FirePASS®

# A REVOLUTION IN FIRE SAFETY

FirePASS®
Fire Prevention and Suppression Systems

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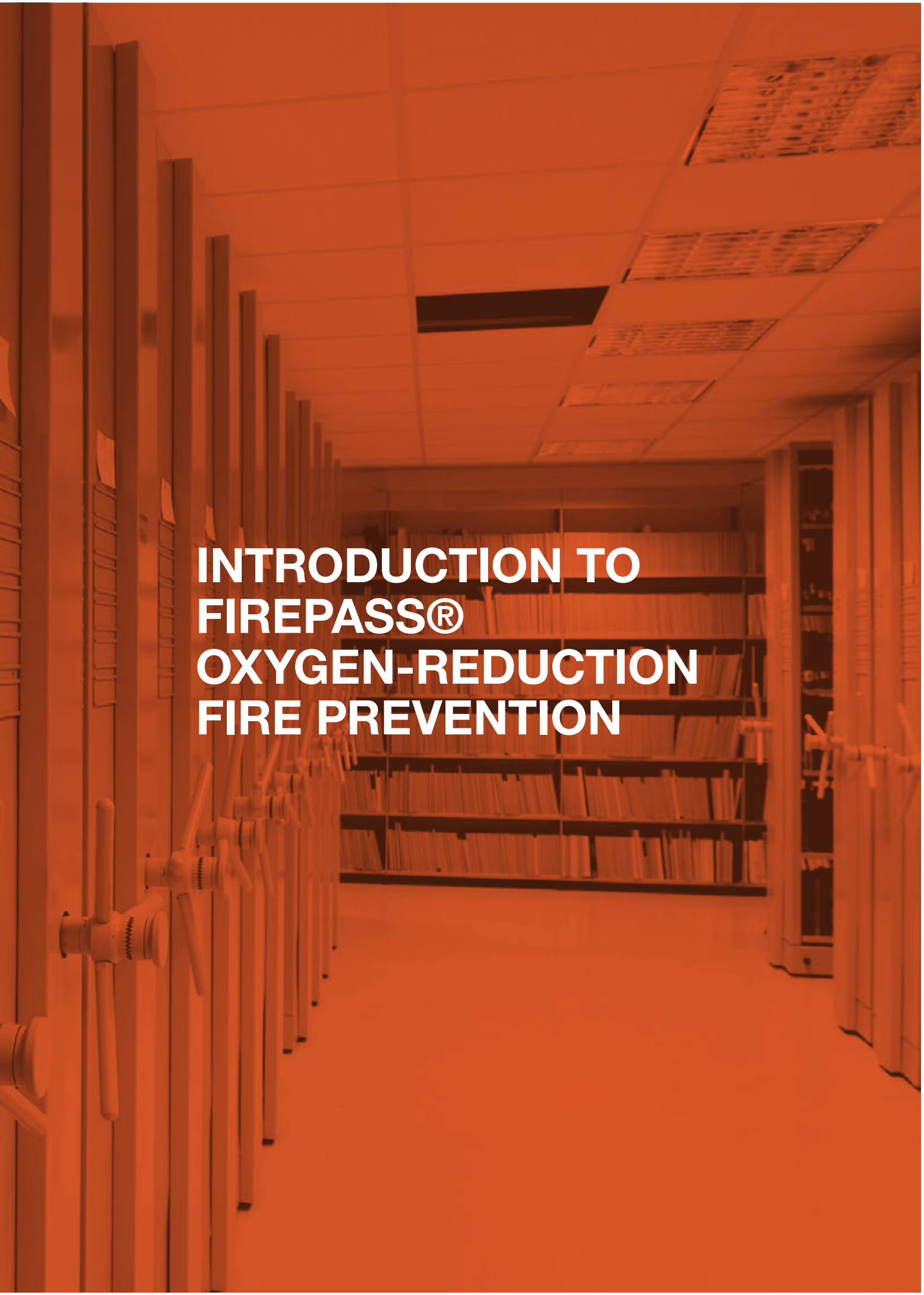


# INTRODUCTION TO FIREPASS® OXYGEN-REDUCTION FIRE PREVENTION

# INTRODUCTION TO FIREPASS® OXYGEN REDUCTION FIRE PREVENTION

**FIREPASS® Oxygen Reduction Fire Prevention, is a revolutionary fire prevention technology that is designed to prevent fire from occurring by reducing and maintaining oxygen at non-combustible levels.**

## SUDDEN DISCOVERY

Many hundreds of years scientists and engineers around the world tried to find a way to make us safe from fire. Different technologies were introduced to fight fire with water, sand, foams, water mist, inert gases, etc. The problem is that they are all reactive and deployed after a fire actually starts providing at least some damaging results.

The amazing property of breathable hypoxic (oxygen-reduced) air to suppress ignition and fire was discovered in 1998 in the U.S.A. by Russian scientist and engineer Igor (Gary) Kotliar. He made this breakthrough during his experiments with the Hypoxic Room System, which he invented in 1993 for simulating altitude in athletic training.

In 1995 Igor Kotliar formed Hypoxico Inc. in New York and started marketing the Hypoxic (Altitude) Room and Hypoxic Tents to cyclists, runners and fitness clubs around the world. This revolutionary concept allowed many famous athletes (see www.hypoxico.com ) to achieve incredible results.

## LEADS TO REVOLUTIONARY CONCEPT

Since then simulated “altitude training” became a standard in training of top level athletes and is used in wellness and medical field as well as for acclimatization at home.

A hypoxic environment for both, athletic training or fire prevention is established by ventilating a room with hypoxic air. Hypoxic air can be produced by filtering out a part of oxygen from ambient atmospheric air that contains 20.9% of oxygen.

For instance, 15% oxygen content corresponds in partial pressure of oxygen to an altitude of 2700 m. By experimenting in this environment, Igor Kotliar discovered a Phenomenon of Ignition Suppression in Breathable Hypoxic Atmosphere and introduced a new scientific term Ignition Threshold. It was discovered that most common materials can not be ignited at 15% of oxygen. However, in order to extinguish a fire the oxygen % must be reduced to at least below 12% but some materials may require the oxygen % to be reduced to 8%. Even though the scientific community did not initially accept this, this discovery allowed a birth of a totally new industry in the fire protection field.

**FIREPASS® has the unique ability to create an environment of breathable, controlled oxygen-reduced air that prevents fire ignition.**

**FIREPASS® prevents fire pro-actively, eliminating damage and business interruption that occurs when suppressing a fire after it has already started.**

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%.

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.

## AN INDEPENDENT REVIEW

FirePASS® engaged a thoracic specialist, Professor Matthew Peters, President of the Thoracic Society of Australia and New Zealand, to conduct 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 is set out in Sections 5 and 6 of this document.

## HIGHEST PROTECTION FOR VALUABLE ASSETS

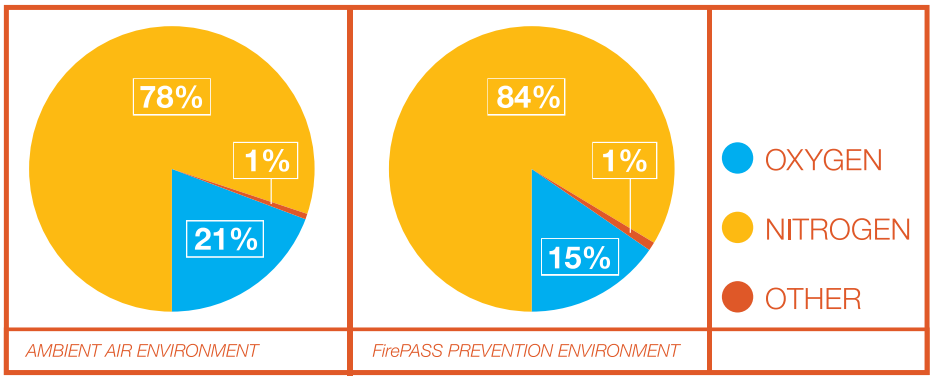
The oxygen-reduced environment slows oxidation and is perfect for preservation of irreplaceable items such as archived documents, artworks, museum exhibits and rare artifacts. The deterioration of materials and stored goods is strongly diminished due to the reduced-oxygen content of the hypoxic air produced.

## 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

FirePASS® takes great pride in introducing the world's latest innovations and technologies to the Australian market.

## ENVIRONMENT




# 02


# FEATURES AND SPECIFICATIONS


# FEATURES AND 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 pressurized 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 is the inventor and patent holder of this technology, which is protected by the United States Patents No.:

Patents: 6,314,754; 6,334,315; 6, 401,487; 6,418,752; 6,502,421; 6,557,374; 6,560,991; 7,207,392; 7,900,709; 7,931,733; US; RE 40,065; European Patent No. 1274490 and other patents worldwide.


# BASIC DESIGN

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


Two compressors on buffer vessels

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% $O_2$.

The included control unit monitors the effective $O_2$-level in the protected areas with the help of the respective oxygen monitoring units. The $O_2$-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 $O_2$-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.

SECTION 2

# HYPOXIC VENTILATION SYSTEM

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 happy to 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.

# PRINCIPLE OF OPERATION

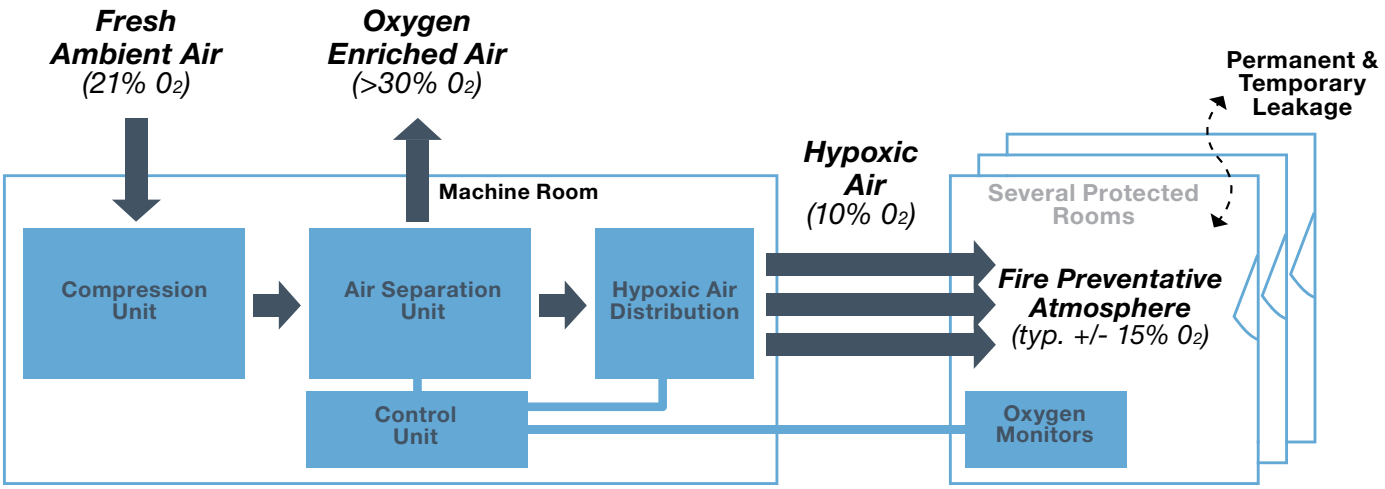
Hypoxic air generators operate by filtering a part of the oxygen from ambient air and providing fresh hypoxic air for the ventilation of the protected areas. As a result, a slight positive pressure will be established inside the protected room. The positive pressure will keep out dust and other impurities, 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). 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 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.

## 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 (1mu), a coarse coalescing filter (0,01mu), an activated carbon absorber and a dust carry-over filter (1mu)
- 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

## SYSTEM CONFIGURATION




**Additional Benefits**

The hypoxic air venting system offers additional value when used to protect historical materials and valuable goods. The deterioration of the materials and stored goods is strongly reduced due to the air's reduced oxygen content. This will slow down or even stop the process of oxidation. The oxygen reduced air provided by the system is completely clean and particle free air (< 1mu).

## OPTIONAL FUNCTIONALITIES FOR THE SYSTEM MAY BE ADDED UPON REQUEST

- Additional dry contacts in the control unit to connect separate visable/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 TCPIP

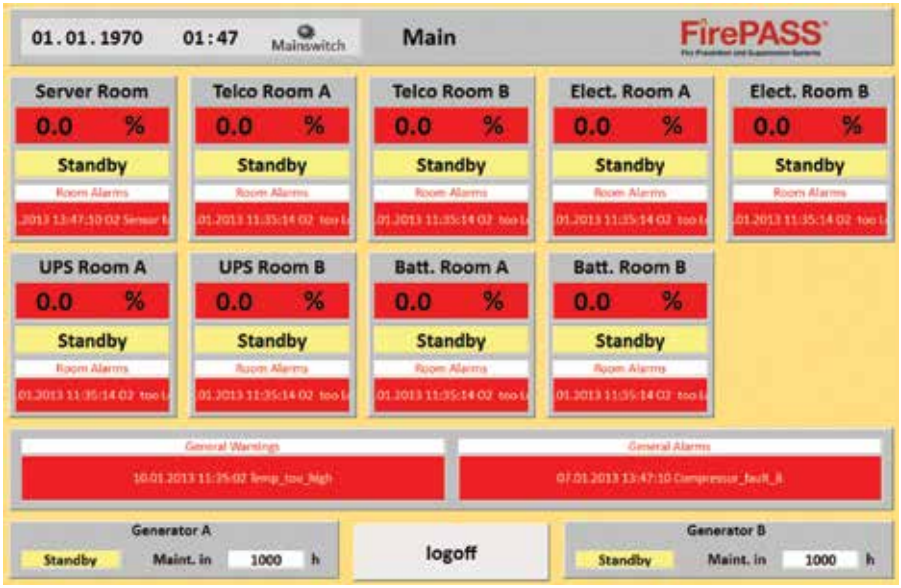
## IMPORTANT NOTES

1. All FirePASS systems perform with nominal data at 20 degrees Celsius ambient conditions. They are normally designed to operate at temperatures between 5 and 30 degrees Celsius. In order to sustain higher ambient temperatures in the machine room of up to 45 degrees Celsius for some hours, the overall design of the system will be amended. This means that the supplied compressors will be equipped with special lubricant and that the refrigerant air dryers used in the system design have been chosen with a capacity reserve. Nevertheless, this does not allow a permanent operation above 45 degrees Celsius
2. Operating the system at room temperatures above 45 degree Celsius or below 5 degree Celsius will result in reduced performance and may cause damage
3. The units shall be protected from excessive moisture and dust
4. The provided air shall comply with the ISO standard ISO8573-1:2010 class 3.4.4. The air temperature has to stay within the range of 10 to 30 degree Celsius

# 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 O2-levels measured by the oxygen monitoring units. The data can be written to a USB drive and transmitted to a computer for analysis.

See below example 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.


Example: The “room info screen” shows all relevant system parameters including actual and past oxygen values.

## 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 O2 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 oxygen values and allows for displaying them on the local touch panel.

The monitor is 24VDC powered and continuously transmits O2 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 O2 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, minimal 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 smoke detectors such as VESDA or equivalent. This is to ensure that any smouldering combustion from cable faults, for example, is reported in its incipient stages.

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-vented 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 machine room (the manner in which it is being cooled/vented) has to be agreed jointly. 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 by product 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 220Volts/50 Hz and shall be buffered via the central UPS.

**Tubing to the protected area**

Supply of the protected area with hypoxic air 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, it shall be acheived with steel piping.

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.

# PIPING

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 10-12mm, 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.

**Note:**

- **Damage caused by using compressed air, not following the specifications, is not covered. This includes too high or too low pressure, wet air and air with high oil content etc.**
- **Maintenance is to be carried out per the times outlined in the manual**
- **Warranty does not cover consumables (filter elements and activated carbon refill)**
- **Warranty applies to parts only**
- **Damage caused due to excessive leakage resulting in high duty cycles is not covered**


SURGE DIVERTER
DO NOT TURN OFF
MAIN SWITCH
DISTRIBUTION BOARD FS
FIRE SERVICES
BUSBAR ZONE

# 03


# CASE STUDIES

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## SYDNEY ADVENTIST HOSPITAL, SYDNEY, AUSTRALIA

In June 2013, FirePASS installed Australia's first oxygen-reduction fire prevention system at the Sydney Adventist Hospital (SAH), located in Wahroonga on Sydney's North Shore.

SAH started in 1903 as a 'Sanitarium' to provide a place of healing where people learned to stay well, and since then has been affectionately known as 'the San'. SAH is NSW's largest single campus private hospital, a multi-award winning facility offering access to world-class doctors, nurses and other health professionals. With approximately 2,300 staff, 500 volunteers and 750 accredited medical practitioners, SAH offers comprehensive surgical, medical, and emergency services to more than 53,000 inpatients and 180,000 outpatients each year.

Darren Walsh from FirePASS' fire protection company, Automatic Fire Protection, presented the FirePASS® fire prevention solution to Bernard Jakovac, Director of Engineering Services at SAH. Bernard could immediately see the benefits of a fire prevention system that would never let a fire start, compared to a traditional fire detection and suppression system.

FirePASS installed a FirePASS® FP-500 System into several rooms at the SAH 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.

A few months after the installation of FirePASS' FirePASS system, there was a fault in the power factor correction room. The VESDA system detected the fault and the FirePASS system prevented a fire starting.

Bernard and the SAH offer interested parties the opportunity to view the FirePASS® FP-500 System in operation. Several consultants and insurance providers have visited SAH to see the new technology and have reported very favourably on this innovation in fire safety.

**Images: 1.** FirePASS FP-500 Twin System **2.** Bernard Jakovac, Director of Engineering Services in front of Sydney Adventist Hospital **3.** Switch Room

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## FIREPASS CORPORATE OFFICE, SYDNEY, AUSTRALIA

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

The FirePASS® system is set up in FirePASS' boardroom and is used for demonstration purposes.

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.

**Images: 4.** FirePASS FP-145 **5.** FirePASS Touch Screen Control Unit **6.** FirePASS FP-145 outside FirePASS Boardroom **7.** FirePASS Boardroom, Sydney


1.


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## OSLO MUSEUM OF CULTURAL HISTORY, UNIVERSITY OF OSLO, NORWAY

The Museum of Cultural History is one of Norway's largest cultural history museums. It holds the country's largest prehistoric and medieval archaeological collections, including the Viking ships at Bygdøy, a substantial collection of medieval church objects, and a rune archive. The museum also has a comprehensive ethnographic (study of people and their cultures) collection that includes objects from every continent, as well as Norway's largest collection of historical coins.

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

**Images: 1.** The Oseberg Viking Ship. Copyright: Museum of Cultural History, University of Oslo, Norway / Photographer Unknown **2 & 3.** Archive Rooms at the Museum of Cultural History, University of Oslo, Norway

## 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. The Oslo City Archives holds and preserves historically and judicially important archives for the City of Oslo, and is responsible for making them available for future generations.

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.

**Images: 4.** Archives

## 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.

**Images: 5 & 6.** FirePASS ® FP-1000 Twin System