Hypoxic Air: Fire Prevention System for Data Centers
EXTINGUISHING OR PREVENTION?

Which one do you prefer?

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

Pressure 6-10 bar

Pressure vessel

Inlet of compressed air into the membrane

Waste air enriched with oxygen

Outlet of hypoxic air from the membrane

Fresh air into the room due to leaks

Leakage of hypoxic air due to leaks

Protected room

Fresh air with 21% of O₂

21% O₂

Control panel

Monitoring of the internal environment
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

<table>
<thead>
<tr>
<th>Risk category</th>
<th>Oxygen level in the air</th>
<th>Specific risk</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%O₂ (%)</td>
<td>Equivalent Altitude (m)</td>
<td>pO₂ (mmHg)</td>
</tr>
<tr>
<td>Class 1</td>
<td>&gt;=17</td>
<td>0 - 1,600</td>
<td>159 - 130</td>
</tr>
<tr>
<td>Class 2</td>
<td>16.9 - 14.8</td>
<td>1,600 - 2,700</td>
<td>130 - 110</td>
</tr>
<tr>
<td>Class 3</td>
<td>14.7 - 13.0</td>
<td>2,700 - 3800</td>
<td>110 - 99</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 4</td>
<td>13.0 - 10.4</td>
<td>3,800 - 5,500</td>
<td>99 - 79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 5</td>
<td>&lt; 10.4</td>
<td>&gt; 5,500</td>
<td>&lt;79</td>
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</tbody>
</table>
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.

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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

<table>
<thead>
<tr>
<th>Volume</th>
<th>Price comparison to traditional fire fighting systems*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 1,000 m³</td>
<td>-5% to +10%</td>
</tr>
<tr>
<td>1,000 - 5,000 m³</td>
<td>-15% to 0%</td>
</tr>
<tr>
<td>5,000 - 10,000 m³</td>
<td>-15% to -20%</td>
</tr>
<tr>
<td>10,000 - 50,100 m³</td>
<td>-20% to -30%</td>
</tr>
<tr>
<td>50,000 and more</td>
<td>-30% and more</td>
</tr>
</tbody>
</table>

*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)