



Fire protection solutions for
combined cycle power plants

*Cool down.
Fire Protection by*

MINIMAX

WITH NATURAL GAS

short start-up times and fast load change

In recent years, the worldwide demand for electricity has increased significantly. This is not only attributable to industrialisation, particularly in emerging nations, but also to growing electrification. In order to meet the demand, the energy sector is currently embarking on the new construction and rehabilitation of power plants.

State-of-the-art combined cycle power plants, which by now even achieve efficiency levels beyond 60%, are especially notable for their complex overall systems. Very disparate operating units, including two different types of turbine, combine to form a construction with very high demands in regard to the organisation of reliability and safety. In addition to this, conditions such as extremely hot surfaces and lubricating oils pose huge fire risks.

If the beginnings of a fire in a power plants are not recognised automatically and extinguished immediately, the costs of damage can quickly run up into millions. Even fire damage in a secondary area can cause prolonged down times for the

entire power generation process. Equally, false fire alarms and extinguisher activation can also lead to power plants down time.

In order to protect people, objects and the environment, a sophisticated and made-to-measure fire protection concept is necessary. In power plants, almost the whole spectrum of modern fire protection equipment comes into use. If such equipment comes from one source, fewer interfaces are required, thus ensuring perfect installation and operation.

Minimax has been dedicated to providing power plants with fire protection concepts from one single supplier for over 30 years.



FIRE PROTECTION

Fire protection concepts recommended by Minimax

Fire protection systems
 Sprinkler systems
 Minifog water mist systems
 Deluge systems
 Hydrant systems
 Foam systems/monitors
 Oxeo inert gas systems (Ar/N₂)
 CO₂ systems
 MX 1230 systems (Novec™ 1230)
 Fire detection systems¹

Energy generation	Fire protection systems	Sprinkler systems	Minifog water mist systems	Deluge systems	Hydrant systems	Foam systems/monitors	Oxeo inert gas systems (Ar/N ₂)	CO ₂ systems	MX 1230 systems (Novec™ 1230)	Fire detection systems ¹
Oil tanks			●		●					●
Boiler house with heat recovery boiler		●	●	●						●
Gas turbines		●				■	●			●
Steam turbine incl. oil chambers/oil ducts		●	●							●
Cable channels, cable rooms/galleries	●	●								●
Electric control rooms						■		●		●
Transformers		●	●							●
Peripherals										
Administration building	●	●		●						●
Server rooms						■		●		●

¹ Where appropriate, with WinGuard (facility management system).



SOLUTIONS FOR

Optimal fire protection in power plants requires specialist solutions for every area to prevent the loss of buildings, valuable equipment and ensuing business interruptions. As a comprehensive supplier for fire protection solutions, Minimax offers a uniquely full range of proven as well as innovative fire protection systems and components that meet the highest standards in every detail and complement each other to form a highly efficient and value-for-money overall solution.

Sprinkler systems: Universal protection

In a wide range of applications where human lives and material assets are to be protected against the effects of fires, Minimax sprinkler systems offer excellent solutions. They detect and notify fires, automatically initiate the water-based suppression process and thus offer reliable protection at all times. Sprinkler systems are highly efficient due to the concept of selective fire fighting: In the event of a fire, only the sprinklers located in immediate proximity to the fire source will be activated. Immediate suppression action using water is taken, while the remaining sprinklers remain closed.

Minifog systems: Fire fighting with water mist

Minifog water mist systems use the physical qualities of water more efficiently than conventional water suppression systems. The extinguishing water is distributed finely through special nozzles and sprinklers and/or increased operating pressure. This increases the overall surface of the water, enabling it to absorb heat and evaporate faster. The related cooling and smothering effect makes it possible in certain applications to fight the fire in a particularly effective way at a minimum consumption of extinguishing water.

Deluge systems:

Fast, with overall coverage

Minimax deluge systems are suitable for use in areas where a fire can spread particularly quickly, e.g. in oil tanks or on transformers. Equipped with hydraulic, pneumatic or electric triggers, deluge systems attack the fire at lightning speed due to the open nozzles. They prevent reignition by cooling down the burnt objects. In certain risk areas, a film-forming foaming agent is added to the deluge system to reinforce the suppression effect.

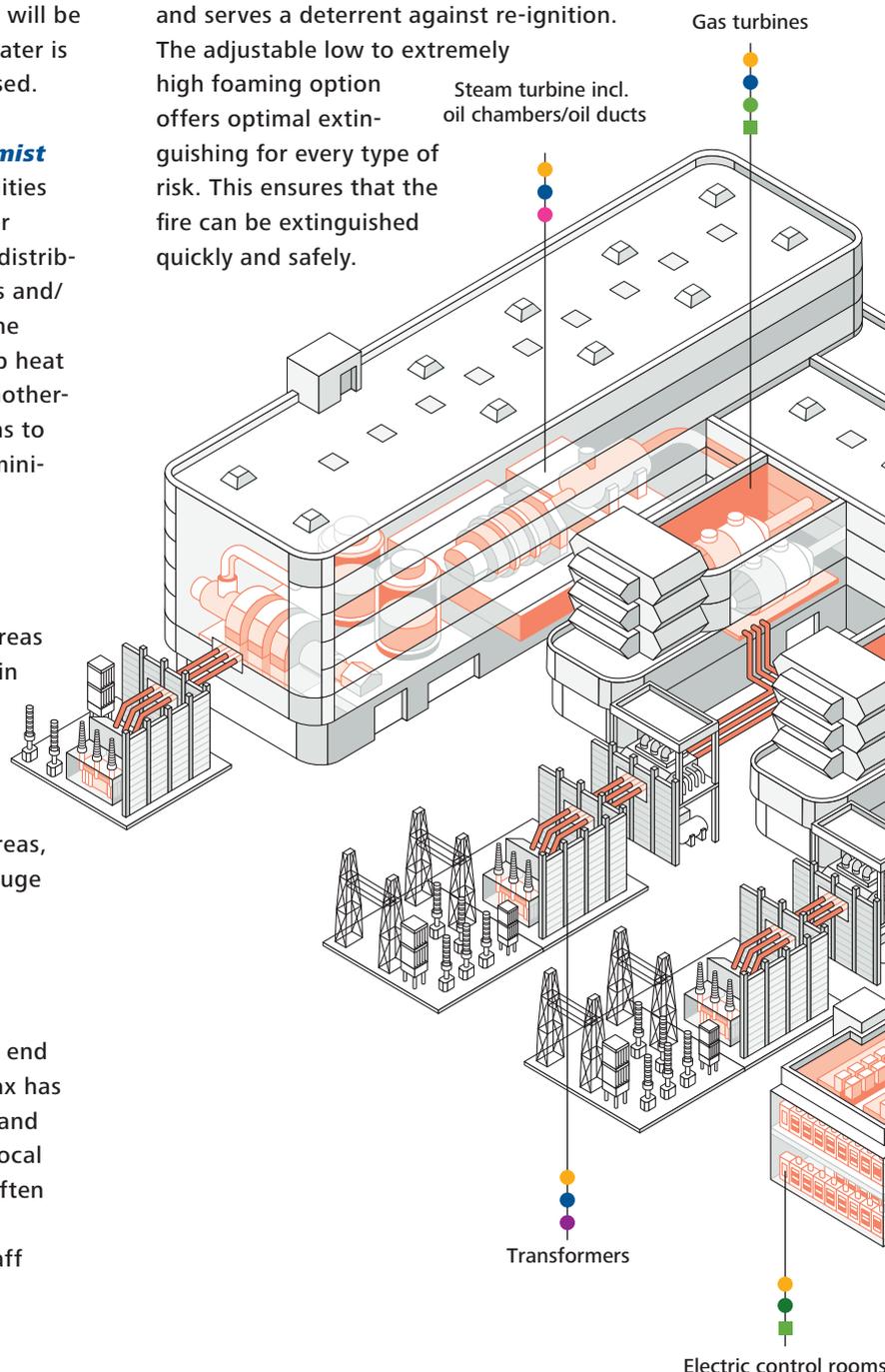
Hydrant systems:

Be prepared for action

Wall and external hydrants are merely the visible end of a reliable supply of suppression water. Minimax has reliable water supply components such as filling and draining stations which are also adapted to the local conditions. The Minimax maximat components often assure the safe supply to hydrants and quick intervention from the fire brigades, operating staff or building users.

Foam extinguishing systems and extinguishing monitors: Large-scale dampening

Fires involving flammable liquids or plastics tend to spread very quickly. Foam extinguishing systems provide a very effective form of fire protection for these risk areas. In case of fire, foam pipes, foam monitors, sprinklers or jets are used, depending on the area of application, to disperse the foam over large areas. The foam is applied on to the fuel, extinguishes the fire and serves as a deterrent against re-ignition. The adjustable low to extremely high foaming option offers optimal extinguishing for every type of risk. This ensures that the fire can be extinguished quickly and safely.

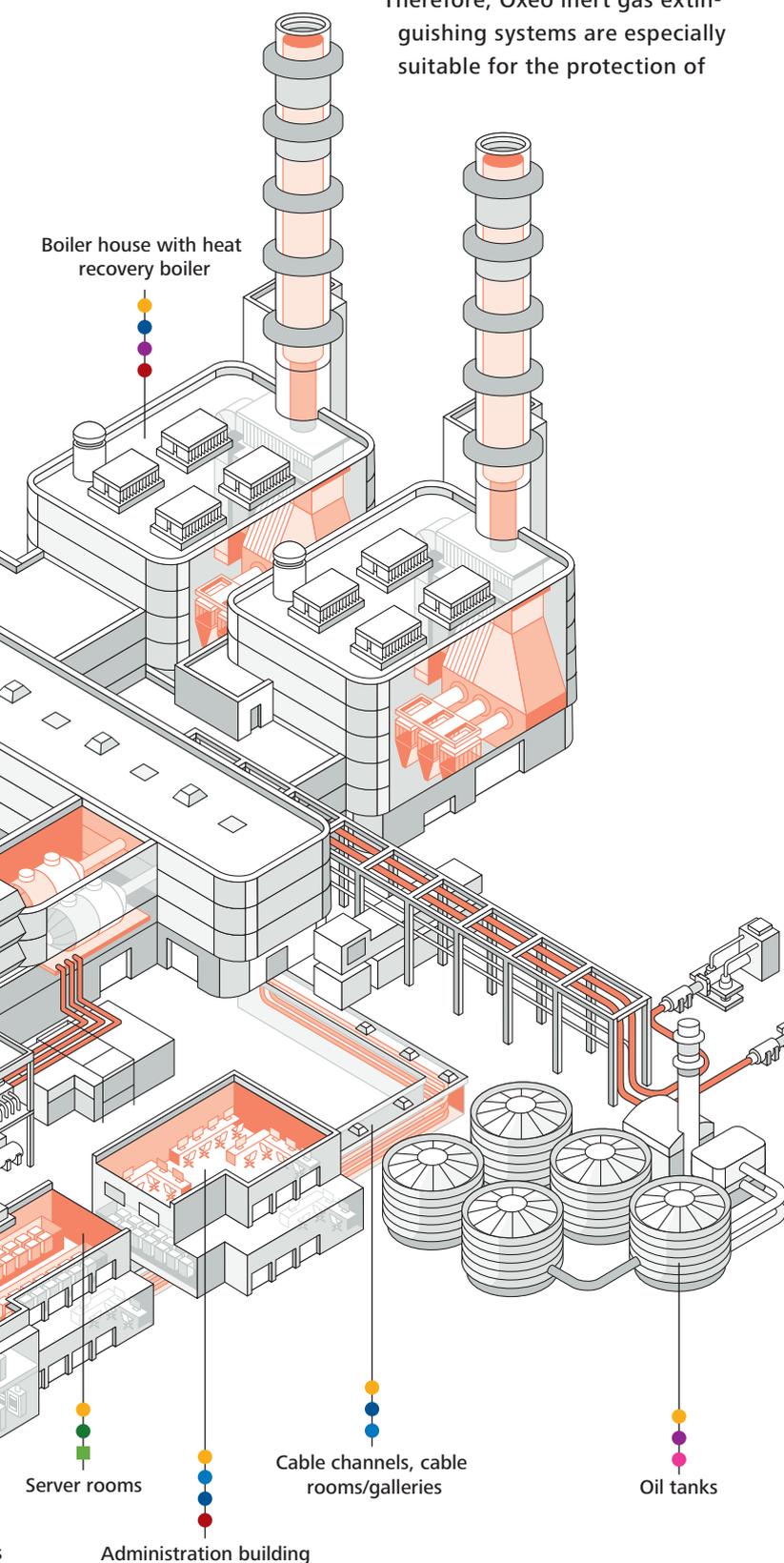


GAS & STEAM power plants

Oxeo inert gas systems: Residue-free extinguishing

Oxeo extinguishing systems ensure a reduction of the oxygen content in the event of a fire, by introducing inert gases such as argon or nitrogen into the protected area. By displacing the oxygen, the fire is extinguished rapidly and without leaving any residue of extinguishant.

Therefore, Oxeo inert gas extinguishing systems are especially suitable for the protection of



high-quality systems, sensitive equipment or valuable assets that might be damaged by the use of non-gaseous extinguishants. Argon and nitrogen are natural components of the ambient air. Moreover, the gases are not harmful for people and electrically non-conductive.

CO₂ extinguishing systems: Highly effective for many applications

The extinguishing effect of carbon dioxide is caused by the fast displacement of oxygen in the vicinity of the source of the fire. The high heat absorption capacity of the gas also withdraws energy from the source of the fire, thus compounding the extinguishing effect. Due to its special extinguishant properties, CO₂ extinguishing systems also protect stand-alone equipment in rooms. CO₂ extinguishing systems only need little space for storing a supply of the extinguishant – large volumes of CO₂ can be stored cost-effectively in low pressure containers. Carbon dioxide is a natural component of the ambient air and electrically non-conductive.

MX 1230 chemical extinguishing systems: Efficient and compact

MX 1230 systems extinguish fires using the chemical extinguishant Novec™ 1230 by 3M™. This extinguishant is neither corrosive nor electrically conductive. It is thus especially suitable for protecting rooms containing electric and electronic equipment. MX 1230 systems, too, extinguish fires without leaving residues on the protected objects, while offering a high level of personal and environmental protection at the same time. They have the added advantage of a particularly compact extinguishant supply; this makes for an attractive solution especially for smaller and medium-sized rooms.

Fire detection systems and suppression system controls: Optimum overview and high flexibility

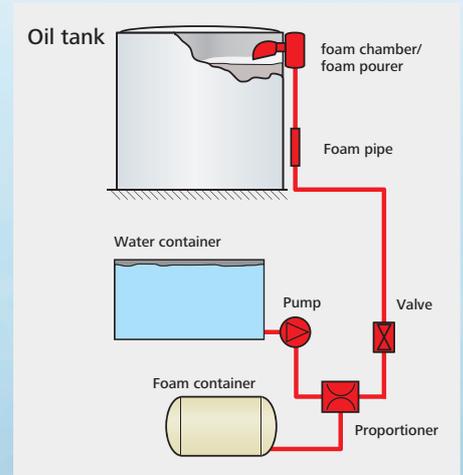
Flames, smoke, gas emissions, heat – a fire that is spreading is a multi-faceted fire. Minimax has the right type of fire detectors for every kind of fire. All fire detectors transmit their signals to the FMZ 5000 fire detection control panel – taking the short route, via a loop. The FMZ 5000 panel controls alarm devices and transmits alarm notifications to a permanently staffed post and to the fire department. Moreover, it can monitor the available suppression systems continuously for proper functioning and can trigger these systems – except for sprinkler systems – electrically in the event of a fire. The FMZ 5000 also offers additional features such as communication with hazard or facility management systems or via web interfaces with Internet-capable devices.

IDEAL PROTECTION

In combined cycle power plants using dual fuel turbines that can be powered with gas as well as with steam, fuel or fuel oil is stored in large tanks.

Risks: Ignition of the gases in the oil tank, lightning strike or generation or sparks due to electrostatic charges.

Fire protection: In this situation, foam extinguishing systems offer optimal protection due to the MX TankFoam RTK system kit. The system generates low expansion foam, which is applied, in the event of a fire, on to the burning surface of the liquid from above. The foam has an immediate cooling effect, smothers the flames and protects the area already extinguished against a repeated outbreak of the fire. At the same time, the side walls and, if appropriate, the roof of the tank are cooled down with a deluge system.



FOR OILTANKS



MX TankFoam RTK

Foam pipe, foam chamber and foam pourer: These three components adapted for combined use form the „MX TankFoam RTK“ system kit. It produces low expansion foam and is specially designed as fire protection for flammable liquids in fixed roof tanks (including those with floating cover or nitrogen blanketing).

The jet of foam-and-water mixture sprayed with great force in the event of fire sucks in air through the holes in the foam pipe. Due to strong turbulences, low expansion foam is generated. The foam is homogenised in the piping to the foam chamber and undergoes a further qualitative improvement. The foam pressure causes the rupture disc to burst releasing the foam into the tank. The resulting extinguishing foam blanket cuts off the oxygen supply to the flames and prevent re-ignition of the fire.

All common foaming agent concentrates can be used with the RankFoam RTK system kit. Special designs with particular active ingredients can also be supplied.

*Detailed Minimax product information.



PROTECTION FOR

From the perspective of fire protection, boiler houses in combined cycle power plants must be sub-divided into two zones. On the one hand, there is the area where the technical equipment is located, such as feed water pumps or electrical control systems; on the other hand, there is the location of the boiler as such, where steam is generated. This area is practically devoid of fire hazards.

Risks: In areas where electric monitoring and control equipment is located, overheating may cause short circuits and smouldering fires. Leaks in the oil supply system may occur on high pressure, medium pressure or low pressure pumps of the boiler feed water and condensate system. In this case, leaking motor oil may ignite on hot surfaces or due to flying sparks. From this point on, the fire can spread quickly to the adjacent surroundings.

Fire protection: For this reason, automatic fire detectors serve to reliably detect initial fires in areas where technical equipment is located. In addition, very visible manual call points for manual activation are located nearby. The Minifog ProCon water mist system, activated automatically or manually in the case of a fire, extinguishes the fire fast and reliably, while consuming significantly less water – compared to classic deluge systems. Optical and acoustic alarms supplement the fire protection package. Wall hydrants and fire extinguishers are installed in the area of the boiler for initial fire fighting measures.



Minifog ProCon water mist systems

By using innovative low pressure water mist technology, Minifog ProCon systems offer a particularly efficient way of fighting fires in many power plants areas, e.g. at steam turbines or cable channels. The Minifog ProCon uses up to 70 percent less water than classic deluge systems. Efficient fire protection and low consumption of water reduce down times and business interruptions following a fire to a minimum. In addition, the water mist reduces the ambient temperature during the extinguishing process; this, in turn, is an effective means to protect people.

Minifog ProCon is at the same time a cost-efficient solution, because it uses low-pressure components and can be connected to a classic water suppression system, e.g. to a sprinkler system. In this case, it is not necessary to install a separate pump unit to supply water to the Minifog ProCon.

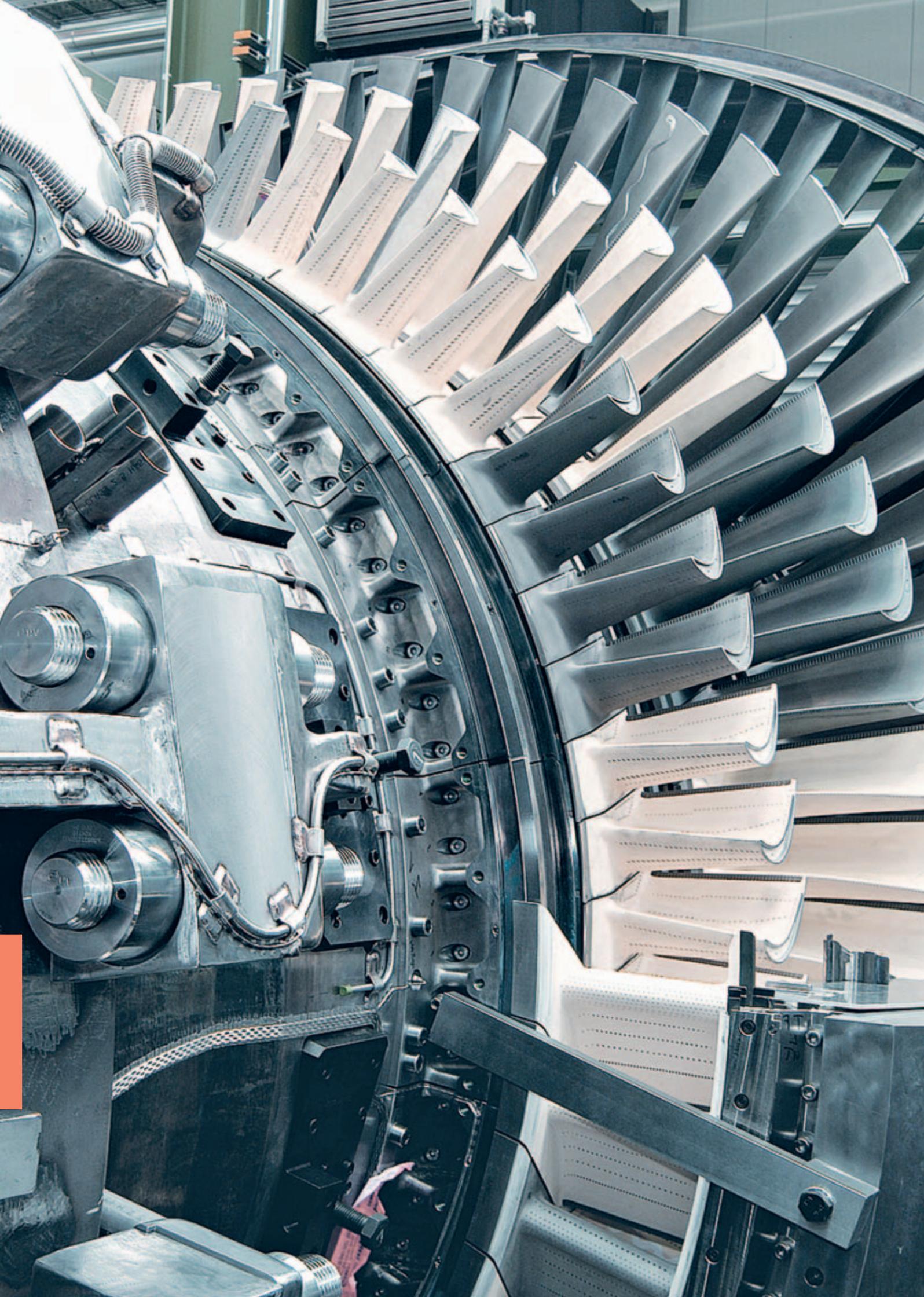
In its construction and functionality, the Minifog ProCon system resembles a classic deluge system. In the event of a fire, the fire fighting process in the extinguishing zone affected by the fire is initiated by the Minimax fire detection and extinguishing control technology. The water is then finely sprayed through the special ProCon nozzles and can produce the special extinguishing effects of the water mist technology.

A suitable ProCon nozzle is available for each application. Impulse nozzles, nozzles and twin swirl hollow cone nozzles are being used most often. Due to the robust construction and the integrated protective caps, the ProCon nozzles are also suitable for use in rough environmental conditions and areas with a high exposure to dirt or contaminants.



HEAT RECOVERY boiler





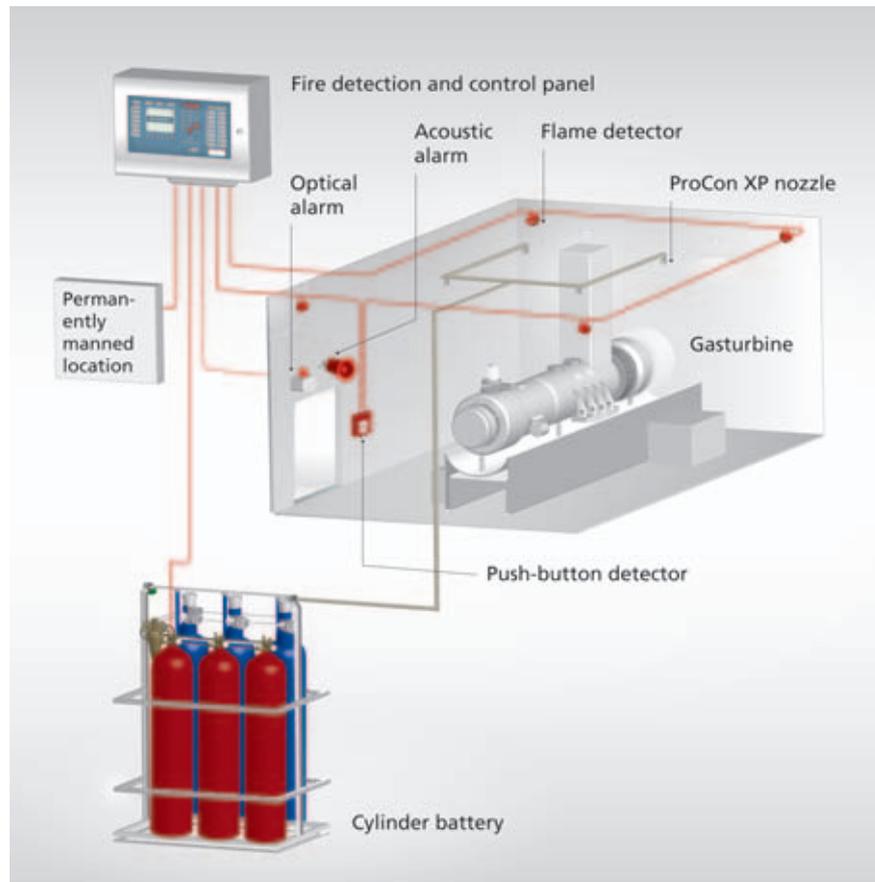
GAS TURBINES

optimally protected

The gas turbine is the centrepiece of any combined cycle power plants. For noise protection reasons, its main components are installed under a sound hood.

Risks: Fuel supply in the vicinity of the burner and the lubricant circulation system including the turbine bearing in the exhaust channel present the main fire risks, given that the fuel or lubricant can ignite easily on hot surfaces. High thermal loads, creating an atmosphere in which fires can spread quickly, aggravate the situation.

Fire protection: Gas turbine fire protection begins with optimal fire detection. In this area, the rapid development of open flames and heat must be considered. Therefore, the UniVario flame and heat detector, especially developed for industrial use, is the perfect solution, and is characterised by its intelligent features and robustness. CO₂ extinguishing systems ensure fast, residue-free extinguishing of fires – even in areas that are difficult to access. For large turbines, low pressure CO₂ systems are often used, since due to liquid storage, they only require little space to store great capacities of extinguishant. Alternatively, the Minifog ProCon XP high pressure water mist system offers reliable protection. Yet Minifog ProCon XP uses approx. 95% less water compared to classic deluge systems. This extremely low consumption

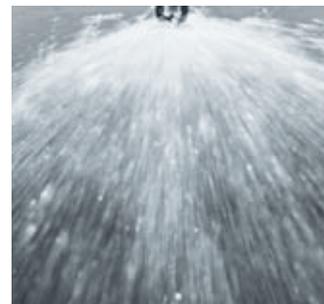


of water reduces the risk of water damage and thermal distortion of hot machine parts to a minimum.



Minifog ProCon XP

Minifog ProCon XP high pressure water mist systems offer excellent fire protection with minimal consumption of water, e.g. for encased gas turbines and motor test stands. For a higher level of safety, the system is based on the innovative ConstantFlow technology. It maintains a constant system pressure at the nozzles throughout the entire operation period. This means that the suppression system is as effective in the last minute as it is in the first, offering increased protection against re-ignition.



Classical spray nozzle



ProCon XP nozzle

STEAM TURBINES

with optimal fire protection

Whether hydraulically controlled valves, turbines or generator bearings, oil supply pumps, turbine conditioning rooms or oil tank and pipe rooms, all of these sections are part of the steam turbine area.



Risks: The fire hazard emanates from flammable liquids that spread over hot surfaces due to leaks in the lubrication or control oil system.

Fire protection: Concerning steam turbines, fire protection focuses on protecting objects in the various sections. In the first place, the intelligent UniVario flame and heat detectors ensure automatic fire detection. They can also be used to monitor processes. Extinguishing is carried out by preference by activating the automatic or semi-automatic spray ProCon water mist system. The substantially lower consumption of water, compared to classical deluge systems, significantly reduces the risk of thermal distortion of hot turbine components (e.g. turbine bearings).



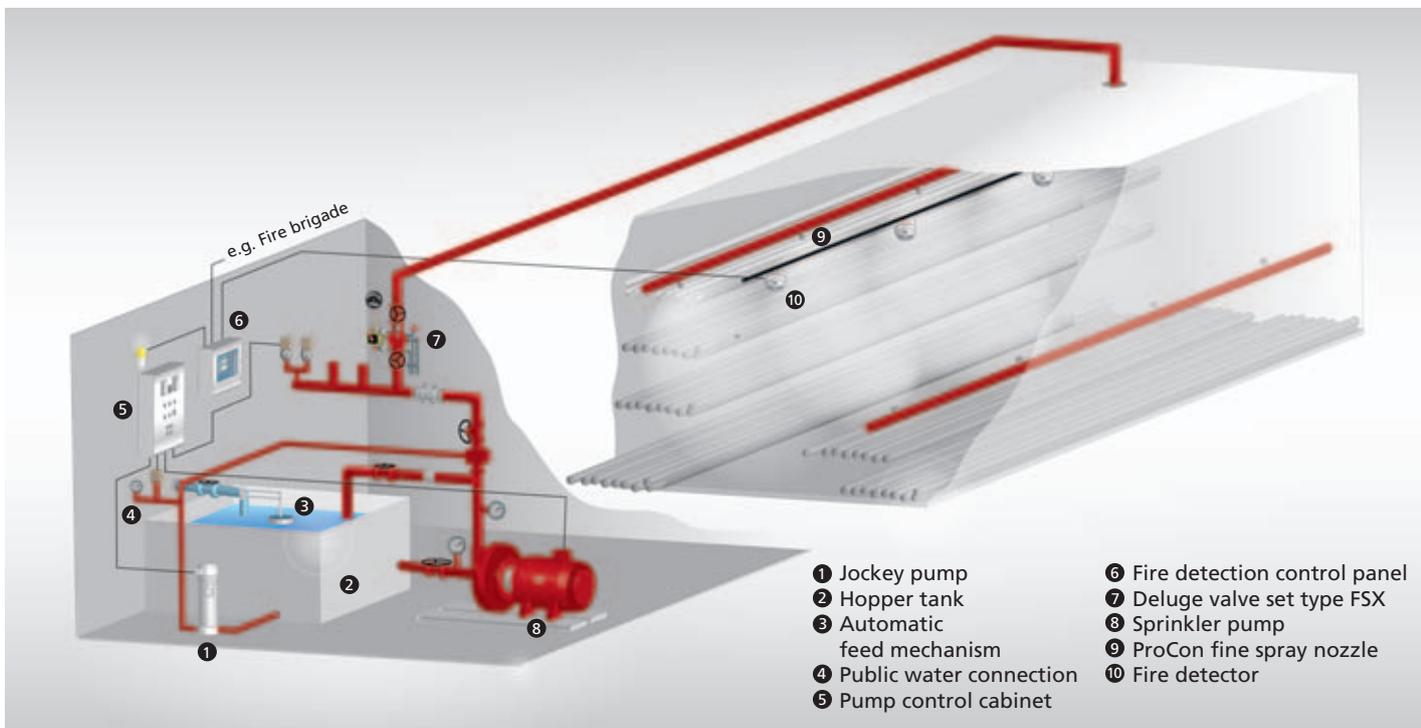
CABLE CHANNELS

Reliable protection for cable rooms and cable galleries

Whether for power supply or data transmission, countless cables are required for the operation and supply of a power plant. In order to provide adequate protection, in addition to for aesthetic reasons, cables are distributed via cable channels and organised in cable rooms and galleries.

Risks: The main reason for fires in such spaces is overheating with subsequent short circuits, which usually occur as a result of excess load. At the same time, the enormously high risk of the fire spreading at a very high speed, favoured by the draft air and the numerous cables, must be taken into account. Fire which spreads through winding and often inaccessible cable ducts can quickly cause interruptions to operation in the whole power plants.

Fire protection: In areas where cables are installed, fire detection systems with optical smoke detectors are used. Ideally, active smoke aspirating systems are employed. These systems help to detect fires even earlier. The Minifog ProCon water mist system is used in cable channels as well as in cable rooms and galleries. Designed with impulse nozzles in cable ducts, and with twin swirl hollow cone nozzles in cable rooms and galleries, this water mist system is particularly notable for its minimal consumption of water. The suitability of Minifog ProCon was proven by DMT in several tests.



UniVario intelligent industrial fire detectors can be used even in the most extreme conditions, thanks to its sturdy casing and assembly technology. They respond to infra-red or ultraviolet radiation or to heat. Thanks to their modular concept and use of the latest signal processing technology these devices meet individual specifications in an extraordinarily wide range of uses. They can be used indoors as well as outdoors, and can be directly integrated into a loop.



E-ROOMS

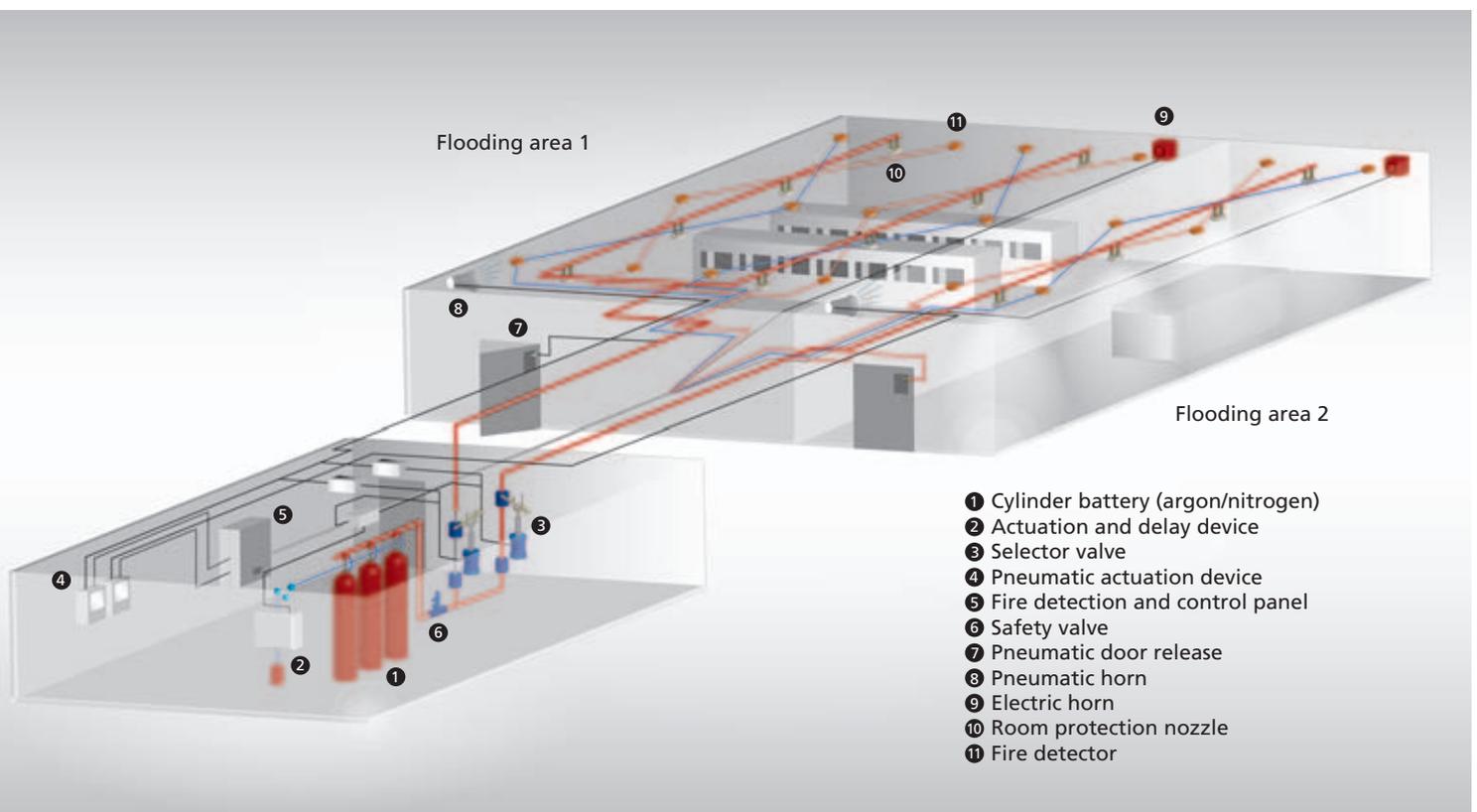
and control rooms protected against fire

E-rooms such as control rooms and systems are extremely sensitive and highly valuable facilities. They serve to control the elementary process in a power plants. This makes them simply indispensable.

Risks: In these locations, fires mainly occur as a result of short circuits caused by overheated cables or electric/electronic components.

Fire protection: Concerning fire protection solutions for these areas, the type of extinguishing solution used is crucial. In order to prevent damage to the facilities through the extinguishing solution, completely residue-

free extinguishing is fundamental. For these areas, Minimax recommends Oxexo inert gas extinguishing systems using argon or nitrogen. Another option is the MX 1230 fire extinguishing system using the Novec™ 1230 extinguishant. Both systems have been especially designed for sensitive rooms and objects and meet all corresponding requirements. A fire detection system with point smoke detectors or a HELIOS AMX5000 smoke aspirating system ensures reliable fire detection at the earliest possible stage.



HELIOS AMX5000 aspirating detector

The latest-generation aspirating smoke detector HELIOS AMX5000 is a highly-sensitive, active smoke detection system. In addition to a pre-signal and contamination assessment, the detector also offers the possibility of adjusting sensitivity in accordance with the unit's use. The Helios AMX5000 detects even the most minute smouldering fire and can be used almost anywhere.



TRANSFORMERS

with optimal fire protection

Transformers make sure that electricity is ready for network distribution. They function as links between the turbine, the turbine generators and the network. They consist typically of the transformer housing with a cooler, expansion deposits and oil-filled insulators.

Risks: The main fire hazard is caused by faults, such as short circuits, within the transformers. This creates a risk of overheating and conditions in which oil can quickly ignite. Older versions of transformers are particularly susceptible to such faults.

Fire protection: As soon as overheating is detected, the transformer is automatically deactivated in order to prevent a fire from breaking out. The basis for the fire

protection is the Buchholz relay. This relay ensures prompt identification of cooling required for components at risk of overheating. A fully-automatic or semi-automatic deluge system developed by Minimax on the basis of the latest research results, protection aims and testing schemes supplement the concept. The special UL-approved nozzles, Viking Model A and Model C-1, achieve an even and consistent distribution of water when activated. In doing so, the system successfully meets the protection aims of "control" and "suppression". At the same time, the consumption of water can be reduced to a level significantly below that of classic deluge systems.



ADMINISTRATION AND IT up to every assignment

Server rooms

IT areas, equipped with computers and servers, which nowadays monitor and control all essential processes, are especially at risk if there is a fire.

Risks: Faulty or overloaded electronic components can easily cause a smouldering fire or open flame fire.

Fire protection: MX 1230 fire extinguishing systems provide ideal protection for server rooms. Fast flooding of the extinguishing zone and reliable, residue-free extinguishing action ensure the best level of protection for sensitive equipment in the event of a fire. Due to the Minimax 50 bar technology, it is also possible to implement multi-zone solutions. Alternatively, Oxeo inert gas extinguishing systems using argon or nitrogen can be used. These systems also extinguish fires quickly and, above all, free of residue. For server rooms, Minimax recommends reliable fire detection at the earliest stage by means of a fire detection system with point smoke detectors or a HELIOS AMX5000 smoke aspirating system.

Administration building

In administration areas, people work above all during the day. As a rule, these areas will be unoccupied for a certain time.

Risks: Overheated, faulty electronic devices are often the cause of fires in administrative buildings. Spreading fires can very quickly affect other parts of the building. It cannot be guaranteed at all times that employees will be present to monitor the occurrence of a fire and to take quick extinguishing action.

Fire protection: Sprinkler systems, as well as fire detection systems, provide proper protection for office and administrative areas. Water-conserving Minifog EconAqua water mist sprinkler systems that can be connected to an existing sprinkler system are also an option. Minifog EconAqua uses significantly less water than classic sprinkler systems. For fast, manual fire fighting action, fire extinguishers, and often also wall hydrant systems, are usually installed in office or administrative areas.



ALL AT A GLANCE

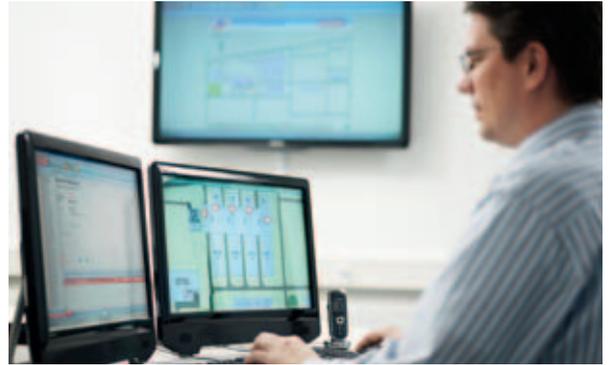
on the safe side

FMZ 5000 Fire detection control panel

The core of active fire protection in a power plant is constituted by the fire detection control panel. This unit collects and registers all fire alarms activated from the manual, smoke, heat and flame detectors and extinguishers distributed throughout the premises. Maximum flexibility is offered by the guideline-compliant FMZ 5000 fire detection control panel:



the technology with freely programmable control and needs-based 'snap and go' function modules makes it possible to adapt this system to all requirements. Of course, it is also available in a ring bus version. Up to 126 participants can be operated on the detector loop. Whether automatic fire detectors, special detectors or UniVario industrial detectors, Minimax has an endless range of models with a variety of response behaviour characteristics for the detection of countless different types of fire.



WinGuard: The PC acts as the fire protection monitor

The WinGuard software displays the fire and hazard detection systems clearly on the PC and is used to control key functions. The system integrates safety and building management, thus offering an ideal monitoring function in power plants with complex system and building structures. With WinGuard, events of the Minimax fire detection and control panels can be transferred. The user sees additional information and help for each message on the screen and can therefore introduce the necessary measures based on the sound information he has received.

Inspection and maintenance: Service for sustainable safety

Regular inspections are a fundamental requirement in order to guarantee the perfect functioning of the fire protection systems whilst ensuring full operational readiness at all times. Minimax service offers the prompt inspection of all fire protection and extinguishing systems in strict accordance with the applicable legislation. Such equipment is checked, maintained and, in the event of a fault, repaired with meticulous care by specially trained Minimax staff members. In addition to system servicing, specific measures and programmes exist to ensure that all protective equipment continues to function correctly and corresponds to the latest technological developments even after years on standby. Legal provisions usually require operators to carry out continuous monitoring procedures on their fire protection systems. If faults are identified, rapid reactions are called for. Minimax offers round-the-clock safety with a sophisticated fault detection management system to ensure that errors and faults are always remedied at top speed, regardless of their location.



REFERENCES

Fire protection solutions for power plants

For over 30 years, Minimax has been committed to developing fire protection solutions especially for power plants. Thanks to the range of product innovations, fire protection technology is regularly adapted to the technical advances made in the energy sector, always in complete accordance with the applicable laws and regulations.



As an integrated solutions provider, Minimax offers everything from one single supplier:

Fire protection advice

Fire protection planning

Sprinkler systems

Deluge systems

Minifog water mist systems

Foam systems/monitors

Oxeo inert gas systems

CO₂ systems

MX 1230 systems

Oxeo Prevent oxygen reduction systems

Fire detection systems

HELIOS smoke aspirating systems

UniVario flame and heat detectors

Hydrant systems

Fire extinguishers

Inspection and maintenance

Repairs

Training courses



Minimax GmbH
Division Energy
Industriestraße 10/12
23840 Bad Oldesloe
Germany
Phone +49 4531 803-0
Fax +49 4531 803-248
E-mail power@minimax.de
www.minimax.com



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