



Fire protection for wind turbines

Safe for certain

**minimax**





# PROBL

## RISKING A FIRE IS RISKING YOUR INVESTMENT

Over the last few years, the generation of electricity from wind energy has become a major technology showing huge growth rates and excellent opportunities for the future. Today's highly efficient wind power stations are a far cry from traditional windmills. Offshore installation and the production of the latest high-performance wind turbines require considerable investment, which must be secured against downtimes and potential loss. Until recently, manufacturers, operators and fire-fighters were unable to reduce the risk of damage by fire.

### **Underestimated risk**

The nacelle is at the heart of wind turbines, as it contains the essential elements such as the generator, the gearbox, brakes, control panels, the transformer and the converter. It also poses a particularly high risk of fire.

If a fire breaks out, for instance as a result of overheated components, electrical faults or a bolt of lightning, the fire can spread easily as the nacelle contains combustible materials

such as mineral oils, lubricants, plastics and electrical components.

Effective intervention is hampered by long response times on the part of the emergency services, remote location with poor roads and wind turbines with extreme hub heights. As access to the seat of the fire is crucial for a successful intervention, fire-fighters are often unable to intervene, as standard fire ladders can only be extended to a height of approximately 30 metres.

Under such circumstances, fire-fighting measures are thus reduced to protecting the immediate vicinity and watching the station on fire burn down. In offshore plants, intervention from the shore is in any case far too slow to make a difference.

### **The consequences:**

- Downtimes or total loss of the unit, with considerable economic consequences for operators, manufacturers and insurance companies.

Minimax is the only supplier in Europe providing mobile and fixed fire protection solutions. For more than 100 years, Minimax has offered planning, design, installation, maintenance and training in the field of fire protection.

- ▶ Loss of corporate image and uneasiness on the part of investors and the general public.

## **Minimax fire protection solutions**

Minimax, the market leader in fire protection solutions, has developed effective systems specifically designed for wind turbines, based on proven and tested components.

The Minimax systems detect a fire at an early stage and extinguish it automatically, minimising downtimes and damage to the equipment.

In order to determine the Minimax protection system that best suits your wind turbine, our specialised engineers will advise you on all aspects of the technology and design with you a tailor-made solution that meets your needs.

On the above basis, Minimax offers a range of different fire protection solutions that are suitable for new wind turbines as well as for retrofitting in existing units.

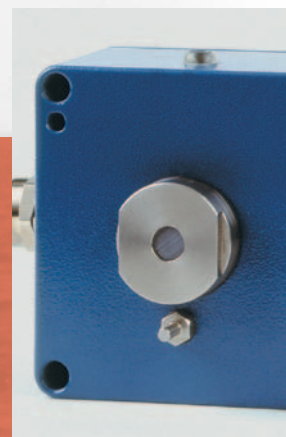
## **FIRE DETECTION SYSTEMS**

Fire gas detectors, smoke or heat detectors installed at the relevant critical locations automatically detect a fire at a very early stage. Also, a number of manual call points are located in the wind turbine. As soon as a detector is triggered, the control panel immediately shuts down the wind turbine and initiates a sequence of pre-programmed procedures. Visual and acoustic alarms indicate the level of risk; at the same time, the alarm signal is forwarded to a "continuously manned post". If the fire hazard is not

eliminated by shutting down the unit, and if further detectors are triggered, the installed extinguishing system is activated.

All messages and data from the fire detection control panel can be easily integrated into the condition monitoring system of the wind turbine.

In addition to that the Minimax fire detection and control panel may be equipped to allow remote diagnostics and remote control of the panel.



# SOLUTIONS

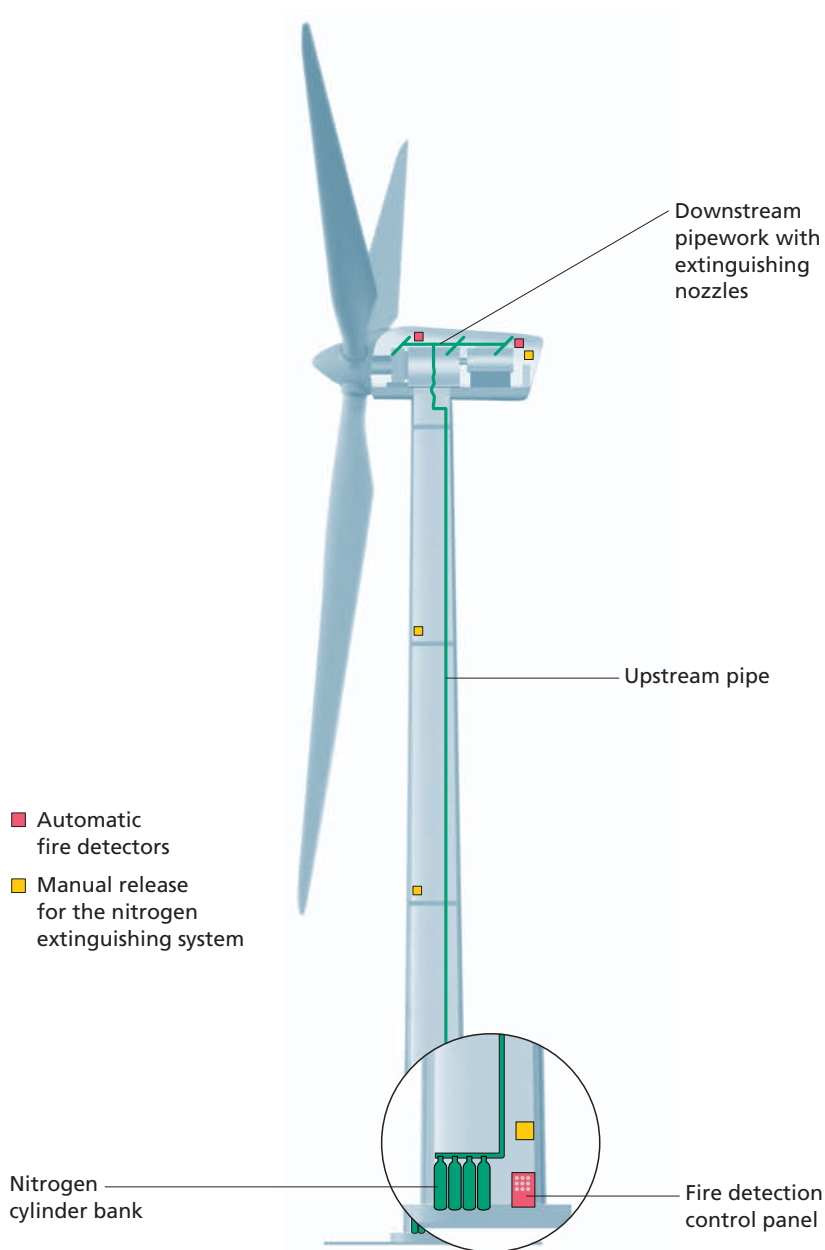
## ARGOTEC – AND THE FIRE RUNS OUT OF AIR

### GAS EXTINGUISHING SYSTEMS

Argotec extinguishing systems with nitrogen from Minimax are the ideal solution for wind turbines.

The figure to the left shows the main components of the fire protection system and their ideal location in the turbine:

- Nitrogen gas cylinder bank at the base of the tower
- Downstream Pipes with extinguishing nozzles in the nacelle and the electrical devices
- Fire detectors and the control panel to detect the fire at an early stage, to control the automatic extinguishing process and alert the fire brigade



Given that offshore wind parks require huge investments and are difficult to reach in the event of an emergency, automatic fire extinguishing systems are a must, as insurance cover is otherwise not obtainable.



As the gas cylinders are stored at the base of the tower, its static properties are not affected by additional weight. The nitrogen is stored in pressurised containers and can thus be quickly distributed through the upstream pipe, reaching even the highest nacelle within seconds.

The nitrogen reduces the oxygen in the air, necessary for each combustion process, and extinguishes the fire quickly and without leaving any residue behind. The gas is non-conductive and reaches even the most remote locations in the nacelle, entering every groove and gap and penetrating housings and switch cabinets.

#### **Fast and effective. Reliable.**

In the event of a fire, the extinguishing process is automatically started and controlled. The downstream pipes and installed extinguishing nozzles ensure a fast and homogenous distribution of the nitrogen in the protection zone so that the concentration necessary to extinguish a fire is reached quickly. The fire is smothered before any serious damage is done.

When the fire is fully extinguished, the wind turbine can be restarted without delay, as the nitrogen gas does not leave any residue behind. Simply ventilate the room to let the gas escape.

#### **Advantages of the Argotec extinguishing technology with nitrogen**

- ▶ Fast extinction without leaving residue behind
- ▶ Only short interruption of operations
- ▶ No damage to electrical and electronic components
- ▶ Nitrogen gas harmless to humans and the environment
- ▶ Extinguishes fires even at extremely low ambient temperatures
- ▶ Compact unit requiring minimum space thanks to 300 bar technology
- ▶ Low-cost extinguishing agent that is widely available
- ▶ Tested and approved quality



# SOLUTIONS

## MINIFOG – AND FIRES DISAPPEAR IN THE FOG

### MINIFOG SYSTEMS

Minifog fine water spray systems were developed to allow for protection concepts that combine excellent fire fighting capabilities with a minimum discharge of water. The Minifog nozzles are installed in such a way that crucial components such as main bearings, gear systems, brakes and generators are effectively protected.

To ensure reliability even under extreme conditions, an antifreeze solution is used that allows for proper extinguishing at down to minus 30 degrees Celsius.

To enhance the efficiency of the extinguishing agent it includes a film forming foam and is sprayed through specially designed nozzles. By atomising the water, its surface is multiplied, increasing the heat binding capability of the agent and intensifying the cooling effect. As the agent evaporates, it effectively reduces the heat from the fire,

while the vapour has a suffocation effect, displacing the oxygen at the seat of the fire.

As the amount of water released by the Minifog system is minimal, there is normally no need to provide extra retaining containers for the extinguishing agent.

The water supply system was developed as a compact unit with minimum weight to allow easy installation in the nacelle. The Minifog system may be installed during nacelle production, thus allowing for a minimised erection time for the wind turbine.

#### Advantages of the Minifog fine water spray technology

- ▶ Highly effective
- ▶ Only small amounts of water required
- ▶ No risk to persons
- ▶ Homogeneous cooling of protected equipment
- ▶ Smoke-cleaning effect
- ▶ Approved technology with low costs
- ▶ Minimisation of expensive downtimes



The water supply unit of the Minifog system is of a compact design requiring only minimum space



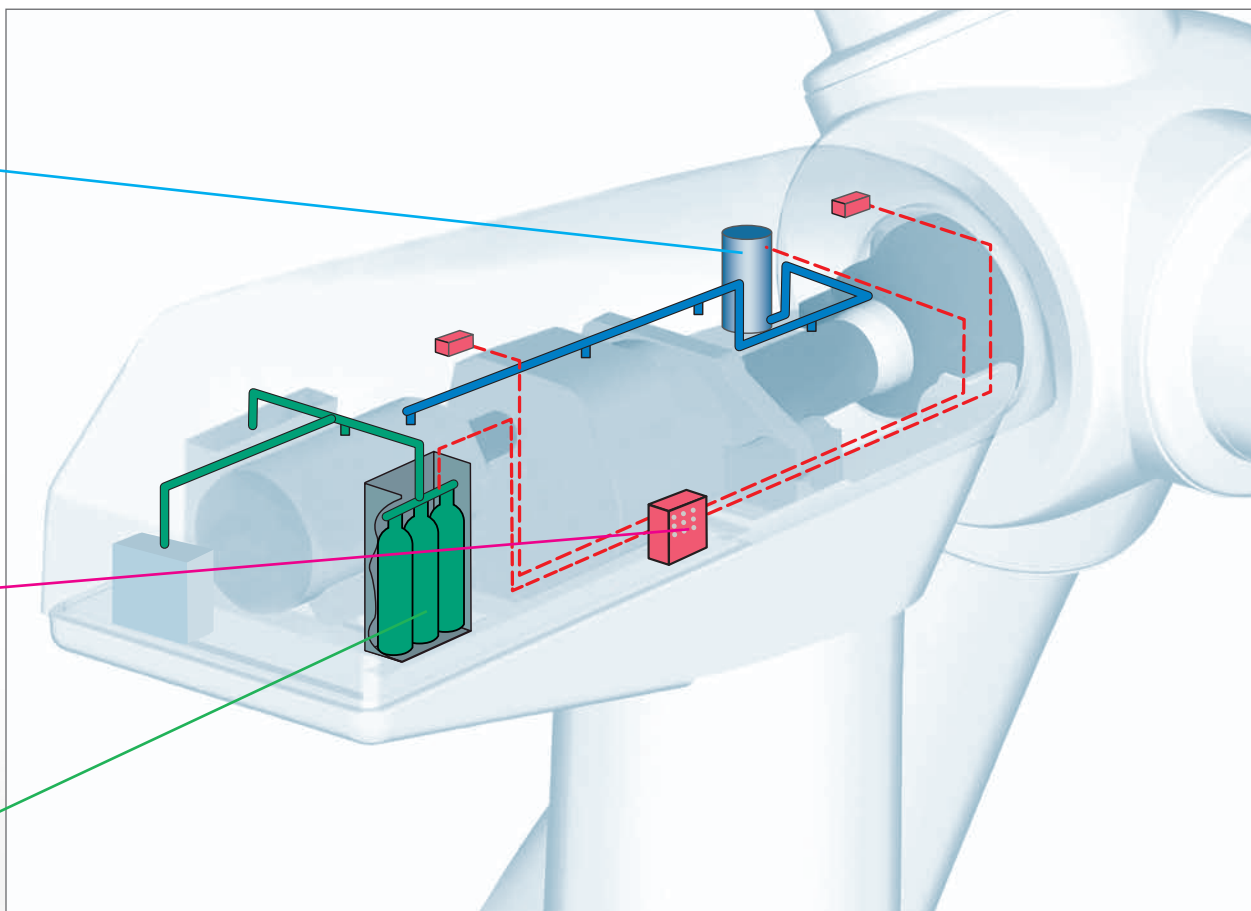
The flexible FMZ 5000 fire detection control panel monitors and controls the attached automatic extinguishing systems



Nitrogen gas cylinders of the Argotec compact extinguishing system are pressurised to 300 bar, so that the weight and space requirements are minimised

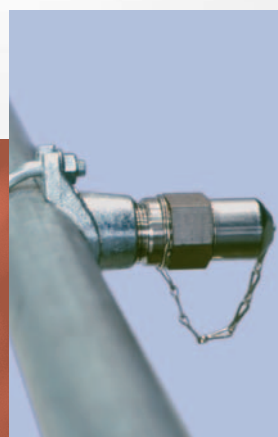
Since 1989, Minimax fire protection systems have been installed in a variety of different wind turbine types. Minimax offers fire protection solutions for all types of units, from simple wind machines to modern turbines with capacities of

several megawatts. Systems are developed and extensively tested in our fire research centre to ensure reliability under realistic conditions.



While a Minifog fine water spray system protects the mechanical components in the nacelle, the electrical and

electronic control cabinets of the wind turbine are safeguarded by an Argotec system.





# ADVANTAGES

## FOR ALL

### Insurance companies

- ▶ Proven reduction of risks and damage by automatic fire protection systems
- ▶ Accurate assessment, thanks to the use of approved and certified products and technologies (VdS, German Lloyd, etc.)

### Operators and investors

- ▶ In the event of a fire, downtimes are minimised
- ▶ Optimised availability, as the risk of fire and serious damage is minimised
- ▶ Only the installation of an automatic fire protection system can prevent total loss by fire
- ▶ Stronger position for negotiations with insurance companies and banks
- ▶ Protection of the investment
- ▶ Upgrading of existing units

### Manufacturers

- ▶ Competitive edge, thanks to improved availability
- ▶ Enhanced image, as fire protection also means protecting the environment

### Fire brigade

- ▶ Effective fire protection for persons and property, prevention of damage to the environment and elimination of operational risks
- ▶ Active support of the fire brigade as weaknesses in the safety concept are effectively eliminated

### Minimax fire fighting solutions

- ▶ Effective prevention of damage by fire and all resulting economic consequences
- ▶ Enhancement of the image of wind turbines as safe and environmentally friendly systems
- ▶ Use of ecologically sustainable technologies

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Please see Minimax product sheets for detailed information.