Specifications given here are for information purpose only and subject to change according to the agreement between customer and supplier.

Multiplace Hyperbaric Oxygen Chamber

Hyperbaric Oxygen Therapy Chamber
Safe, certified, flexible best value chambers

O₂ multi
Specifications given here are for information purpose only and subject to change according to the agreement between customer and supplier.
WHAT IS HBOT?

Hyperbaric Oxygen Therapy (HBOT) is a clinical treatment where the patient breathes 100% oxygen intermittently while enclosed in a hyperbaric oxygen chamber at a pressure greater than one atmosphere. Hyperbaric oxygen therapy is growing fast and continuously. More than 17 disease has been approved to be treated by Hyperbaric Oxygen treatment in Europe and USA.

Oxygen is colourless, odourless gas that makes up about 21 percent of the atmosphere. It is essential to life for two reasons;

- Oxygen is one of the body’s basic building blocks. All of the body’s major components – water, protein, fat & carbohydrate contain oxygen.
- Oxygen helps bring about certain chemical reactions within the body that results in energy production.

WHY IS OXYGEN SO IMPORTANT?

- Oxygen is colorless, odorless gas that makes up about 21 percent of the atmosphere. It is essential to life for two reasons;
- Oxygen is one of the body’s basic building blocks. All of the body’s major components – water, protein, fat & carbohydrate contain oxygen.
- Oxygen helps bring about certain chemical reactions within the body that results in energy production.
WHAT DOES HBOT DO TO THE BODY?

What does HBOT do to the body?

- Decreased Inflammation
- Saturates the body with oxygen, including the plasma and white cells, increasing the oxygen level by 20-30%.
- Increases the body’s ability to fight infection.
- Creates new capillaries and increases blood flow.
- Clears and deactivates toxins and metabolic waste from the body.
- Stimulates the body to create new blood cells
- Increases the body’s production of stem cells 800% (after 40 treatments)
- Accelerates the rate of healing
- Reduces swelling

Normal Blood Flow

Restricted Blood Flow

Hyperbaric Oxygenation

Hyperbaric Oxygenation
WHAT HAPPENS DURING TREATMENT?
You will go into a multiplace chamber - able to accommodate several patients with a technician, who will be inside, with you at all times.
Oxygen will be delivered via a comfortable mask or hood, allowing you to relax and read while the treatment is going on.
Once comfortably inside the chamber, you will be aware of air slowly being pushed into the chamber - called compression. At this point you will feel a fullness in your ears similar to that felt in an aircraft.
Once you feel this you should clear your ears. This is most easily done by moving your lower jaw around or blowing through your nose while holding your nostrils between your fingers, with your mouth closed.
You will be shown this in detail by the technician. If you feel any discomfort, tell the technician who will be able to help you. At the end of the treatment the mask or hood will be removed and the air inside the chamber slowly released. This is called decompression. You will feel your ears pop again, which is normal, but you will feel no pain.

WHEN A PERSON IS IN A HYPERBARIC OXYGEN CHAMBER?
- Oxygen molecules are dissolved into the plasma.
- Oxygen levels are increased only slightly in the hemoglobin (RBC), which is already working at about 95 percent capacity.
- The bloodstream can carry as much as six times more oxygen than while breathing room air outside of the chamber.
- The plasma is infused with enough oxygen to sustain life without any hemoglobin.
- This oxygen-saturated plasma moves from the circulatory system into tissue spaces, seeping into areas where there is no blood flow, or where blood flow is diminished or compromised and carries oxygen molecules with it. More oxygen is delivered to more cells than can be delivered by the circulatory system.
- There is less energy transfer involved when a cell receives an oxygen molecule.

Other body fluids, such as the cerebrospinal fluid, are also infused with molecular oxygen.

The total effect is that the body has become hyperoxygenated and thus, the process is known as hyperbaric oxygenation.
**BRIEF HISTORY**

<table>
<thead>
<tr>
<th>Landmarks</th>
<th>in the development of HBO Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>Boerema showed life can be maintained in pigs in the absence of blood by using HBO</td>
</tr>
<tr>
<td>1960</td>
<td>Sharp and Smith become the first to treat human carbon monoxide poisoning by HBO</td>
</tr>
<tr>
<td>1961</td>
<td>Boerema and Brummelkamp used hyperbaric oxygen for treatment of gas gangrene; Smith et al. (UK) showed the protective effect of HBO in cerebral ischemia.</td>
</tr>
<tr>
<td>1962</td>
<td>Illingworth (UK) showed the effectiveness of HBO in arterial occlusion in limbs</td>
</tr>
<tr>
<td>1963</td>
<td>First International Congress on Hyperbaric Medicine in Amsterdam</td>
</tr>
<tr>
<td>1965</td>
<td>Perrins (UK) showed the effectiveness HBO in osteomyelitis.</td>
</tr>
<tr>
<td>1966</td>
<td>Saltzman et al (USA) showed the effectiveness of HBO in stroke patients</td>
</tr>
<tr>
<td>1970</td>
<td>Boschetti and Cernoch (Czechoslovakia) used HBO multiple sclerosis</td>
</tr>
<tr>
<td>1971</td>
<td>Lamm (FRG) used HBO for treatment of sudden deafness.</td>
</tr>
<tr>
<td>1973</td>
<td>Thurston showed that HBO reduces mortality in myocardial infarction</td>
</tr>
<tr>
<td>1970s</td>
<td>Extensive expansion of hyperbaric facilities in Japan and the USSR</td>
</tr>
<tr>
<td>1980s</td>
<td>Development of hyperbaric medicine in China</td>
</tr>
<tr>
<td>1983</td>
<td>Formation of the American Collage of Hyperbaric Medicine (founder /president, late Dr. Neubauer of Florida)</td>
</tr>
<tr>
<td>1986</td>
<td>Undersea Medical Society (USA) adds the word hyperbaric to its name and is called UHMS. Reached a membership of 2000 in 60 countries.</td>
</tr>
<tr>
<td>1987</td>
<td>Jain (Switzerland) demonstrated the relief of spasticity in hemiplegia due to stroke under hyperbaric oxygenation; HBO integrated with physical therapy.</td>
</tr>
<tr>
<td>2001</td>
<td>The Undersea &amp; Hyperbaric Medical Society established a clinical hyperbaric facility accreditation program in the USA.</td>
</tr>
</tbody>
</table>

**TREATABLE DISEASES**

European Committee of Hyperbaric Medicine Jury will issue its recommendations using a 3 gradescale according to the strength each recommendation has been evaluated.

Type 1 : Strongly Recommended.
Type 2 : Recommended.
Type 3 : Optional.
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Type I
- CO poisoning
- Crush syndrome
- Prevention of osteoradionecrosis after dental extraction
- Osteoradionecrosis (mandible)
- Soft tissue radionecrosis (cystitis)
- Decompression accident
- Gas embolism
- Anaerobic or mixed bacterial anaerobic infections

Type II
- Diabetic foot lesion
- Compromised skin graft and musculocutaneous flap
- Osteoradionecrosis (other bones)
- Radio-induced proctitis / enteritis
- Radio-induced lesions of soft tissues
- Surgery and implant in irradiated tissue (preventive action)
- Sudden deafness
- Ischemic ulcer
- Refractory chronic osteomyelitis
- Neuroblastoma Stage IV

Type III
- Post anoxic encephalopathy
- Larynx radionecrosis
- Radio-induced CNS lesion
- Post-vascular procedure reperfusion syndrome
- Limb replantation
- Burns >20% of surface area and 2nd degree
- Acute ischemic ophthalmological disorders
- Selected non healing wounds secondary to inflammatory processes
- Pneumatosis cystoides intestinalis

Other Indications
- Post sternotomy mediastinitis
- Sickle cell disease
- Malignant otitis externa
- Acute myocardial infarction
- Femoral head necrosis
- Retinitis pigmentosa
- Cerebral palsy
- Multiple sclerosis
- Fetoplacental insufficiency
- Facial (Bell's) palsy
- Interstitial cystitis
- Tinnitus
Carbon Monoxide (CO) Intoxication

The purpose of oxygen therapy for the treatment of carbon monoxide poisoning is to reduce the amount of carbon monoxide in the blood and restore the oxygen level to normal as quickly as possible.

**Mechanism of carbon monoxide toxicity**

- CO has 210 times greater affinity for haemoglobin than does O2.
- CO causes cellular hypoxia by impairing haemoglobin-mediated oxygen delivery to tissues.
- CO also binds cytochromes, causes endothelial oxidative injury, lipid peroxidation and triggers inflammatory cascades.

**TREATABLE DISEASES – AUTISM**

When a typical person focuses on a task or generate speech, the brain is doing more work and there is an increase in blood flow to the brain. This increase in the blood flow to the brain supplies the brain with more oxygen and glucose, giving the cells their needed energy to perform their task.

In autistic children, several studies have shown the opposite, they actually have diminished blood flow to begin with, and when their brain is attempting to perform a task, such as generating speech or focusing, their blood flow does not increase giving them the needed oxygen and glucose the cells need.

**TREATABLE DISEASES – DIABETIC FOOT ULCER**

Many patients with diabetic foot ulcers experience significant disability and ultimately require amputation. Despite attentive management with multiple modalities including surgical debridement, relief of pressure, and other standard measures, many diabetic foot ulcers persist as chronic, non-healing wounds. Hyperbaric oxygen (HBO) therapy is an effective adjunct to standard modalities for the treatment of diabetic foot ulcers. HBO therapy increases oxygen tension in tissues, thereby supporting physiologic wound healing while inhibiting the growth of anaerobic organisms. Randomized clinical studies confirm that HBO therapy accelerates wound healing and decreases the need for amputation in patients with diabetic foot ulcers.
SOME PICTURES

DIABETIC PATIENTS

Necrotic infacted wound- osteomyelitis

Before treatment & After 70 sessions HBO2 + medical treatment + wound care

Before treatment & After 60 sessions HBO2 + medical treatment + wound care

Wound with venous stasis necrosis of subcutaneous

Before treatment & After 80 sessions HBO2 + medical treatment + wound care + graft

Before treatment & After 25 sessions HBO2 + medical treatment + debridement + dressing
BAROKS - WHO WE ARE?

Baroks O2Multi hyperbaric chamber and related hyperbaric facilities that provide medical service for patients who suffer decompression sickness or/and diseases subject to hyperbaric treatments.

Baroks shows the same care and attention it shows at project stage, at the production and integration stage as well. It ensures that, each chamber produced in its ISO certificated facilities by its staff experienced in hyperbaric chambers, is of the same quality and standard. Baroks meets periodical maintenance and technical service needs of your HBO chambers, with its experience of HBO systems usage for more than 10 years and its professional technical staff.

The Multiplace Hyperbaric Treatment System is designed to safety provide hyperbaric oxygen therapy to patients at pressure up to 5.5 bar as well as treating diving accident. The entire hyperbaric treatment system including all subsystems, components, and ancillary support systems are designed to meet or exceed stringent hyperbaric engineering design and fabrication standards for health care facilities as required by EN14931 “Pressure vessels for human occupancy (PVHO) – Multiplace Chambers”.

The Multiplace treatment system is designed to pressurize the chamber using compressed medical grade air. Hyperbaric oxygenation is achieved by providing the patient 100% pure oxygen by mask or hood while exposed to elevated barometric pressure.

Certification

Baroks HBO chambers are certified according to European and USA standards as follows:
1. Medical Certificate according to EU 93/42/EEC (CE certificate)
2. Pressure Vessel Certificate according to EU 97/23/EEC (CE certificate)
3. Inspection certificate of Fire Suppression system according to American NFPA 99 standard
SCOPE OF SUPPLY

BAROKS O2multi chambers ‘Scope of Supply’ is as follows. We do proived Turnkey solution to our customers.

<table>
<thead>
<tr>
<th>Product</th>
<th>O₂Multi Multiplace</th>
<th>Operation Pressure</th>
<th>Operation Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>12 + 2 person</td>
<td>5.5 bar</td>
<td>5°C - 50°C</td>
</tr>
</tbody>
</table>

1. HBO Chamber
2. Manuel Control Panel
3. Computer Controlled System
4. Fire Suppression
5. Climate Control
6. LP Air Supply

OPTIONAL
7. HP Air Supply
8. Oxygen Supply
9. Medical Devices
10. Spare Parts

- Transport (CIF)
- Installation (turnkey)
- Tech. Training (3 days)
- Medical Training

Certificates:
- ISO 9001:2008
- ISO 13485
- CE 97/23/EEC
- CE 93/42/EEC
- NFPA 99:2002
- ISO IEC 25051

Documents:
- User Manuel
- CE certified equipment’s
- Certification file

Delivery schedule:
- Delivery from factory: 5 months
- Shipment time: 2 weeks
- Installation time: 2 weeks
- Training on site: 3 days

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# 1. **O₂multi HBO CHAMBER**

Baroks design and produce O₂multi type multiplace HBO Chambers in different size starting from 4 Person upto 12 Person. In case requested we can produce more than 12 person chambers. Below table shows the technical specifications of our O₂multi chambers.

<table>
<thead>
<tr>
<th>CAPACITY</th>
<th>12 + 2</th>
<th>10+2</th>
<th>8+2</th>
<th>6+2</th>
<th>4 P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Pressure</td>
<td>5.5 Bar</td>
<td>5.5 Bar</td>
<td>5.5 Bar</td>
<td>5.5 Bar</td>
<td>5.5 Bar</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0°C - 50°C</td>
<td>0°C - 50°C</td>
<td>0°C - 50°C</td>
<td>0°C - 50°C</td>
<td>0°C - 50°C</td>
</tr>
<tr>
<td>Main Chamber Capacity</td>
<td>12 + 1 People</td>
<td>10 + 1 People</td>
<td>8 + 1 People</td>
<td>6 + 1 People</td>
<td>4 + 1 People</td>
</tr>
<tr>
<td>Entry Chamber Capacity</td>
<td>2 People</td>
<td>2 People</td>
<td>2 People</td>
<td>2 People</td>
<td>2 People</td>
</tr>
<tr>
<td>Chamber Inner Diameter</td>
<td>2200 mm.</td>
<td>2200 mm.</td>
<td>2200 mm.</td>
<td>2000 mm.</td>
<td>2000 mm.</td>
</tr>
<tr>
<td>Main Chamber Length</td>
<td>5000 mm.</td>
<td>4500 mm.</td>
<td>4000 mm.</td>
<td>3500 mm.</td>
<td>3000 mm.</td>
</tr>
<tr>
<td>Entry Chamber Length</td>
<td>1200 mm.</td>
<td>1200 mm.</td>
<td>1200 mm.</td>
<td>1000 mm.</td>
<td>Not exists. Single</td>
</tr>
<tr>
<td>Number of Flat Walls</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
<td>2 pcs.</td>
</tr>
<tr>
<td>Cylindrical Wall Thickness</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>Flat Wall Thickness</td>
<td>&gt;70 mm</td>
<td>&gt;70 mm</td>
<td>&gt;70 mm</td>
<td>&gt;60 mm</td>
<td>&gt;60 mm</td>
</tr>
<tr>
<td>Base Dimension</td>
<td>6500 x 1370 mm</td>
<td>6000 x 1370 mm</td>
<td>6000 x 1370 mm</td>
<td>6000 x 1370 mm</td>
<td>6000 x 1370 mm</td>
</tr>
<tr>
<td>Total Length</td>
<td>6500 mm.</td>
<td>6500 mm.</td>
<td>6500 mm.</td>
<td>6500 mm.</td>
<td>6500 mm.</td>
</tr>
<tr>
<td>Material</td>
<td>H II Steel</td>
<td>H II Steel</td>
<td>H II Steel</td>
<td>H II Steel</td>
<td>H II Steel</td>
</tr>
<tr>
<td>Number of Doors</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
<td>3 pcs.</td>
</tr>
<tr>
<td>Dimensions of Door Holes</td>
<td>1760 X 860 mm</td>
<td>1760 X 860 mm</td>
<td>1760 X 860 mm</td>
<td>1760 X 860 mm</td>
<td>1760 X 860 mm</td>
</tr>
<tr>
<td>Viewport Inner Diameter</td>
<td>Ø 220 mm.</td>
<td>Ø 220 mm.</td>
<td>Ø 220 mm.</td>
<td>Ø 220 mm.</td>
<td>Ø 220 mm.</td>
</tr>
<tr>
<td>Electrical Power Need</td>
<td>50 KW</td>
<td>50 KW</td>
<td>50 KW</td>
<td>50 KW</td>
<td>50 KW</td>
</tr>
<tr>
<td>Certification</td>
<td>TUV Süd</td>
<td>TUV Süd</td>
<td>TUV Süd</td>
<td>TUV Süd</td>
<td>TUV Süd</td>
</tr>
<tr>
<td>Product Standards</td>
<td>EN 14931, MedCert</td>
<td>EN 14931 , MedCert</td>
<td>EN 14931, MedCert</td>
<td>EN 14931, MedCert</td>
<td>EN 14931, MedCert</td>
</tr>
</tbody>
</table>

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1.1. HBO CHAMBER (PRESSURE VESSEL)

Baroks O2multi Multiplace Chamber System is a Multiplace Hyperbaric Oxygen Chamber that is designed, manufactured and tested according to EN 14931 norms. Chamber Design has been made according to AD2000. Pressure Vessel consists of 2 compartments which are called Main compartment and Entry compartment. Main compartment capacity is 12 patients and 1 health official and entry compartment capacity is 2 patients.

Dimensions

The main compartment and entry compartments are 2,180mm internal diameter with a combined overall length of 6,500 mm. The main compartment has an internal length of 5,000 mm and the entry compartment is 1,200 mm long. All dimensions are approximate within standard fabrication tolerances.

Painting

Chamber is painted with certified flame-proof and non-poisonous marine type epoxy paint both inside and outside. In order to make chamber surface smooth, before painting, sand blasting process applied to surfaces and then pasting is applied to the surface. The chamber life-span becomes longer through this special application. Our Painting process is inspected and Certified by JOTUN inspectors.

Body (Cylindrical Shell)

O2multi Multiplace Chamber is designed according to AD2000 norms. Internal diameter of cylindrical shell is 2080 mm in diameter and the other main dimensions of cylindrical shell are showed in figure below.

Specifications given here are for information purpose only and subject to change according to the agreement between customer and supplier
Materials and Tests
Only quality-certified “Boiler Steel H-II” with test reports has been using in O2multi Multiplace Chamber production. In addition, before production of the chamber, ultrasonic lamination tests and after welding process; x-ray, magnetic particle and ultrasonic tests (Non-destructive tests) have been doing by professional engineering staff. After the production, hydrostatic tests have been doing by engineers with attendance of TUV inspectors.

Medical Lock
Medical Lock of the Chamber provides the transfer of the necessary medicines or equipment’s to and from the chamber during a treatment session without interruption. Medical Lock is equipped with a double secured lock system and the accidental opening of the outer door of the medical lock is prevented when the chamber is pressurised. This secured lock system prevents opening of the other door when one of them is already open.

Doors
Our chambers are designed to have 3 doors to meet best comfort for the patients and operators. Doors are designed as rectangular to allow easy access to the chamber interior. Rectangular door size are 1,760mm X 860mm (Clear Height X Width) as standard, however can be designed and produced bigger if requested.

Viewports
Viewports are used to observe the patients inside from outside. As standard 6 viewports is used in main compartment and 2 in entry compartment. Viewports clear view area diameter is 250 mm as standard. Viewports are manufactured from a certified special material called PMMA that is called acrylic.

1.2. CHAMBER EQUIPMENTS
Chamber equipments involve equipments in or on the chamber itself. These equipments could generally be listed as follows:

<table>
<thead>
<tr>
<th>CHAMBER EQUIPMENTS</th>
<th>Main Lock</th>
<th>Entry Lock</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Seats</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td># BIBS Masks</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td># of Emergency Safety Valves</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Entertainment TV</td>
<td>2</td>
<td>none</td>
</tr>
<tr>
<td>Lighting System</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>CCTV cameras</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Pressure Sensors</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Thermo- Hygrometer</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Information Panel (LCD)</td>
<td>1</td>
<td>none</td>
</tr>
<tr>
<td>Silencers</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Medical box</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Respirator connection</td>
<td>1</td>
<td>none</td>
</tr>
<tr>
<td>Aspirator connection flange</td>
<td>1</td>
<td>none</td>
</tr>
<tr>
<td>Headphones</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Caisson Gauge</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Decompression valve (inside)</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Compression valve (inside)</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Flame dedector</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Smoke dedector</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Speaker / microphone</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO2 scrubber</td>
<td>None</td>
<td>none</td>
</tr>
<tr>
<td>Aircondition internal fancoil</td>
<td>1</td>
<td>none</td>
</tr>
</tbody>
</table>
**BIBS (Built-in Breathing System)**

Chamber BIBS system provides the required oxygen for the breathing of the patients and health official inside the chamber and also discard the left-over air with exhaust system. Oxygen Treatment Hood is provided to administer oxygen or other therapy gases to patients as well as the mask. O2Multi Multiplace Chamber is equipped with AVOX BIBS regulators for patients.

**Emergency Valves**

Emergency Discharge Valves provides to keep the inside chamber not to exceed settled maximum level. In a faulty case when the chamber pressure increases too much it discharges the excessive pressure to prevent patients getting harm. There are two types of valves in the system. Automatic valves initiates discharging the inside air as soon as the chamber pressure reaches 3 bar. Manual valves are used when the automatic valves are out of order or when speeding up of the discharge is needed. All used emergency valves are CE certified best quality products from Europe.

**Seats**

Hypertech O2Multi seats are easily removable and orthopaedic seats made specifically for hyperbaric use. The covers of the seats are certified flame-proof, made from artificial plain leather and flame-proof foam is used inside. The seats are designed in such a way to ease the assembling and dismantling.

**Cold Lighting System**

Internal lighting of the chamber is provided by 12V LED light source. This provides safety fire protection against any electrical sparks. The switches of the lighting system are found on the control panel.

**Sensors**

There are many sensors in and out of the chamber. Pressure sensors, temperature sensors, humidity sensors, oxygen sensors, etc. All sensors are CE marked and approved for use in hyperbaric environment.

There is 2 pressure sensor in the main and one in the entry compartment. 2 oxygen sensor in the main and 1 in the entry compartment.

**CCTV Cameras**

Hypertech O2Multi chambers are equiped with high quality, Samsung lens cameras for each compartment. It also contains infrareds to enable observation even in zero lux condition.

There are four cameras installed in the main compartment and in the entry compartment there are 2 cameras. With these cameras, operator can monitor all patients during the session.
**Entertainment TV Monitors**

Baroks O₂Multi Multiplace chambers are equipped with DVD entertainment system. In this system there are 2 pieces 21” LCD 12V DC monitors are installed on the doors. Patients inside during the long treatment session, can watch DVD or TV.

**Internal information Panel**

There is information panel inside the chamber. This panel includes displays. Patients can observe the temperature, humidity, pressure and oxygen level.

1.3. **MANUEL CONTROL CONSOLE**

**Control Panel**

Baroks Control Panel provides the use and control of the Multiplace Chamber System manually. Baroks O2multi control panel is user friendly and easy console with state of the art design and appearance.

**Pneumatic Equipment (Attached to the Chamber)**

Baroks O2Multi control panel attached to the chamber also includes following pneumatic equipments:

- Electric drive to control descent rate (compression) –
- Electro-pneumatic proportional rate valve.
- Manuel bypass handles for compression.
- Electric drive to control ascent rate (decompression) –
- Electro-pneumatic proportional rate valve
- Manuel bypass handles for decompression.
- Decompression valve
- 1x LP air c/W gauge (main supply)
- Pipes connections, fittings for
- 2 solenoid valve to switch the BIBS from oxygen to air.
- valves for fire suppression deluge system
- 2 x 6” mirror scale (0-230 msw) precision debt gauges

2. **Computer Controlled System**

Baroks O₂Multi Chamber is controlled and observed from a Computer Controlled Station similar shown in the following picture.

Baroks O2Multi Multiplace Chamber is fully automatic with an industrial based PLC system and automation software. Main features of the system is following:

- Automation System (ISO 25051 Certified)
  - Industrial PLC based PC
  - automation software
  - Customized
  - Generating and storage of numerous treatment profiles.
  - Graphical display of pressure vs time, oxygen %, temperature, humidity, gas stock pressure.
  - Separate display for AC and MC
  - Treatment number, treatment for patient number
  - Keyboard and mouse integrated with the panel
  - Patient and session info register
  - 3-step security encoding
  - Fault feedback
Specifications given here are for information purpose only and subject to change according to the agreement between customer and supplier.

- PC (80 GB hard disk, cordless keyboard and mouse)
- 17" colour TFT monitor
- Sound powered phone for AC and MC
- 2 x CO2 analyser feeds into PC system and controls the flush rate (ventilation).
- 2 x Oxygen analyser 0-30%. Analyzers feeds into PC system and controls the flush rate (ventilation).

2.1. AUTOMATION PANEL

Automation panel in O2multi Multiplace Chamber Systems has been developed specially for automatic control of chamber system and designed ergonomically for operator usage.
This panel mainly consists of the following equipments:

- Set of light dimes for illumination of MC and AC
- Patient (audio/visible) warning signals
- Intercom (electrical communication) system for AC& MC with volume control, earphone and microphones and PTT function
- Sound powered phone (SP-T)
- PLC (automation) control for compression and decompression
- Cooling heating control switches
- Fire suppression controls (controls for water deluge for fire suppression)
- Gas selection (air/oxygen) for the Breathing system for AC & MC
- Fault warning system
  - Electrical main power loss
  - Oxygen concentration exceeding %19 - %23
  - Exceeded descent rate
  - Exceeded ascent rate
  - Oxygen supply failure
  - Water deluge fire fighting reservoir failure
- Emergency warning for AC and MC
- Information panel digital readouts for actual time (24 hour/min)
- Oxygen concentration (%) AC and MC
- Chamber temperature
- UPS (30 min at least) for safety vital equipments such as illumination, gas analyzers, communications, monitoring, fault recording system

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Intercom
Intercom system provides the communication between the patient and operator. This system includes an intercom device which designed special for pressure rooms, a microphone and two speakers which are inside the cabin.
This intercom includes backup battery system. This enables the system to communicate for a long time in case there is an electrical cut. It also has an entertainment unit which you can connect the music player to the intercom speakers.

Sound-Powered Phone (SP-T)
There are 2 sound-powered phone in the O2multi Multiplace Chamber System (One in entry lock and the other one is in main lock). This equipment can be used in communication between chambers inside and outside even there is no electricity in the system. With this equipment, communication can be done safely in a fire hazard or an electrical system fault.

CCTV System
The proposed video system allows monitoring all activities of the chamber occupants. 2+4 light sensitive CCD cameras are directly mounted onto the chamber windows on AC and MC. Video signals are routed through special cables to a selection device enabling the chamber operator to select one of the incoming signals to the 17” split screen monitor to display both AC and MC camera pictures.
The CCTV System monitors and records the chamber occupants during chamber operations. The cameras are able to display the entire chamber interior. The displays which come from digital record device transfer to LCD screens with the TV box.

Patient Warning Panel
Patient warning panel can be used for patients in the chamber inform operator during treatment session. There are LED lights in the automation panel which represents each of patients. Operator can communicate with patients by using intercom or sound-powered phone.

DVR – Digital Recorder
The video is recorded on a Digital Video Recorder, located at the monitoring panel on the control console. A selector switch is provided to allow the operator to select the camera video (main or entry) to be displayed on the monitor and recorded on the DVR. The DVR will capable of recording more than 20 hours of video in a high-resolution JPEG format to its hard disk. An Ethernet port on the DVR allows images to be downloaded or real-time monitoring by PC’s.
User is also able to store the content of the hard disk to a CD or transfer it to another media store via Ethernet cable.
Audio Video System
The chamber will be equipped with a music entertainment centre c/w DVD, TV, Radio, MP3 and CD to patient. The system supplies in the 2x 15" TFT monitors. The entertainment system will consist of the following single components:

- 2 Speaker Processors (converts digital input to audio signal)
- DVD Player
- TV/Radio Tuner
- CD/MP3 Player
- Spare for 2 additional devices
- Video Switch
- 2x 15" TFT Monitors
- Various cables

DVD Player
This system is able to accept input signals from various sources (e.g.: DVD) and broadcast these to the patients through an intrinsically safe system. The patients listen and watch the selected audio program through the main chamber speaker and monitor.

Entertainment TV
There is 2 TV installed inside the chamber, which operates safely with 12 V DC source. Hence suitable to work in Hyperbaric environment.

2.2. PLC & PC HARDWARE

PLC
PLC is an abbreviation for “Programmable Logic Controller” which acts as a “brain” for whole automation system. PLC is the controller of electronic and electro-pneumatic devices used in system. Both digital and analog sensors, buttons, solenoid valves, etc. Connected to PLC for automation.

PC & PLC HARDWARE
System includes a PC (Personnel Computer) for working of automation software. By this PC, automation software runs and works in collaboration with PLC to automatic control of system.

2.3. AUTOMATION SOFTWARE - BAROSOFT

“Automation” has been using as automation system software in O2multi Multiplace Chamber Systems which had developed by Baroks engineers. “Automation” software can be used in full-automatic session running.

2.4. AUTOMATION SENSORS & VALVES

Automation Sensors
There are lots of sensors such as pressure sensors, humidity sensors, temperature sensors, oxygen sensors, etc. in the system to provide working of automation system.
Pressure sensors has been using for monitoring of pressure in entry and main locks. Temperature sensors has been using for monitoring of temperature in entry and main locks. Humidity sensors has been using for monitoring of humidity in entry and main locks. Both signals from these sensors send to digital display units and PLC.
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Oxygen sensors work collaboratively with oxygen analysers in order to monitor oxygen percentage in entry and main locks. Automation valves describe solenoid-valves which have been using for control the pneumatic valves by electrical signals via solenoids. There are solenoid-valves connected to the air supply lines and oxygen supply lines for controlling of oxygen and air flows into the chamber and outside the chamber.
3. Low Pressure Air Supply System

Baroks O₂Multi Multiplace Chamber System uses medical grade air coming from its certified medical air supply system. The medical air supplied is certified according to 93/42/EEC. It also complies with EN12021.

3.1 LOW PRESSURE (LP) COMPRESSORS

There are 2 Low pressure with flow rate of 1.1 m³/min and pressure out at 13 bar screw type compressors to pressurize air. Brands can be Kaeser or Atlas Copco.

3.2 LOW PRESSURE (LP) AIR TANKS

There are 2 galvanized air tanks with volume of 1000 lt and pressure at 13 bar for storing of pressurized air in order to provide air to the system even compressors don’t work. These tanks has been made from certified steel and protected with hot zinc (Galvanisation). Air tanks also have their separately pressure safety valves and pressure gauges. Air tanks have been testing at 20.8 bar pressure.

3.3 FILTER BANK & AIR DRYER

Air quality is an important issue in medical applications. There should be no oil and dust in the air from the compressor and environment. Filter bank and air dryer provides this medical-grade air for usage in hyperbaric applications.

4. Fire Fighting System

Fire fighting system has been built in O₂multi Multiplace Chamber System for fire fighting in a fire situation.

Fire fighting system can be activated by both manual or automation control and system can cut off electricity automatic for safety.

Fire fighting system consists this parts:

- 2 Water tanks,
- Stainless steel piping inside the chamber,
- Detecting and activating system (Flame and smoke sensors),
- 3 Hand held fire extinguishers.
4.1. WATER TANKS

There are one water tank with 700 lt volume and one water tank with 300 lt volume and all of them are at 13 bar pressure. These tanks supply water for fire fighting system. Fire fighting system uses water in fog producing and spraying.

Water tanks in fire fighting system have been produced with pressure vessel standards and quality control. All of the tanks have been painted with suitable paint in order to protection from corrosion and all of the tanks have their separate pressure gauges.

4.2. DETECTING AND ACTIVATING SYSTEM (FLAME AND SMOKE SENSORS)

For detecting fire and automatic activation of fire fighting system, there are flame and smoke sensors in the chamber.
Flame sensors use infrared technology to detect the sparks before a fire starts out. So, system can inform the operator before a fire begins.
Smoke sensors detect fire from smoke and send signals to the fire fighting system.
4.3. HAND HELD FIRE EXTINGUISHERS

There are total 3 hand held fire extinguishers in chamber; two of them is in main lock and the other one is in entry lock.

5. Air Condition System

Air condition system in O2multi multiplace chamber system has been using for control the temperature in chamber.

Air condition system involves these components:

- Chiller unit,
- Chamber internal heat exchangers,
- Control unit in control panel,
- Climate panels inside the chamber.

5.1. CHILLER UNIT

Chiller unit is the external unit of air condition system which provides cold water to the system.

In chiller unit, there is a special fluid called “cooling fluid” or “coolant” which circulates by a separate compressor in chiller unit. First, this coolant has been cooled down and then this coolant cools down the water and anti-freeze mixture which also circulates separately in system. This cooled water has been sent to chamber internal heat exchangers by a pump in the chiller.

Italian “Ferroli” brand chiller units have been using in O2multi Multiplace Chamber Systems.

5.2. CHAMBER INTERNAL HEAT EXCHANGERS

The inside unit of the air condition system is a composition of a two-way radiator and 2 pieces 12V DC fans. Internal heat exchanger is the two-way radiator which cools or heats the ambient air in the chamber. Radiator cools the air by using cooled water which supplied by chiller unit. Radiator heats the air by using heated water which supplied from a boiler or central heating system of the building.

5.3. CONTROL UNIT IN CONTROL PANEL

Controlling of air-condition unit can be done via control unit on the control panel. Control unit showed in figure above:
5.4. CLIMATE PANELS INSIDE THE CHAMBERS

Climate panels inside the chamber consists 2 pieces 12V DC fans that mentioned in “7.2. CHAMBER INTERNAL HEAT EXCHANGERS” issue before.

One of the fan is main fan of the air-condition system for inside of the chamber and provides general air circulation. The other one is operates the floor ventilation to provide more active and powerful cooling / heating.

All of the fans consist of totally enclosed brushless DC motor for providing safe operation in oxygen-enriched environment.
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