PREVENT FIRES ACTIVELY AND SECURELY

OxyReduct®
Innovative oxygen reduction-based fire prevention system

WAGNER®

THE FIRE PROTECTION SOLUTION FOR MAXIMUM SAFETY STANDARDS

Fires can break out at any time, which is why a reliable fire protection solution is a must – and OxyReduct® by WAGNER makes it easy to implement.

Even small fires can cause a great deal of damage. They can bring businesses to a standstill: operations may be impeded or interrupted, goods and assets partially or completely destroyed. This is why it is important that measures be taken early on to limit the damage a serious incident can cause. However, conventional technical fire prevention systems generally work passively. In other words, they only react after a fire has already broken out and been detected. Advanced fire prevention is based on the principle of „fire prevention, not damage limitation".

Lower oxygen, raise safety

When conventional fire protection systems reach the limits of their capabilities, the patented OxyReduct® fire prevention system shines. The approved technology allows controlled reduction of oxygen levels within a room or protected area. Releasing nitrogen into the protected area lowers oxygen concentrations to a level just below the specified ignition threshold for the materials present, and holds them there. Such an atmosphere eliminates the possibility of an open fire developing: the remaining oxygen is no longer sufficient to sustain a fire or permit it to spread. This minimises fire risks while avoiding damage caused by smoke, soot or extinguishing agents.

From innovation to standard

In 1994, WAGNER became the first company to employ nitrogen as an extinguishing gas, as an alternative to halon or CO_2. WAGNER's decades of experience with gas extinguishing technology led it to develop its innovative concept of using nitrogen to reduce oxygen levels, and thereby minimizing fire risks from the outset. As the primary component in our natural ambient air, nitrogen can be obtained easily from anywhere, so that it can be used to maintain a consistent protective atmosphere within the protected area.

Tailor-made security

OxyReduct® provides individually tailored fire prevention solutions for areas where, besides the essential need for personnel protection, it is crucial to ensure electronic equipment remains available, goods are delivered and valuable assets are protected:

Typical applications

- IT and EDP rooms
- Data centres
- Deep freeze warehouses and cold storages
- Warehouses with small load carriers
- Hazardous material storages
- Automated high-rack storages
- Libraries, museums, archives, repositories

Officially recognised solution, proven hundreds of times over Stay out of the hot seat with the OxyReduct® active fire prevention system.

VdS Inspected. Approved. Safe. S 6040001

VB cert

Complies with Machinery Directive 2006/42/EG

BE PROACTIVE AGAINST FIRE RISKS

Large-scale fires causing millions of material damages happen every year. The origins of those fires, where determined, often lie in electrical defects.

Manageable and unforeseen fire risks

Fires that originate in the stock itself are rare, but not unheard of. For example, hot spots may develop undetected before being brought in from the order picking area, resulting in a sudden fire outbreak several hours later. Heat-shrunk packaging films and foods irradiated for preservation purposes may also contribute towards outbreaks of fire. However, technical defects in electrical equipment are the main cause of fires. Such defects include issues involving cabinets and control boxes, electrical motors, or (in deep freeze storage areas) refrigerating sets and defrosters. Repair work involving welding and thermal cutting also increases the risk of fire immensely.

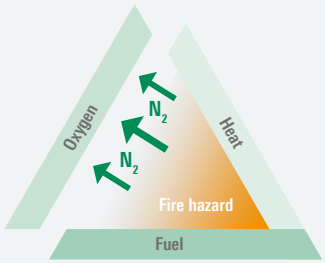
The advantages of active fire prevention

With OxyReduct®, WAGNER provides a system capable of preventing fire development reliably and actively. It minimizes fire risks by maintaining a fire-resistant protective atmosphere (i.e. continually reduced oxygen concentration levels). To protect persons and property optimally and effectively against operational interruptions, highly sensitive air sampling smoke detectors of the TITANUS® family form the basis of all protection concepts.

> *Experience shows that a fire can break out at virtually any time. The fact no fire has erupted in many buildings for decades does not prove that there is no risk, but constitutes a lucky streak for those concerned, the end of which must be reckoned with at any time!*
>
> Higher Administrative Court of Münster (10 A 363/86), Dec. 11,1987

Taking the wind out of fire's sails:

- Preventative fire prevention to protect people, assets and processes
- Minimal damage caused by smoke, fire, extinguishing agents or chemical reactions
- Natural nitrogen extracted from ambient air; no need to dispose of fire residues, ashes or extinguishing gases



OxyReduct® reduces O_2 concentrations to inhibit fire outbreak and spread.

Protects your company's existence and success:

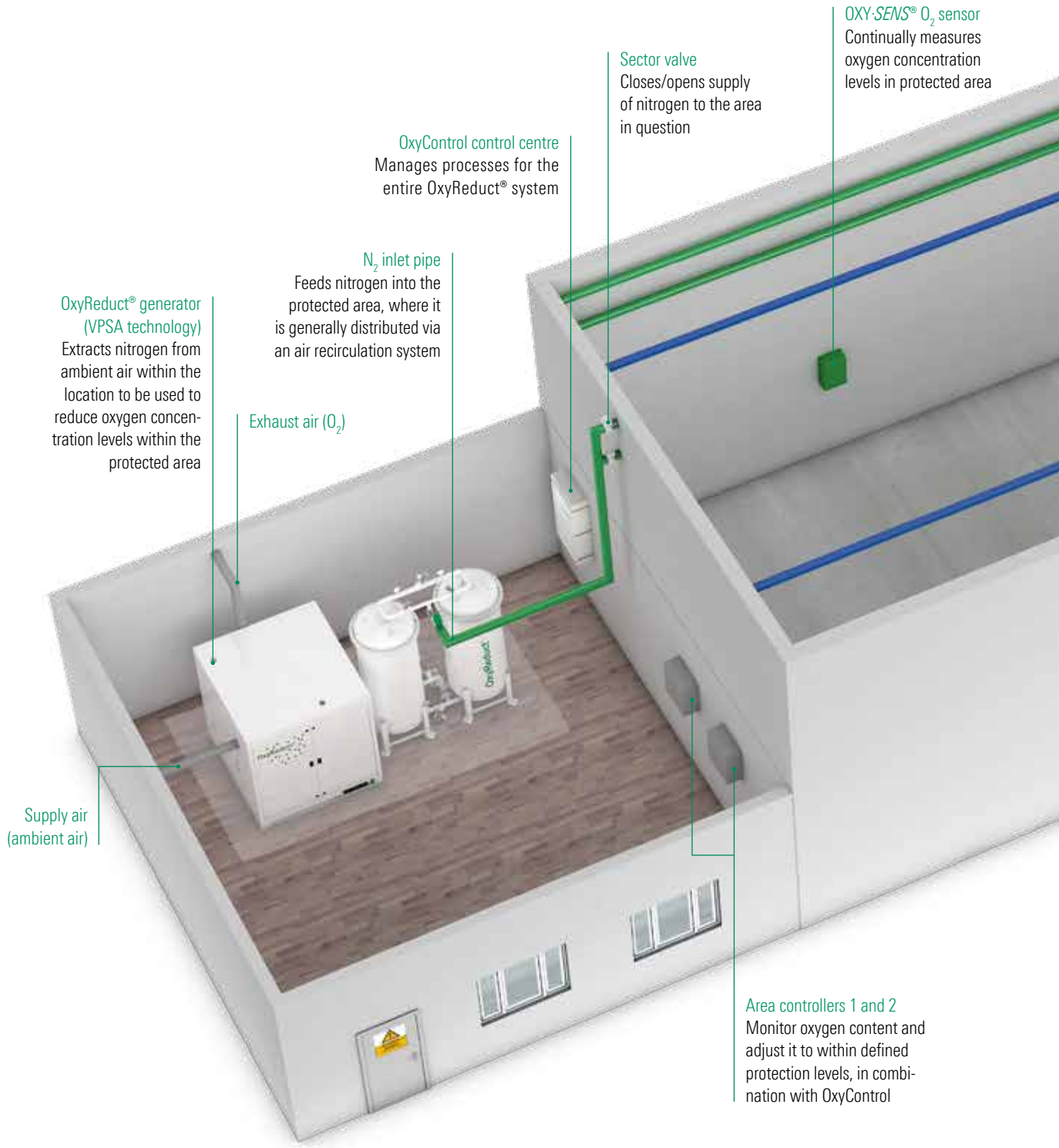
- Reduces business risks
- Avoids expensive downtime/ interruptions
- Protects your investments and assets
- Easy to adjust the fire prevention system in response to changes in usage or building renovation/extension
- Excellent cost-benefit ratio thanks to low operating costs (compared to climate control or lighting systems)
- Low operating costs made possible by the newest generation of WAGNER machines (VPSA technology)
- Certified, tested system that has been employed successfully hundreds of times

Award-winning fire protection

OxyReduct® is the first active fire prevention system officially recognised by VdS. This recognition is an expression of high quality and reliability, and is of central importance to both owners and operators. VdS Schadenverhütung GmbH is accredited for a variety of inspections and certifications as per DIN, ISO and EN standards, and is a member of the European Fire and Security Group (EFSG). OxyReduct® provides maximum personnel protection.

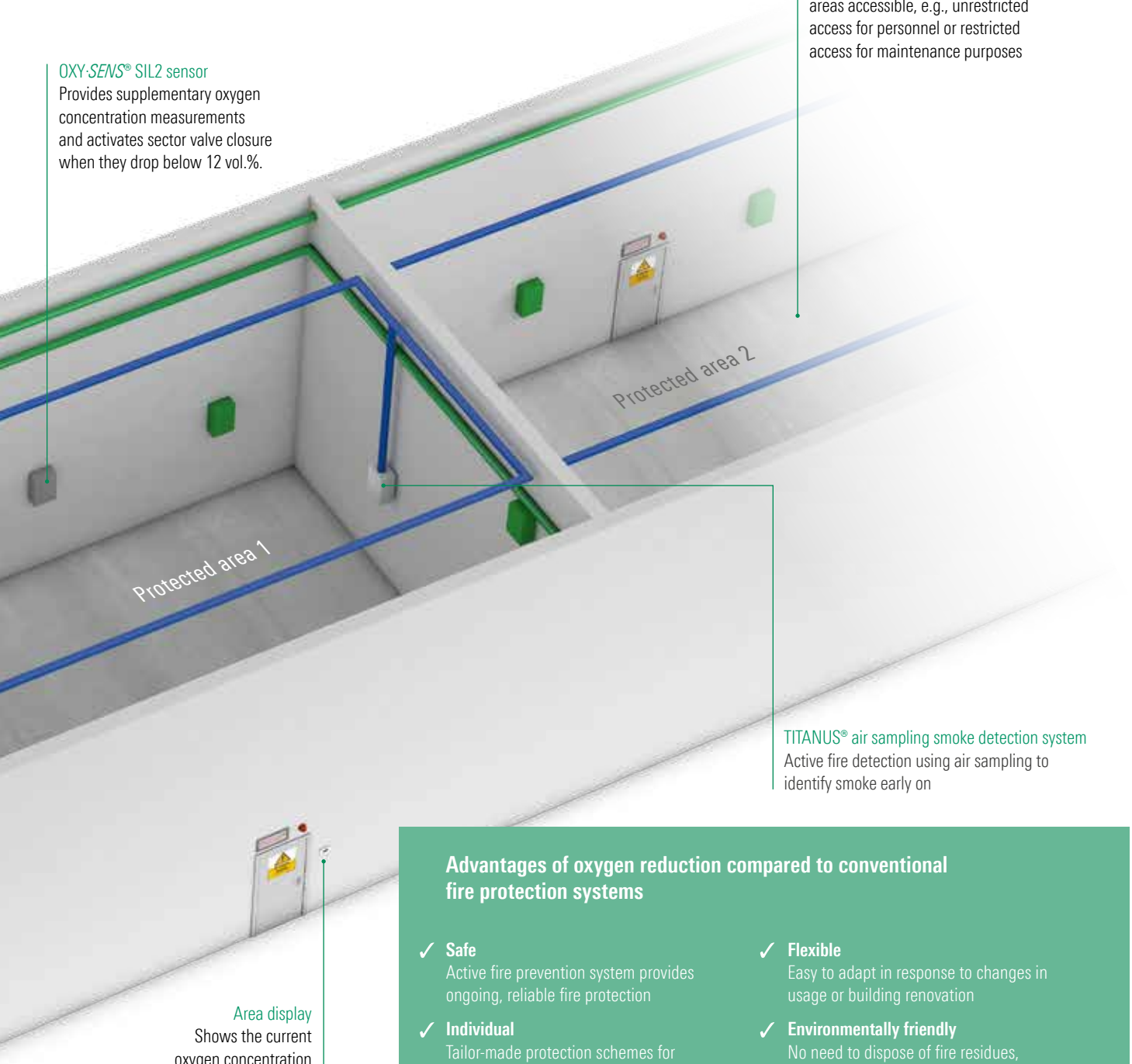
COMPREHENSIVE SECURITY AND BENEFITS

WAGNER plans and installs OxyReduct® fire prevention systems for one or more protected areas. The systems can also be cascaded for very large-volume rooms.



Needs-appropriate protection concepts
Multiple protection schemes and oxygen concentration levels may be employed in order to keep protected areas accessible, e.g., unrestricted access for personnel or restricted access for maintenance purposes

OXY-*SENS*® SIL2 sensor
Provides supplementary oxygen concentration measurements and activates sector valve closure when they drop below 12 vol.%.



TITANUS® air sampling smoke detection system
Active fire detection using air sampling to identify smoke early on

Area display
Shows the current oxygen concentration levels within any given protected area

Advantages of oxygen reduction compared to conventional fire protection systems

- ✓ **Safe**
  Active fire prevention system provides ongoing, reliable fire protection
- ✓ **Individual**
  Tailor-made protection schemes for customer-specific risks and protection specifications
- ✓ **Simple**
  Extracts nitrogen directly from ambient air on site to use in reducing oxygen concentration levels
- ✓ **Efficient**
  VPSA technology offers potential energy savings of up to 80 % compared to conventional membrane technology
- ✓ **Flexible**
  Easy to adapt in response to changes in usage or building renovation
- ✓ **Environmentally friendly**
  No need to dispose of fire residues, ashes or extinguishing gases
- ✓ **Tested**
  VdS certified including installer and system recognition
- ✓ **Space-saving**
  Takes up less space compared to extinguishing systems, thus utilizing storage space more effectively
- ✓ **Economical**
  Attractive cost-benefit ratio for investments in active fire prevention

SIMPLE, NATURAL FIRE PROTECTION

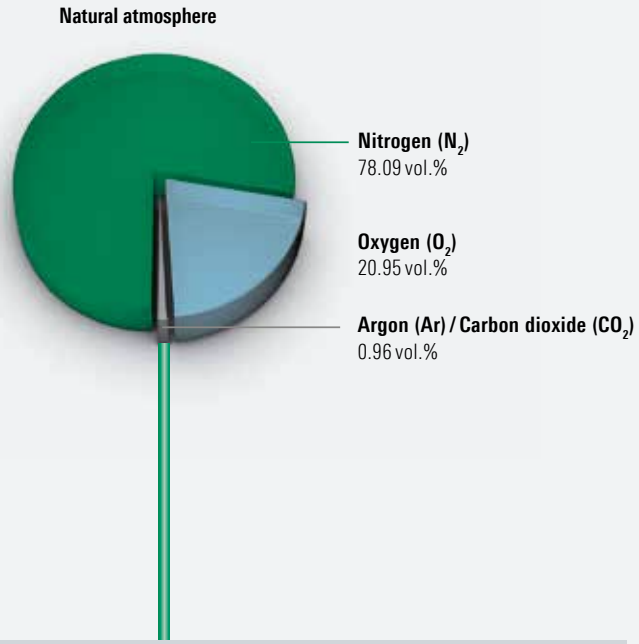
Instead of storing nitrogen in extinguishing cylinders, OxyReduct® generates the nitrogen it needs from the surrounding air, since nitrogen is the primary component of our natural atmosphere. This saves space and makes the system more flexible.

Nitrogen's natural properties ensure that it will be distributed homogeneously, thus providing controlled, uniform oxygen reduction throughout the entire protected area. WAGNER uses a variety of technologies to generate nitrogen.

Nitrogen production M-Line
With the OxyReduct® M-Line, nitrogen is generated using membrane technology. The ambient air is pressed through an aluminium tube with hollow fibre membranes, similar to fine straws. The oxygen molecules diffuse through the fibres, while the nitrogen molecules are transported from the nitrogen generator via the pipe network into the protection area.

The membrane technology uses bundles of hollow fibre membranes to extract nitrogen from the ambient air.

The activated carbon inside the CMS containers binds the oxygen in the atmospheric air, while nitrogen can pass through the containers unhindered.



Nitrogen generator model overview

The self-developed product portfolio offers a unique range and enables installation concepts that are optimally tailored to customer requirements. For your individual project requirements, we always find the better solution in fire protection.

Nitrogen generation V-Line & P-Line

The OxyReduct® V-Line and P-Line, on the other hand, generate nitrogen using activated carbon. In the processes of Vacuum Pressure Swing Adsorption (VPSA) and Pressure Swing Adsoprtion (PSA) oxygen is separated from nitrogen via Carbon Molecular Sieves (CMS). For this purpose, the ambient air is pressed into a CMS container. The activated carbon binds the oxygen it contains. Unhindered, the nitrogen passes through the container and thus enters the protected area.

TAILOR-MADE PROTECTION CONCEPTS

Each protected area and each customer's individual needs require a corresponding fire protection concept.

WAGNER has developed and realized special protection concepts for a variety of applications. After conducting a risk analysis and identifying protection goals, WAGNER uses these protection concepts as the basis for an OxyReduct® fire prevention solution that is tailored to the customer's specific needs.

Concept I – Permanent reduction of oxygen concentration levels

By continuously reducing oxygen concentration levels, the OxyReduct® fire prevention system prevents fires from developing or spreading. To achieve this, we define oxygen concentration levels based on the ignition thresholds of the materials present, then reduce the atmospheric oxygen to the target concentration in a controlled manner and maintain that concentration level, creating a protective atmosphere.

Concept II – Oxygen reduction with two adjustable levels

OxyReduct® can also adjust oxygen levels completely automatically at specific times. For example, the protected area might have a slightly reduced O_2 concentration of 17 vol. % during the day, ensuring that it remains freely accessible. During night and weekend hours, the system reduces oxygen concentration to the second level (14.6 vol. %) in order to ensure maximum fire protection during periods without supervision.

Concept III – Quick release

The OxyReduct® fire prevention system lowers atmospheric oxygen concentration to 17 vol.%, thus significantly limiting fire behavior. It then works in tandem with an early fire detection system, and rapidly lowers oxygen levels if alarms are triggered. It achieves this by using nitrogen tanks to lower oxygen concentration to a level that can extinguish the fire. The system can maintain this level almost indefinitely in order to prevent re-ignition. This protection concept is perfect for applications involving areas that are difficult or impossible for fire brigades to access.

Concept IV – two-stage quick-action reduction

After a fire has been detected by highly sensitive aspirating smoke detectors, the oxygen level in the room is first lowered to e.g. 17 vol. % O_2 by introducing nitrogen from stored pressure containers. This results in a significantly reduced fire behaviour and in the ideal case the fire already extinguishes. This oxygen level can be maintained as long as required by an OxyReduct® nitrogen generator. As the protected area is still freely accessible, the operator has the opportunity to locate and remove the cause of fire. If an expansion of the fire should nevertheless be detected during this phase, the oxygen concen-

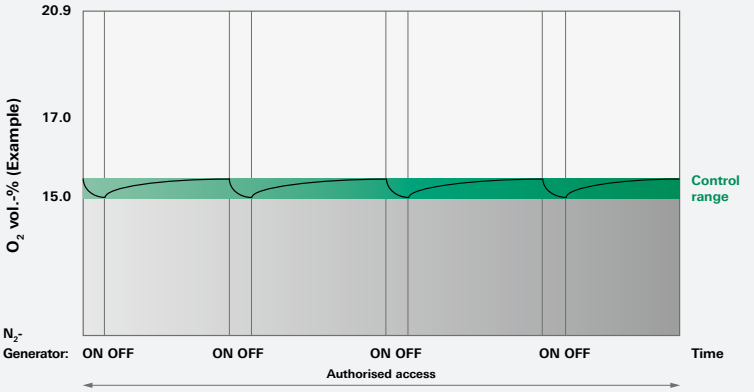
tration is reduced to a lower level which is clearly below the ignition threshold of the predominant materials. The second safety level is intended to completely prevent the spread of fire and can also be maintained for any length of time.

Advantages of the two-stage quick-action reduction:

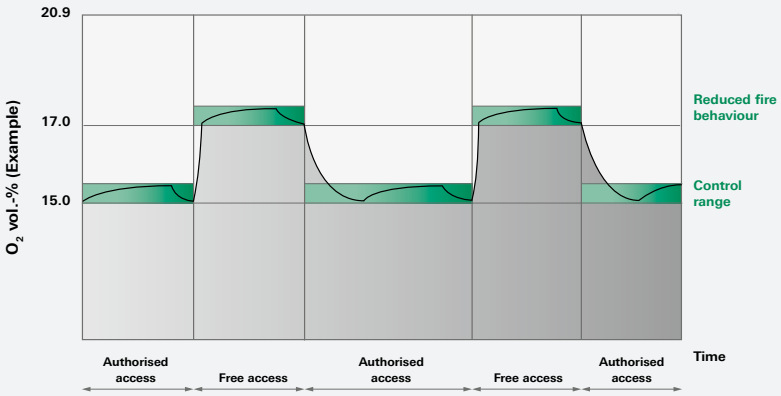
- No immediate disconnection of the power supply necessary
- Ideal for data centres
- Fire protection solution also applicable with a free cooling concept
- Lowest operating costs with very high protection level

Schematic diagram of OxyReduct® concepts

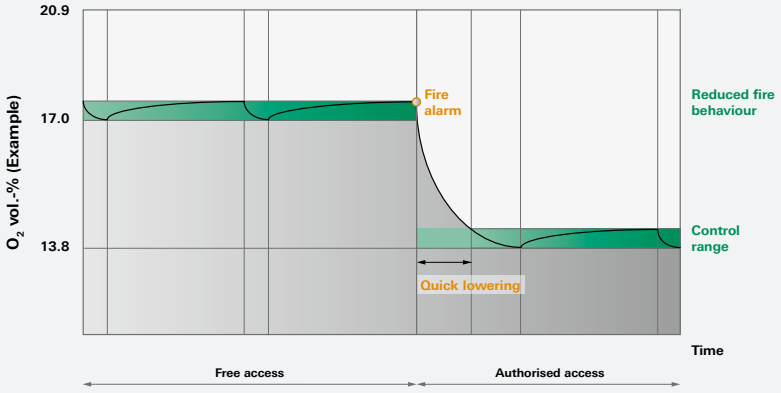
Protection concept I – permanent reduction



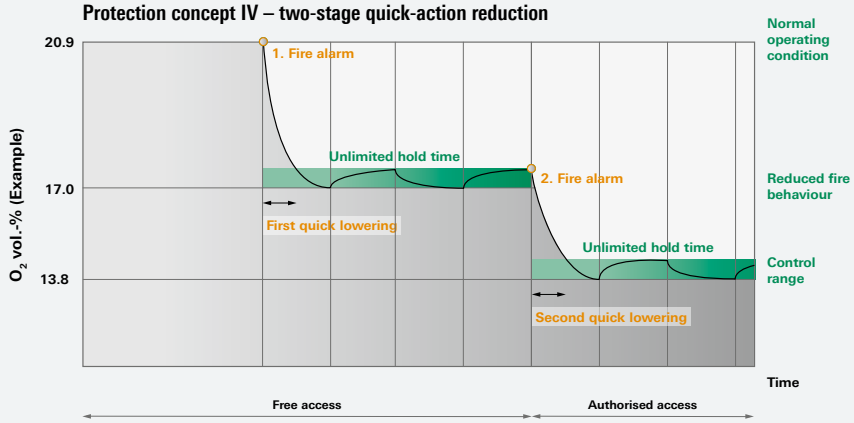
Protection concept II – dual-level regulation concept (day/night)



Protection concept III – quick release



Protection concept IV – two-stage quick-action reduction



MAXIMUM PERSONAL AND ORGANISATIONAL SAFETY

Safety comes first – because that's the only way to keep processes, goods and assets safe. Optimum personnel protection includes certain occupational safety measures.

Using nitrogen to reduce oxygen levels affects neither the processes nor the goods within the protected areas; healthy people can also live and work without restrictions in lower-oxygen environments. Our protection concepts incorporate appropriate occupational safety measures, in order to ensure that oxygen reduction systems never represent a risk to human health and safety.

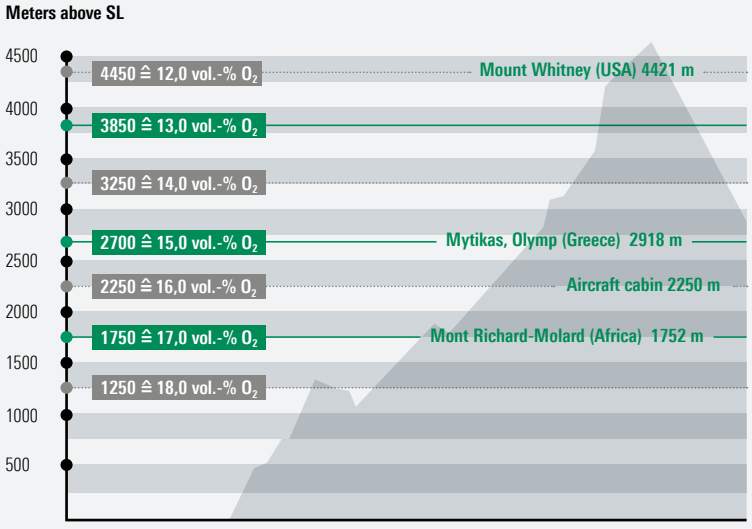
Like being at high altitude

Human beings are accustomed to getting by with less oxygen than the atmosphere contains (20.9 vol.%). As geodetic elevation increases (e.g., in the mountains or on airplanes), partial atmospheric pressure decreases, resulting in reduced oxygen absorption.

Working in oxygen-reduced environments

Crucial for users and operators is that, under normally applicable regulations, protected areas can remain freely accessible at oxygen concentration levels as low as 17 vol.% – only condition: the relevant safety guidelines are observed.

Oxygen content compared to sea level (SL)



INTELLIGENT FIRE PREVENTION THROUGH INNOVATIVE POWER

As technological leaders, we set global standards with our innovative fire protection concepts.

Security by the technological leader

WAGNER has been developing and realizing technical fire protection systems since 1976, and has established itself internationally as an innovative provider of systems and solutions. Its spectrum of expertise ranges from individual consultancy and application-specific development of your fire prevention solution to system installation and routine maintenance.

Individual fire prevention concepts

No matter what your specific safety and security needs are, our fire protection systems will systematically ensure maximum safety. Our engineers tailor protection concepts to meet your needs and offer your business the greatest possible degree of fire protection. Minimising this risk secures your company and your economic success.

Oxygen levels classified as per BGI/ GUV-I 5162, Working in Oxygen-Reduced Environments

Category 0:
20.9 vol.% > oxygen content > 17 vol.%
No restrictions; freely accessible to all employees (without known cardiovascular, circulatory, vascular, or respiratory diseases)

Category 1:
17 vol.% > oxygen content > 15 vol.%
Accessible to employees following occupational health examination; 30 minute breaks every four hours

Category 2:
15 vol.% > oxygen content > 13 vol.%
Accessible to employees following occupational health examination; 30 minute breaks every two hours

Category 3:
< 13 vol.% oxygen content
Accessible only with specific supplementary measures

Protection of 38,400 m³ high-bay warehouse

Davert, one of the leading manufacturers of organic food products in Germany, operates a fully automated high-bay warehouse in Ascheberg, North Rhine-Westphalia.
Up to 7,400 pallets are stored in the 24 m high racks. Decisive for the selection of OxyReduct® were low costs compared to a water-based system and low maintenance costs.

A fire prevention system for our warehouse costs around two thirds of the price for a sprinkler system.

Friedrich Niehoff, Executive Partner
Davert GmbH

ACTIVE FIRE PREVENTION AS THE NEW STANDARD

Comprehensive protection through fire prevention

When constructing its second warehouse, the British Library turned to OxyReduct® once again to protect millions of books and newspapers. Today, two storage areas with volumes of 85,000 m³ and 45,000 m³, containing the printed treasures of the United Kingdom, are protected by state-of-the-art technology. Protective goals include preventing fires from breaking out and protecting materials against damage by extinguishing agents, while keeping operating costs down. Since no personnel work inside the fully automated warehouse during normal operations, oxygen concentration levels between 14.8% and 15% are maintained continuously.

Having had very good experiences with the OxyReduct® *system, we elected to work with WAGNER once again.*

Patrick Dixon, Head of Construction
and Technology at the British Library

Fire protection even under extreme conditions

KLM Kühl- und Lagerhaus Münsterland GmbH turned to WAGNER's OxyReduct® active fire prevention system for fire protection within the largest fully automatic deep-freeze high-bay warehouse in Germany, which has a total protection volume of 380,000 m³.

Thanks to highly energy efficient V-Line technology, we not only score points in terms of safety, we also keep operational costs down.

Georg Grewe, Managing Director
of KLM Logistik

OXYREDUCT® HAS PROVEN ITSELF INTERNATIONALLY – HERE ARE JUST A FEW OF OUR REFERENCES

Multi-stage data centre fire prevention

In Europe's most modern data centre, noris network AG relies upon energy-saving KyotoCooling® (a free-cooling method) and innovative fire prevention technology. WAGNER developed a two-stage quick-action reduction system for the two protected areas, which have a total volume of 16,000 m³. In the event of an emergency, IT areas are protected from fire hazards carefully and purposefully, without having to be disconnected from mains power.

We cannot risk downtime under any circumstances, so **OxyReduct®** *won us over completely.*

Ingo Kraupa, Chairman
of noris network AG

WAGNER Group Plant Engineering & Construction

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WAGNER sets standards in fire protection – with innovative and comprehensive solutions

Fire detection units

Very early fire detection systems (TITANUS®)

Active fire prevention (OxyReduct®)

Fire extinguishing (FirExting®)

Hazard management (Visu*LAN*®)