteries) are frequently assigned to so-called ex-zones (explosion protection zones). The type of ex-zone determines the nature of the risk. Therefore, special fire ex detectors and gas detection have to be installed.
Ex-detection	Electrical operating equipment used in explosion-hazard areas must meet certain safety requirements. Fire detectors used in explosion-hazard areas must comply with a particular type of ignition protection so that they can be ruled out as potential ignition source. An ignition protection class is considered to be the set of measures which are put in place on electrical equipment to prevent them igniting an explosive atmosphere. It sums up all measures taken in designing electrical operating equipment in order to prevent the ignition of an explosive atmosphere. Each type of ignition protection is advantageous for particular types of devices or applications. This is based on the principle of isolating ignition sources. The norms describe several types of ignition protection which can be used individually or in combination.
Gas detection	<p>Gas detection technology should be used wherever hazardous gas concentrations in a generator / battery room may develop unnoticed. Dangerous concentrations can occur when, in case of leakage, the content of a gas is sufficient to reach the lower explosion limit (LEL) in the room. With even lower concentrations, the gas remains combustible and may burn off and consequently produce a conflagration. To plan a gas warning system, it is essential to know the ambient conditions. The status of the environment must be recorded in a checklist. This includes:</p> <ul style="list-style-type: none">• Substances to be detected• Prevailing / associated substances• Handling of these substances• Wherefrom stem which substances?• How are they transported, stored and processed?• Temperatures• Humidity situation• Wind conditions / ventilation• Cleanliness of the atmosphere (sensor poisons and inhibitors!) <p>Based on this information, the type, number, and position of the detectors can be determined.</p>
Interference from the ventilation system	To guarantee reliable fire detection, the fire detector must be mounted away from the air flow of the ventilation system so that, in the event of a fire, the smoke is not thinned down close to the detector.
Service life	The design of modern fire detectors means it is possible to reduce significantly the ingress of contamination compared with older detectors. Additionally, intelligent detectors are equipped with automatic signal tracking so that low to medium contamination in the metering chamber does not affect the detection behavior.

ASATEchnology – for early and most reliable fire detection

ASATEchnology is a unique technology from Siemens that converts signals into mathematical data which are compared with programmed values in real time using intelligent algorithms. The special signal analysis process is very reliable in preventing false alarms caused by on-site deceptive phenomena.. Find out more about [Sinteso](#) or [Cerberus PRO](#) fire detectors with **ASATEchnology**.

Sinorix H₂O Gas – for intelligent and efficient extinguishing

This innovative gas/water-combined extinguishing system uses nitrogen and water as extinguishing agents. During a fire, Sinorix H₂O Gas floods an area simultaneously with both nitrogen and water mist for ideal protection from combustion, smoke, and heat damage. Both extinguishing agents are carried by the same piping network and are distributed by the same nozzles to the extinguishing area. As it is discharged, this mixture fans out through the room, extinguishes the fire, and cools hot surfaces quickly and reliably. Nitrogen is used as the extinguishing agent and as the propellant for the water. Thanks to the water component, re-ignition is avoided. As a result, the retention time of the extinguishing agent does not have to be that exact and minor leaks are not critical. As part of the nitrogen is used to propel the water, there is a resulting softened initial burst of gas, which results smaller overpressure flap openings and thus lowers costs.

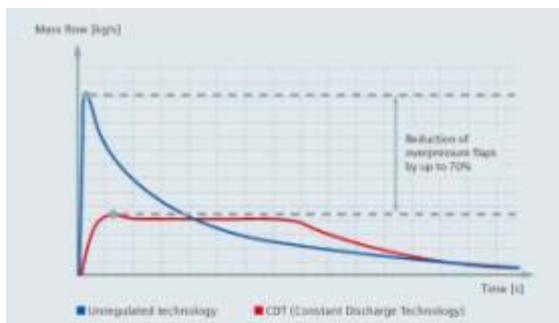
Sinorix H₂O Gas is very suitable for the protection of generator rooms.

Find out more about [Sinorix H₂O Gas](#) extinguishing systems.

Sinorix CDT – for innovative and safe extinguishing

Sinorix CDT (Constant Discharge Technology) is a pressure-regulated extinguishing system. Sinorix CDT uses the natural gases nitrogen, argon or mixtures. They have non-conductive properties, are chemically inert and do not create any harmful decomposition products. Sinorix CDT is very suitable to protect a battery rooms.

A conventional unregulated extinguishing system follows an exponential discharge characteristic with a significant peak at the beginning of the discharge. However, the Sinorix CDT technology consists of a cylinder valve plus a pressure-regulating function which discharges the gas into the flooding zone at constant mass flow throughout the flooding time. This eliminates the peak at the beginning of the discharge.



The graph shows how the mass flow [kg/s] changes over time[s] when using an unregulated valve (blue line) and a regulated CDT valve (red line) during a discharge.

Thanks to the constant mass flow, the cross-section of the pipes can be dimensioned smaller than with conventional unregulated extinguishing systems, and the size of the overpressure flaps can be reduced by up to 70%. Thus, Sinorix CDT is especially beneficial for interior or cellar rooms, where large overpressure flaps are hard to install due to structural conditions. Find out more about Sinorix CDT [here](#).

Everything you need for comprehensive fire safety

Incorporated in a concept tailored to your customer's requirements, Siemens and its Solution Partner network provide:

- Early and reliable fire detection solutions, offering an unrivalled financially backed "Genuine Alarm Guarantee"
- Fully forwards and backwards compatible systems, to ensure any system provided is equipped to integrate the latest technology Siemens has to offer
- Clear and fast alarming and evacuation processes
- Innovative and fast extinguishing technologies

All these aspects are at the core of comprehensive fire safety. Only if they are fulfilled, your customers can be assured that people in your buildings are safe and assets and business processes are protected.

In order to offer your customers peace of mind, Siemens and its Solution Partner network have a variety of service and solution offerings that can be tailored to individual client's needs. To find out more about this, please visit our Web site at www.siemens.com/firesafety or contact your local Siemens organization through [the online contact form](#).

Advantage Engineering– share the experience

With our dedicated program for consulting engineers, you can benefit from our extensive application know-how and complete portfolio.

With Siemens, you can offer your customers comprehensive fire safety for any application and environmental condition. Your customers will appreciate this as it enables them to reliably protect people, assets and business processes from fire.

Backed by more than 160 years of experience in the field, our offerings for early detection, reliable alarming, orderly evacuation and safe extinguishing are based on innovative and unique technologies. They provide you with convincing arguments like maximized life safety or environmental friendliness, and open the door to strong, long-term customer relationships. And with Siemens, you gain a reliable partner at your side and benefit from our smart tools, in-depth trainings and personal support – wherever you are, wherever you go. For more information please visit www.siemens.com/advantage-engineering.

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Our world is undergoing changes that force us to think in new ways: demographic change, urbanization, global warming and resource shortages. Maximum efficiency has top priority – and not only where energy is concerned. In addition, we need to increase comfort for the well-being of users. Also, our need for safety and security is constantly growing. For our customers, success is defined by how well they manage these challenges. Siemens has the answers.

“We are the trusted technology partner for energy-efficient, safe and secure buildings and infrastructure.”

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