FirePASS® Fire Prevention Systems
**FirePASS®**
**Oxygen Reduction Systems**

“How does FirePASS® work? The key to the technology is that oxygen-reduced (hypoxic) air is produced by partly filtering out oxygen from ambient atmospheric air. Normal atmosphere contains 21% oxygen. The hypoxic air injected into a FirePASS® protected space is 15% oxygen and 84% nitrogen (1% is made up of argon, carbon dioxide and other gases). Initial combustion cannot occur at this level. Common flammable solid materials and liquids cannot be ignited with an oxygen level below 16%.

For people & safe for the environment

FirePASS® produces and uses breathable air for fire prevention. It is safe for people and safe for the environment. No chemicals or gases are involved. The FirePASS® agent is simply oxygen-reduced (hypoxic) air.

There has been extensive medical research in the UK, Europe and Australia to support the safety of working in a hypoxic environment of oxygen at 15%.

Safe for people & Safe for the environment

At sea level, 15% oxygen content is equivalent, in terms of human physiology, to normal atmospheric air at an elevation of around 2,700 metres (9,000 feet) above sea level or being on a commercial flight. Millions of people around the world live at altitudes equivalent to exposure at or below 15% oxygen concentration at sea level.

Hypoxic air environments are currently used for physical training and rehabilitation of athletes, as well as in medical research.

**Unique and patented technology**

Unlike other oxygen depletion fire prevention systems which inject pure nitrogen, FirePASS® injects natural air with lowered oxygen (around 10%) into the protected areas. This is inherently safer for occupied areas and more acceptable to occupational health and safety bodies. Injection of pure nitrogen can pose problems with pockets of high concentration where personnel can become affected.

The FirePASS® technology is patented and universally accepted by occupational health and safety bodies worldwide including OSHA in the United States and Worksafe.

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**“FirePASS® has the unique ability to create an environment of breathable, controlled, oxygen-reduced air that prevents fire ignition.”**
OXYGEN REDUCTION TECHNOLOGY

AN INDEPENDENT REVIEW

Thoracic specialist, Professor Matthew Peters, President of the Thoracic Society of Australia and New Zealand, conducted an independent review on working in hypoxic conditions, with a goal to develop a protocol for workplace safety.

A copy of Professor Peters’ report including a Hypoxic Environment Checklist can be found in the expert review brochure published by Fire Protection Technologies.

HIGHEST PROTECTION FOR VALUABLE ASSETS

In addition to its valuable fire prevention properties, the oxygen-reduced environment slows oxidation and is perfect for preservation of irreplaceable items such as archived documents, artworks, museum exhibits and rare artifacts. The deterioration of materials and stored goods is drastically lowered due to the reduced-oxygen content of the hypoxic air produced. The oxygen reduced air provided by the system is completely clean and particle free air (< 1 μm).

APPLICATIONS

- Data Centres
- Server Rooms
- Electrical Switch Rooms
- Warehouses
- Museums
- Archives
- Libraries
- Art Galleries
- Control Rooms in power plants
- Hazardous materials storage
- Food storage areas/ deep freeze/ cold storage rooms

‘Fire Protection Technologies takes great pride in introducing the world’s latest innovations and technologies to the Australian market.’

FEATURES & SPECIFICATIONS

- Provide a safe and breathable oxygen environment
- Patented and proven technology
- Very small footprint
- Plug and use
- Multiple hazards can be protected with just one system
- Generators require very little maintenance – a cycle of 6 months is typical
- No nitrogen injection, so safer than other systems
- No extensive piping
- No expensive refilling
- No pressurised cylinders, no leaking
- No false discharge and no discharge failures

- Designed, engineered and manufactured to customer requirements and specifications
- Easily installed into existing premises as well as in newly built spaces
- Can fit any application ranging from self-contained units for smaller volumes, to vast systems for large buildings, protecting single or multiple rooms and compartments
- Can be used as an alternative, but also as a complementary or supplementary option that enhances conventional fire-safety without interfering with performance

FirePASS® has invented and holds the patents of this technology (international publication number WO 2001/078843)

FirePASS® prevents fire pro-actively, eliminating damage and business interruption that occurs when suppressing a fire after it has already started.
The system consists of a hypoxic air membrane generator system and a distribution system which is built into standing metal cabinets; one separate hypoxic air buffer vessel, separate compressors mounted on compressed air buffer vessels plus a separate refrigerant air dryer and one separate condensate cleaner. The system produces hypoxic air with never less than 10% O₂.

The included control unit monitors the effective O₂-level in the protected areas with the help of the respective oxygen monitoring units. The O₂-level is regulated by opening the valves for the associated rooms as well as switching the compressor on and off depending on the pre-set O₂-levels and on the actual need for hypoxic air of the total system. As a need for additional hypoxic air increases (due to inherent leakage within the room), hypoxic air is delivered via the buffer vessel into the room.

Two standing cabinets for generator and distribution system with inbuilt control unit and separate hypoxic air buffer vessel

Two compressors on buffer vessels
The key factor that determines the running costs of any hypoxic air venting system is the leakage rate of the protected volume. We therefore recommend improvements to sealing in order to reduce running costs.

An investment in improving the sealing typically has short payback times as there is immediate pay-off through reduced energy consumption and reduced maintenance costs.

We are able to test the enclosure integrity to determine the extent and location of leakage points and provide recommendations on sealing improvements and to discuss any additional requirements.

In order to control and maintain the environment to the desired oxygen level, the system will include an advanced oxygen monitoring system with ultra-stable, long-life zirconium oxide oxygen sensors.

**COMMON CHARACTERISTICS OF THE SYSTEM**
- Generator system and distribution system with control unit mounted in standing metal cabinet
- Multistage filtration consisting of a fine coalescing filter (1μm), a coarse coalescing filter (0.01μm), an activated carbon absorber and a dust carry-over filter (1μm)
- In-built moisture control and automatic draining for each section
- Standing hypoxic air buffer vessel
- Condensate cleaner
- Oxygen monitoring units and control panel to monitor protected areas
- UPS (with 24 hour battery back-up) for the control unit and oxygen monitoring units
- Three phase alternating current 400V/50Hz power supply for the compressors and 220V/50 Hz for the generator.

**OPTIONAL FUNCTIONALITIES FOR THE SYSTEM MAY BE ADDED UPON REQUEST**
- Additional dry contacts in the control unit to connect separate visible/audible alarms
- Signal inputs for a door switch that enables the hypoxic air supply to be turned on or off
- Separate, additional display located outside the protected area, showing the oxygen concentration level
- Remote location of the control unit, built into a separate metal cabinet
- The system can be connected to a building management system or other central monitoring unit with ModBus TCP/IP

**HYPOXIC VENTILATION SYSTEM**

**PRINCIPLE OF OPERATION**
Hypoxic air generators operate by filtering a part of the oxygen from ambient air and providing fresh hypoxic air for the ventilation of the protected areas. As a result, a slight positive pressure will be established inside the protected room. The positive pressure will keep out dust and other impurities, while constant hypoxic ventilation will aid in the removal of gaseous products that may be generated inside the room.

The flow of the hypoxic air will be adjusted to maintain a level of oxygen in the internal atmosphere between 14.5% and 15.7% typically (these levels may change depending on the room and contents to be protected). Usually, the system is designed so that hypoxic flow will shut down at 14.5% O₂ and automatically resume when a level of 15.7% is detected. This provides a good margin for safety in the event that excessive personnel access creates leakage. At the same time, this provides a level of oxygen that is perfectly safe for long-term exposure (full working day) of personnel.
**CONTROL UNIT**

The control unit has a user-friendly touch screen for easy programming and settings, protected by passwords to provide various levels of security. The touch screen will be installed in the generator metal cabinet jointly with the control unit. It may be optionally installed in a separate small metal cabinet and located remotely. The control unit shows and tracks all alarms and warnings and stores the system performance data over a period of time of more than one year, including the regularly tracked $O_2$-levels measured by the oxygen monitoring units. The data can be written to a USB drive and transmitted to a computer for analysis.

See example below, of the main screen of the control unit touch panel interface. Additional functionalities can be supplied upon request.

The control unit may be enabled to communicate with a building management system installed on site by Modbus-TCPIP protocol via standard Ethernet cable. Alternatively, the system can be upgraded to be monitored and controlled from any PC via a web-browser based interface.

The control unit will be equipped with a UPS (hold-time 24 hours) that supplies the control unit and the touch panel as well as the oxygen monitors and the BMS interface. This will keep all monitoring and alarming functionalities working even in the event of mains power failure.

**OXYGEN MONITOR**

FirePASS provides a high quality, dedicated and certified stand-alone continuous oxygen monitoring unit for the detection of oxygen content specifically in hypoxic environments. The system consists of a digital touch panel display and a sensor head with a zirconium oxide sensor cell for the detection of $O_2$ with a range of 0-25%. It has an inbuilt relay for local alarms for a pre-set oxygen concentration and is equipped with a buzzer. The oxygen monitoring unit stores the measured $O_2$ values and allows for displaying them on the local touch panel.

The monitor is 24VDC powered and continuously transmits $O_2$ concentration data via a 4-20mA signal. The sensor head, the electronics and the display are built into a wall-mounted aluminum housing that is installed in the protected room. The $O_2$ sensor cell has a minimum life of 5 years.

**INSTALLATION**

FirePASS® systems have a smaller footprint compared to conventional gaseous suppression systems and do not require rigid piping within the protected spaces. The only requirement is simple, low pressure piping to each protected area and to the ambient air, along with wiring of the oxygen monitoring units in the protected areas. It is recommended that protected areas be equipped with highly sensitive aspirating smoke detectors (HSSD). This is to ensure that any smouldering combustion from cable faults, for example, is reported in its incipient stages, even though it will not reach the flaming stage.

A comfortable, breathable atmosphere is created inside the protected space by the ongoing ventilation with fresh hypoxic air.

The highly reliable hypoxic air generators require very little maintenance – a maintenance cycle of 6 months is typical. Regular monthly inspections are recommended to ensure a fire preventative atmosphere is maintained.

FirePASS® systems can be implemented as an alternative, but also as a complementary or supplementary option which enhances the conventional fire-safety means without interfering with their performance.

**Note:** The protected areas have to be well sealed in order to minimize the permanent leakage of air in and out of the room. All spaces in the protected area must have split-type air cooling or closed, dedicated air recirculation systems.

**PREPARATORY WORK**

Sealing the rooms

The key factor relating to running costs (energy consumption and maintenance) of an installation of FirePASS® fire prevention systems, is the leakage. This is the sum of permanent leakage of the protected area and the temporary leakage created by door openings. Investing in improving the sealing of the protected areas will have a direct impact on running costs as they are directly proportional to the leakage rate achieved. The payback for such improvements typically is less than one year.

To evaluate the current leakage of the area to be protected, we recommend performing an integrity fan test prior to any works being commenced.
VENTING / COOLING

The area where the compressors and filtration units are housed is required to be well-ventilated in order to allow a permanent supply of fresh, ambient air to the compressors. Alternatively, the room can be cooled with chillers but this will also require a supply of fresh air. There is a requirement for a small drain in the machine room for the wastewater of the condensate cleaner.

Note: The final design of the equipment room and the manner in which it is being cooled and ventilated should be specifically designed to suit the particular application. Separate recommendations will be given regarding all preparatory work. Material and diameters of tubing/piping mentioned in the following sections are to be verified, based on the final design.

INSTALLING THE SYSTEM

FirePASS® systems come readily mounted and tested. Once on site, the system is connected to the room sensors and to the power supply. The system is then connected to the rooms via the installed tubing. The byproduct oxygen-enriched air is vented outside.

The power supply for the compressors is 400 Volts/50 Hz/3-phase with slow fuses to serve the compressors. The generator units need 230 Volts/50 Hz and shall be buffered via the central UPS.

PIPING

1. To the protected area:

Supply of the hypoxic air to protected area with can be achieved either with metallic, PVC, PA, ABS or similar material tubes or pipes. If the piping for the provision of hypoxic air to the protected area crosses other fire sections, metallic piping shall be used and should be protected against corrosion.

The tubes or pipes shall be installed in a way that they build the shortest possible connection to the room and have as few bends as possible. For the piping to the protected area, the sufficient inner diameter will depend on the length and number of bends (generally, 11 mm for all areas, with two tubes or pipes in parallel for the supply of the bigger area).

The installation of tubing or piping is to be planned, prepared and carried out by certified installers.

Noise generated at the air outlets is reduced by installing sound mufflers.

2. Oxygen enriched air outlet

Piping for the oxygen enriched air outlet may be done with a PVC, PPS, ABS or similar pipe, or with a metal duct. It is to lead directly outside the building, ideally up to the roof level, to avoid any increase of the danger of fire.

A sufficient inner diameter will be approximately 10-12 mm, depending on the location of the protected area and the respective distance and number of bends required.

The installation of the piping is to be planned, prepared and carried out by certified installers.

Note: The oxygen enriched airflow has to be vented outside the protected area whilst the system is operating, as this waste flow will carry up to 35% oxygen content.

WIRING THE ROOM’S OXYGEN SENSORS

Each room is to be equipped with two Oxygen Monitoring Units as a minimum. The monitoring units are typically placed at eye level, at an appropriate distance from the door of the room. This is to provide for monitoring of oxygen conditions and alert if doors are wedged open or not closed properly, whilst minimising the amount of false high oxygen alarms.

Each sensor is to be wired directly to the FirePASS® control panel with its own 7-wire, fire rated shielded cable.

MAINTENANCE

The FirePASS® hypoxic air generators are highly reliable passive units that can operate for decades with proper maintenance. This normally includes, as a minimum, changing the filters after every 3,000 operating hours or at latest after 12 months. This cycle applies if the supplied fresh air is compliant with the required quality. If the air quality is lower (in the event of dust, humidity, temperature etc.) the cycle of filter changes needs to be reduced.

The compressors require regular maintenance with a cycle of 2,000 running hours. We recommend a maintenance cycle of 2,000 hours for the whole system (both for compressors and generators).

INSPECTIONS

Acceptance test

The operator/operating company must subject the FirePASS® oxygen-reduction system to an acceptance test by a qualified person after installation or after any significant modification to the system. This test must take place prior to commissioning.

Regular Inspections

The operators/operating company must have the proper function of the FirePASS® oxygen-reduction systems tested by a qualified person at least once per year. Special operational circumstances may make it necessary to carry out more frequent inspections.

Record of Inspections

The results of the inspections must be recorded in an inspection report. The records of the acceptance tests must be kept throughout the operating time of the FirePASS® oxygen reduction system. The records of the regular inspections must be kept for at least 4 years. These may be stored on computer data carriers. These documents must be presented to the competent supervisory authorities upon request.

WARRANTY

The FirePASS® hypoxic air generator systems come with a regular warranty of two years. The warranty commences on the date of delivery.
CASE STUDIES

SYDNEY ADVENTIST HOSPITAL, SYDNEY, AUSTRALIA

Australia’s first oxygen-reduction fire prevention system was installed in the Sydney Adventist Hospital using a FirePASS® FP-500 system. Several rooms are protected including the power factor correction room and the hospital’s main switch room that feeds the operating theatres.

FirePASS® FP-500 System typically protects a volume of 500m³.

ARA CORPORATE OFFICE, SYDNEY, AUSTRALIA

ARA Installed a FirePASS® FP-145 System at their corporate office located at Stanmore in Sydney.

FirePASS® FP-145 is a self-contained unit protecting one room of up to 200 m³. This system has a simple installation - plug and play.

OSLO MUSEUM OF CULTURAL HISTORY, UNIVERSITY OF OSLO, NORWAY

The Museum of Cultural History is one of Norway’s largest cultural history museums.

FirePASS® is protecting 6 areas of around 14,000m³.

OSLO CITY ARCHIVES, NORWAY

The Oslo City Archives is the city’s executive authority within the archival domain. The City Archives has a supervising and advisory responsibility for the city’s records management, both electronic and paper.

FirePASS® FP-8000 Twin System is protecting 2 large archive rooms with a volume of 8,000 m³ offering full redundancy of air compression and air separation units.

MINISTRY OF DEFENCE PENSION FUND, MUSCAT, OMAN - TIER 4 DATA CENTRE

Ministry of Defence Pension Fund, Muscat, Oman - Tier 4 Data Centre. Muscat is the capital of Oman. The city lies on the Arabian Sea along the Gulf of Oman and is one of the Middle East’s oldest cities.

FirePASS® FP-1000 Twin System is protecting 9 areas in the Data Centre.

# PRODUCTS:

## Gaseous Suppression
- Inert Gas (IG-01, IG-55, IG-100, IG-541)
- Novec 1230™ Fluid (FK-5-1-12)
- FM-200® / NAF S 227 (HFC-227ea.)
- Ecaro 125® / NAF S 125 (HFC-125)
- Carbon Dioxide (CO₂)
- Hybrid Systems (N₂ / Water)
- Pressure Relief Vents
- Enclosure Integrity Testing Equipment
- Pipe & Fittings

## Water Suppression
- Water Mist - High Pressure
- Water Mist - Intermediate Pressure
- Water Mist - Low Pressure
- Hybrid Systems (Water / N₂)
- Monitors & Delivery Systems
- High Speed Deluge

## Foam Suppression
- Foam Concentrates
- Foam Proportioning
- Foam Delivery Systems
- Foam Concentrate Testing

## Explosion Protection
- Explosion Suppression
- Explosion Isolation
- Explosion Vents & Pressure Relief
- Spark Suppression
- Explosibility Testing

## Fire Detection
- Linear Heat Detection - Digital
- Linear Heat Detection - Fibre Optic
- Linear Heat Detection - Micro Chip
- Flame Detection
- Video Imaging Detection
- Spark Detection
- Control & Indicating Equipment
- Thermal Imaging Detection

## Military & Defence
- Military Vehicles
- Naval Vessels

## Special Applications
- Micro Environment
- Oxygen Reduction
- Kitchen Protection Systems
- Dry Chemical Vehicle Systems
- Compressed Air Foam
- Marine & Offshore Vapour Mitigation

## Support Services
- Design / Engineering
- Technical Support
- Services & Testing

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‘Every solution for your special hazard needs’