



●
HYPOXIA
PROTECTION

**Hypoxic Air:
Fire Prevention System for Data
Centers**

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EXTINGUISHING OR PREVENTION?

Which one do you prefer?

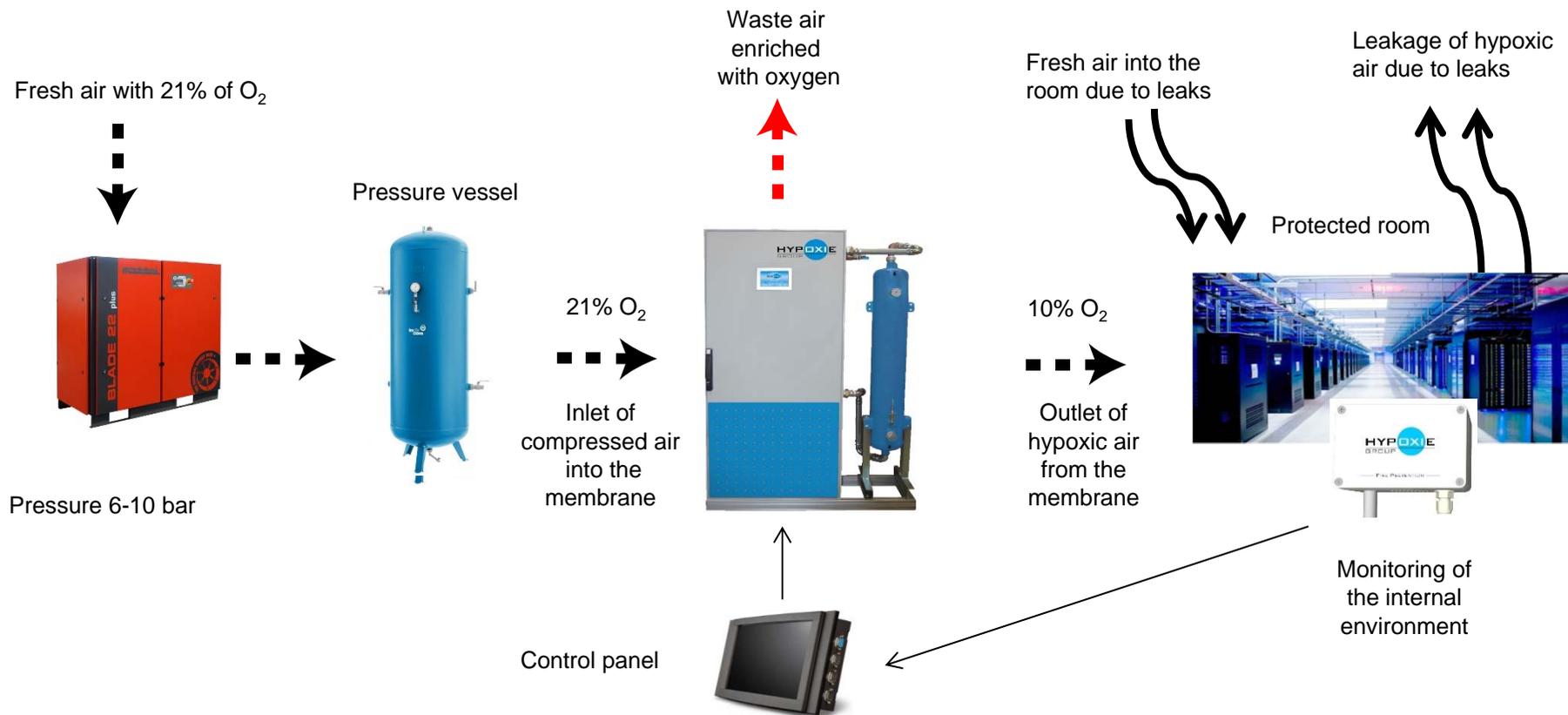


Hypoxic air fire preventive systems - permanent reduction of oxygen content in the ambience

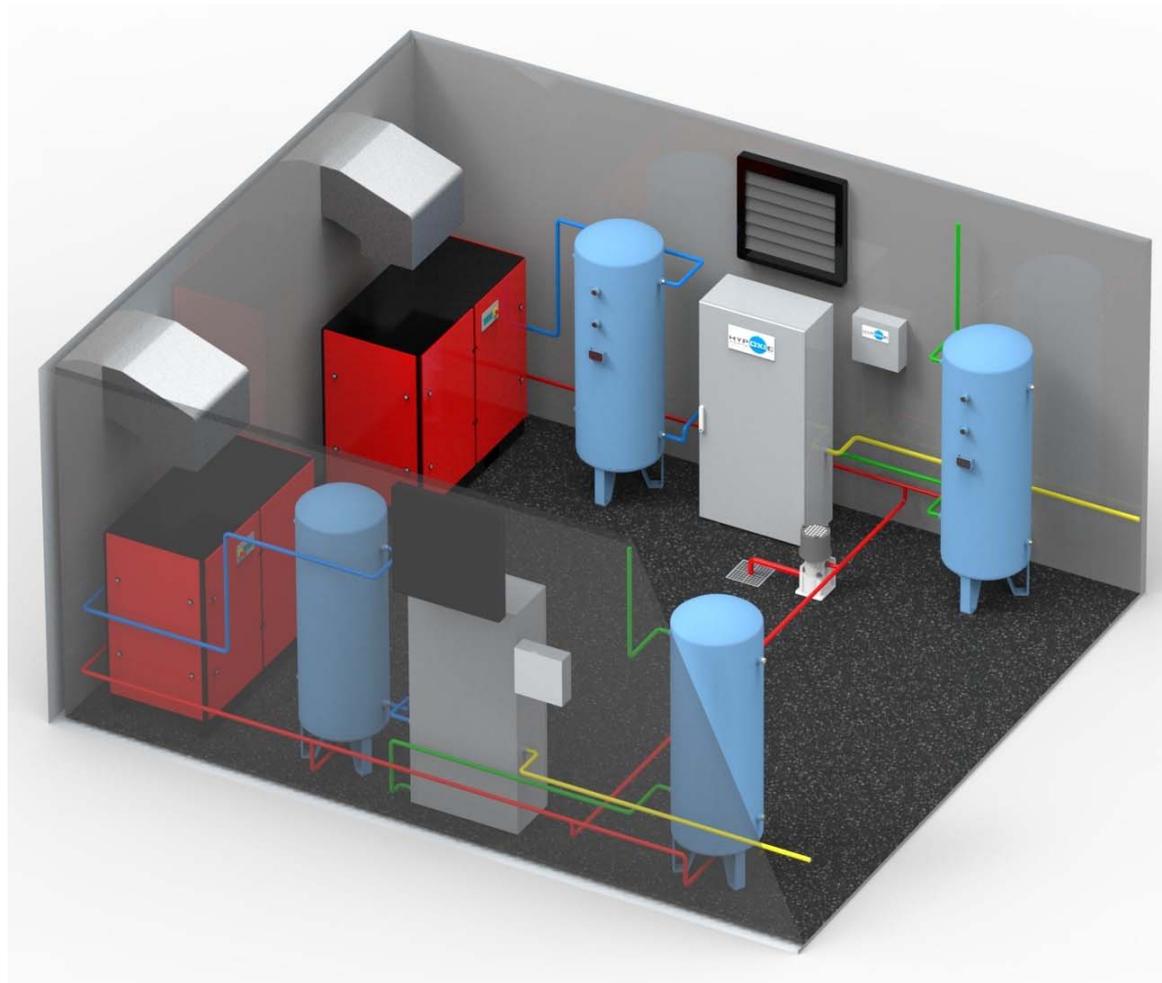
PRINCIPLE OF PREVENTIVE HYPOXIC PROTECTION

- The hypoxic fire prevention system can permanently eliminate one of the 3 factors of fires = the oxygen. This prevents the start of fire in the protected area.
- The principle of the hypoxic technology is the reduction and subsequent permanent maintenance of the oxygen content in the protected area below 16% (in most cases).
- It is not fire suppression or extinguishing system but a system preventing fire itself by means of normobaric hypoxia.

SYSTEM OPERATION



TECHNICAL ROOM



SAFETY OF WORK IN HYPOXY

Table according to Consensus statement of the Medical Commission of UIAA No. 15: Work in hypoxic conditions March 2015 (p. 17)

Risk classification according to the exposure to reduced oxygen content and safety measures

Risk category	Oxygen level in the air			Specific risk	Measure
	%O ₂ (%)	Equivalent Altitude (m)	pO ₂ (mmHg)		
Class1	>=17	0 - 1,600	159 - 130	No risk	Instructions for employees
Class 2	16.9 - 14.8	1,600 - 2,700	130 - 110	No risk for whole day shift if serious lung or heart diseases and serious anemia are excluded	Exclude serious diseases (min requirement – climb 2 floors without breathlessness) Instructions for employees
Class 3	14.7 - 13.0	2,700 - 3800	110 - 99	No risk if serious diseases for Class 2 are excluded, work load is limited (see Table 3) a the duration of exposition is no longer than 4 hours/day or 2x2 hours/day with high work load	Exclude serious diseases (physician for occupational medicine) Check the level of work load Instructions for employees
Class 4	13.0 - 10.4	3,800 - 5,500	99 - 79	Risk of AHN and of other disorders (e.g. limited movement coordination) may occur among non-acclimated persons	Special measures are necessary
Class 5	< 10.4	> 5,500	<79	Risk of acute hypoxia, dizziness, mental or other disorders (e.g. limited movement coordination) may appear in 30 minutes for non-acclimated persons	Special measures are necessary

STATE HEALTH INSTITUTE - OPINION

Based on this (and other) material, we are changing our opinion as follows:

Work in hypoxia with an oxygen concentration of about 15% can be permanent under the following conditions:

- a) the workers must be thoroughly trained in the principles of occupational safety and first aid provision;
- b) the health conditions of the workers must be verified and controlled, in accordance with current legislation, in particular with regard to respiratory, circulatory diseases, anemia and diseases which would prevent rapid escape in case of an accident and the use of personal protective equipment. The medical fitness of the employee is assessed by the physician of the occupational health care on the basis of the performed medical check-up individually and with regard to the health condition of the worker and the work actually done. The proposal for carrying out occupational health inspections is not the subject of this opinion;
- c) the worker must also be able to leave the workplace at any time in case of subjective difficulties;
- d) the ease of leaving the premises;
- e) the reliability of the O₂ concentration control; the O₂ concentration in the workers' breathing zone must be continuously monitored at the permanent workplace with the immediate release of an alarm when the oxygen concentration drops below 14%;
- f) we recommend having at least two people simultaneously in the working area, with the possibility of communicating with the outside environment;
- g) the designation of the workplace with a warning of reduced oxygen concentration and indicating the oxygen content of the area.

MUDr. Michael Vít, PhD.
Head of the center for occupational hygiene and occupational diseases

USE OF HYPOXIA - PROTECTION

- IT and Data Centers
- Large-volume warehouses
- Archives, museums
- Depositories, vaults
- Industrial freezers
- Ammunition warehouses
- Cable tunnels
- Transformer stations, distribution stations
- Fuel tanks



ADVANTAGES versus DISADVANTAGES

- + Reduced fire resistance of structures - less than 30 minutes
- + Installation of heat and smoke removal equipment not required
- + No need to install an air handling unit to ensure a minimum healthy air circulation
- + Insurance discounts - risk rating very low
- + No damages due to fire or loss of work processes
- + Fewer fires; less work for fire departments; reduced risk of imminent threat to life and health of both civilians and fire fighters and rescuers, and evacuation of persons; reduction of costs of damages after fires
- + Extended life of all materials (archives, museums, depositories). Ageing of materials is caused by oxidation which can also be prevented by hypoxic atmosphere.
- + - Operational costs
- Limited use - the system requires sufficient tightness of the protected area

PRICE COMPARISON

Volume	Price comparison to traditional fire fighting systems*
1 - 1,000 m ³	-5% to +10%
1,000 - 5,000 m ³	-15% to 0%
5,000 - 10,000 m ³	-15% to -20%
10,000 - 50,100 m ³	-20% to -30%
50,000 and more	-30% and more

*These comparisons are only the investment costs of the technology. The calculation does not include the economic benefits of hypoxia systems for related fields (e.g. it is not necessary to install heat and smoke removal equipment, air conditioning, fire resistance of structures can be reduced)

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presales@conteg.com

www.conteg.com

