

# **Part B – Health Facility Briefing & Design**

## **26 Hyperbaric Chamber Therapy Unit**



iHFG

# **International Health Facility Guidelines**

Version 6.0, 4 January 2023

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## Hyperbaric Chamber Therapy Unit

### 1 Introduction

Hyperbaric Unit refers to a facility for the discipline Hyperbaric Medicine. This involves an ambulatory mode of treatment for patients using a pressure vessel referred to as Hyperbaric Chamber. This enables the treatment of illness or injury by the use of oxygen or a combinations with other gas mixtures at an ambient pressure greater than atmospheric pressure.

#### *Description*

The treatments performed using a Hyperbaric Unit generally comprises the following:

- Hyperbaric Oxygen Therapy (HBOT) - This refers to breathing pure oxygen in a pressurized environment where air pressure is increased 2 to 3 times higher than normal air pressure.
- Therapeutic Recompression – which involves giving 100% oxygen for several hours in a sealed chamber at pressures higher than 1 atmosphere. This is a treatment for the decompression illness, to reduce the effects of systemic gas bubbles in the body such as in the blood stream by physically reducing their size and providing improved conditions for the elimination of bubbles and excess dissolved gases.

Apart from the Hyperbaric Chamber, the balance of the Unit is very similar to an Ambulatory unit with a range of support facilities for receiving and managing patients.

Initially, HBOT was developed as a treatment for diving disorders involving bubbles of gas in the tissues, such as decompression sickness and gas embolism. The chamber treats the patients by increasing pressure, reducing the size of the gas bubbles and improving the transport of blood to downstream tissues. After the elimination of bubbles, the pressure is gradually reduced back to atmospheric levels.

In addition, HBOT may be used for a variety of conditions and treatments including the following:

- Gas gangrene and carbon monoxide poisoning
- Possible treatment of Cerebral Palsy and Multiple Sclerosis
- Severe Infections
- Bubbles of air in blood vessels
- Wounds that may not heal because of Diabetes or Radiation injury

A number of Hyperbaric treatment schedules have been published over the years for both therapeutic recompression and HBOT.

The equipment required for Hyperbaric Oxygen treatment consists of a pressure vessel or chamber. Monoplace chamber are intended for only one patient per vessel. Multiplace chambers are intended for multiple patients in the same vessel. Monoplace chambers may be either rigid or flexible (inflatable) and able to deliver 100% oxygen. Under these Guidelines only rigid chambers are permissible.

Operation is performed to a predetermined schedule by trained personnel who monitor the patient and may adjust the schedule as required.

### **Medical uses**

The following indications are generally considered for the uses of hyperbaric oxygen therapy in a Hyperbaric Unit:

- Air or Gas Embolism
- Carbon Monoxide poisoning
- Carbon Monoxide poisoning complicated by cyanide poisoning
- Central retinal artery occlusion
- Clostridial Myositis and Myonecrosis (gas gangrene)
- Crush Injury, Compartment Syndrome and other Acute Traumatic Ischemias
- Decompression sickness
- Enhancement of healing in selected problem wound
- Diabetically derived illness such as short-term relief of diabetic foot, diabetic retinopathy and diabetic nephropathy
- Exceptional blood loss (anemia)
- Idiopathic sudden sensorineural hearing loss
- Intracranial abscess
- Mucormycosis especially Rhinocerebral disease in the setting of Diabetes Mellitus
- Necrotizing soft tissue infections (necrotizing fasciitis)
- Osteomyelitis (refractory)
- Delayed radiation injury (soft tissue and bony necrosis)
- Skin grafts and flaps (compromised)
- Thermal burns

### **Other HBOT treatments with insufficient evidence**

There is interest in the use of HBOT for other treatments, however the results are sometimes inconclusive. Evidence is insufficient to support its use in autism, cancer, diabetes, HIV/AIDS, Alzheimer's disease, asthma, Bell's palsy, cerebral palsy, depression, heart disease, migraines, multiple sclerosis, Parkinson's disease, spinal cord injury, sports injuries or stroke.

There are concerns regarding the increased risk of damage to the eardrum in children with autism spectrum disorders.

### **Hearing issues**

There is limited evidence that hyperbaric oxygen therapy improves hearing in patients with sudden sensorineural hearing loss who present within two weeks of hearing loss. There is some indication that HBOT might improve tinnitus presenting in the same time frame.

### **Chronic ulcers**

HBOT in diabetic foot ulcers increased the rate of early ulcer healing but does not appear to provide any benefit in wound healing at long-term follow-up. In particular, there is no difference in major amputation rate. For venous, arterial and pressure ulcers, no evidence is apparent that HBOT provides a long-term improvement over standard treatment.

### **Radiation injury**

There is some evidence that HBOT is effective for late radiation tissue injury of bone and soft tissues of the head and neck. Some people with radiation injuries of the head, neck or bowel show an improvement in quality of life. Importantly, no such effect has been found in neurological tissues. The use of HBOT may be justified to select patients condition and tissues status. However, further research is required to establish the best people to treat and timing of any HBO therapy.

### Neuro-Rehabilitation

As of 2012, there was insufficient evidence to support using hyperbaric oxygen therapy to treat people who have traumatic brain injuries. In Stroke and Multiple Sclerosis, HBOT does not show benefit, however routine use is not recommended.

### Cancer

In alternative medicine, hyperbaric medicine has been promoted as a treatment for cancer. A 2012 review article in the Journal, Targeted Oncology, reports that "there is no evidence indicating that HBOT neither acts as a stimulator of tumor growth nor as an enhancer of recurrence. On the other hand, there is some evidence implies that HBOT might have tumor-inhibitory effects in certain cancer subtypes. However, a 2011 study by the American Cancer Society reported no evidence it is effective for this purpose.

### Migraines

Low-quality evidence suggests that HBOT may reduce the pain associated with an acute migraine headache in some cases. It is not known which people would benefit from this treatment and there is no evidence that hyperbaric medicine can prevent future migraines.

## 2 Functional and Planning Considerations

### Operational Models

#### Hours of Operation

Hyperbaric Unit may be operated at any time of the day or night according to the preference of the operator and the urgency of treatment required. However, regardless of the hours of operation, all required clinical and technical staff must be available on the premises at all times for the safe monitoring of the patient(s), operation of the equipment and management.

The most typical hours of operation for a Hyperbaric Unit match those of other Ambulatory and Outpatient facilities.

#### Equipment Types

There are several types of Hyperbaric Chambers including:

- Multiplace (or Class A) or "walk-in" chambers for multiple patients
- Monoplace (or Class B) for single patients
- Animal Chambers (or Class C) not for human use (not covered by these guidelines)
- Chambers for testing and training divers
- Small hyperbaric chambers for neonates or animal experiments

Multiplace chamber is a hyperbaric chamber with one or more compartments that is designed for occupancy by more than one person at a time. This chamber is pressurised with compressed air while the patient's breath 100% oxygen via masks, head hoods or endotracheal tubes and it allows entrance or exit via an airlock whilst the treatment compartment remains under pressure, please refer to the image below.

## Hyperbaric Chamber Therapy Unit



Monoplace chamber is a stand-alone, single compartment hyperbaric chamber designed for occupancy by one person without an attendant. The entire chamber is pressurised with 100% oxygen and the patient breathes the ambient chamber oxygen directly. The unit may be transportable or fixed in position within a facility. These Guidelines recommend Monoplace chambers in preference to Multiplace chambers. The examples provided in the SOA within these Guidelines are for Monoplace chambers, please refer to the image below.



Hyperbaric Chambers are regarded as medical equipment and manufactured as such with high precision and safety features. They may be available as rigid or flexible (inflatable) units. However; under these Guidelines only rigid units are permitted.

The pressure within a Chamber is typically more than .4 atm. Atm is a unit of pressure defined as 101325 Pa (1.01325 bar). It is sometimes used as a reference or standard pressure.

### 3 Unit Planning Models

A Hyperbaric Unit may be designed as a Stand-alone facility or one integrated with other health facilities such as Outpatient Clinics or Hospitals. It will be regarded at the Role Delineation level of 3.

## Hyperbaric Chamber Therapy Unit

If integrated within another health facility such as a hospital, Hyperbaric Unit will be regarded as a department within the facility. It has many in common elements and can link with other department such as Emergency and Outpatients.

The planning of the unit will be very similar with Outpatient and Ambulatory units incorporating minor procedures or treatments as described in the section below.

In a hospital setting it is desirable to have a path for patient transfer via a trolley or wheelchair from the Emergency Unit or the Ambulance Bay. If the facility includes Inpatient and Intensive Care services, it is highly recommended for a path of patient transfer from the Hyperbaric Unit to the Inpatient Units and ICU.

### Functional Zones

A Hyperbaric Unit can include the following functional zones, arranged in relation to each other depending on operational policies, service delineation and relationships to other services:

- Entry/ Reception including:
  - Waiting with beverage bay and drinking water facilities if required
  - Public amenities if not located in close proximity
  - Interview room
  - Patient bed bays for holding pre-procedure and recovery following procedures
  - Storage for files and stationery
- Outpatient/ Diagnostic facilities including:
  - Consultation rooms
  - Examination rooms (or combined with Consultation)
- Treatment Facilities including:
  - Patient holding bays
  - Patient changing room/ area
  - HBOT treatment room
  - Trolley/ Stretcher Bay
  - Gas cylinder storage room
  - Compressor room
- Support areas including:
  - Clean Utility room
  - Dirty Utility room
  - Store rooms for clinical and non-clinical use
- Staff Area:
  - Administrative offices/ workstations
  - Change rooms with showers, toilet and lockers
  - Staff Room and amenities

Apart from the facilities listed under the Treatment Room above, all other facilities may be shared with nearby health facility units such as Outpatient or Emergency Unit.

## 4 Functional Relationships

### External

Depending on the type of facility (stand-alone, part of a hospital) the following external relationships should be considered and enabled:

- Emergency Unit- Allow for the transfer of patients delivered urgently to the Emergency Department or those displaying adverse results after HBOT treatment.

## Hyperbaric Chamber Therapy Unit

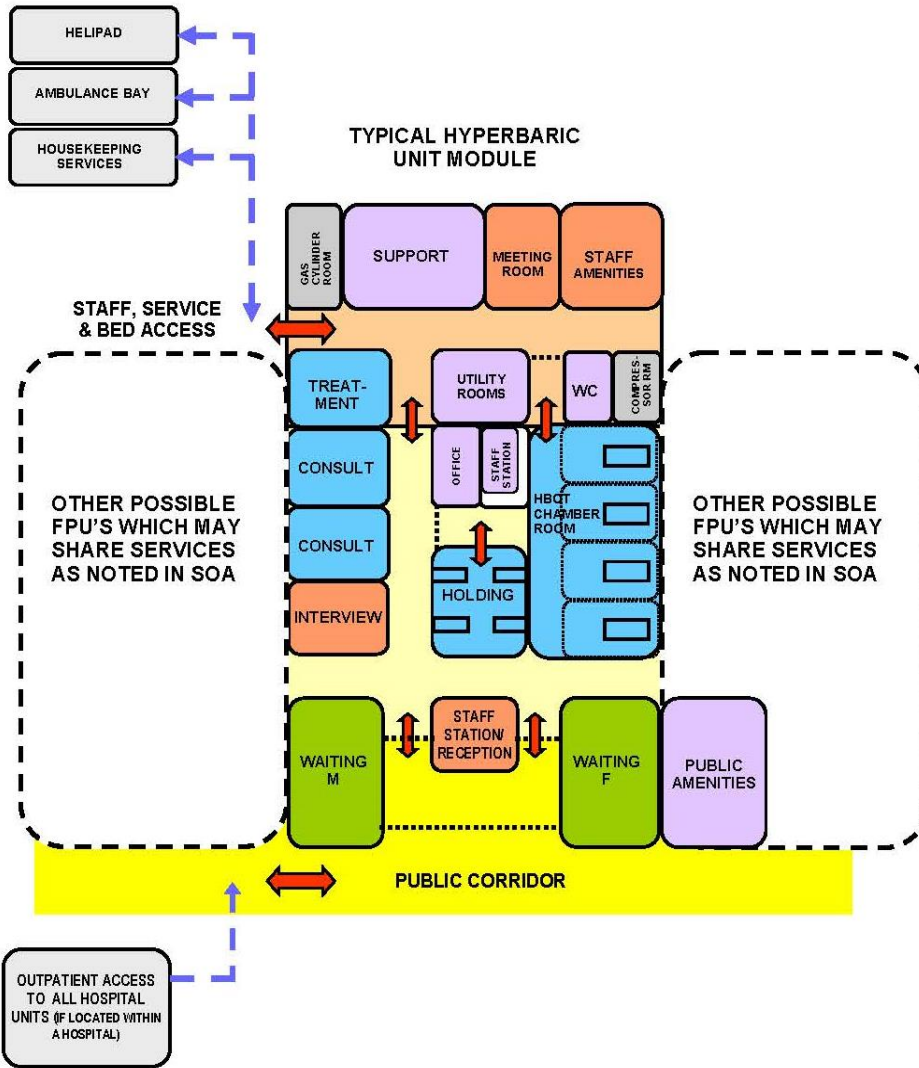
- Ambulance Bay- Allow for the convenient transfer of patients to and from other facilities.
- Inpatient Unit- Allow for the transfer of inpatients requiring HBOT or post-treatment transfer of patients for further recovery.
- Linen Handling Unit- If such a unit is present allow for the delivery of re-useable linen.
- Biomedical Engineering Unit- If present allow for the staff access to the equipment for routine maintenance and testing.
- Helipad- If present allow for the rapid transfer of critical patient to the unit.

### *Internal*













Internal relationships within the unit are best demonstrated in the diagram below. The diagram assumes a self-contained unit with all Functional Zones incorporated. However, in most hospital settings it is possible and even desirable to share some of the staff amenities with adjacent units.



Functional Relationship Diagram



LEGEND

- |   |  |  |   |
|---|--|--|---|
|  Patient Areas |  Procedural Areas       |  Public Areas & Amenities |  Direct Relationship   |
|  Support Areas |  Circulation            |  Public Corridors         |  Indirect Relationship |
|  Staff Areas   |  Staff/Service Corridor |  Controlled Access        |  Path of Travel        |

## 5 Design Considerations

### General

Waiting Areas, Patient Consult and Treatment Areas shall be designed to cater for a wide range of patients visiting the Unit, including elderly, parents with children, patients with limited mobility and bariatric patients.

Waiting Areas shall be provided with a minimum of 4 seats per Consultation Room with discrete separation for Male and Female.

Where a paediatrics service is provided, a separate controlled area should be available for paediatric patients.

The design should give patients and visitors the impression of an organised and efficient Unit.

Additionally, carparking space allowance should be considered in the planning process to align with relevant Municipality standards and requirements but no less than the requirements set out within these Guidelines under Part B Preliminaries.

If the unit is within a hospital provide discrete access to the Emergency Unit, Ambulance Bay, Inpatient Unit and ICU via corridors and lifts which are not mixed with public reception/ waiting areas.

### Equipment

Medical equipment used for the provision of the HOBOT should be approved by minimum two of the following authorities:

- Food and Drug Administration (FDA)
- Health Canada
- Conformité Européenne (CE)
- Australian Register of Therapeutic Goods (ARTG)
- Japans Ministry of International Trade and Industry (MITI)

The traditional type of Hyperbaric Chamber used for HBOT and therapeutic recompression is a rigid pressure vessel. Such chambers can be run at absolute pressures about 6 bars (87 psi), 600,000 Pa or more in special cases. Such chambers and the associated treatments may be provided by Hospitals, Diving Organisations and the Navy.

The Hyperbaric Chambers may vary in size from semi-portable, one-patient units referred to as "Monoplace" to whole-room units capable of accommodating multiple patients such as 4 to 8 and typically referred to as "Multiplace". The Multiplace units may be rated for lower pressures unless they are mainly intended for the treatment of decompression sickness.

A rigid Hyperbaric Chambers may consist of:

- A pressure vessel with the view ports or fixed windows, typically made of acrylic
- One or more patient access hatches; either small, circular or larger hatches for patients on trolleys
- An airlock (for Multiplace units) with two doors, one to the outside and one to the inside that allows the main chamber to maintain its pressure whilst a person enters or exists
- A small access hatch suitable for passing medications, instruments and food
- Observation viewports or closed-circuit television (CCTV) to allows technicians and medical staff to monitor the patient within the chamber

## Hyperbaric Chamber Therapy Unit

- An intercom system allowing two-way communications between the patient and the staff
- Optional carbon dioxide scrubber including a fan that passes the gas inside the chamber through a soda lime canister
- A control panel outside the chamber to control air flow by opening and closing valves to and from the chamber and regulate oxygen to hoods or masks if necessary
- An over-pressure relief valve
- A built-in breathing system (BIBS) to supply and exhaust treatment gas
- A fire suppression system.

Flexible Monoplace chambers are available ranging from collapsible flexible aramid fiber-reinforced chambers which can be disassembled for transport via truck or SUV, with a maximum working pressure of 2 bar above ambient complete with BIBS allowing full oxygen treatment schedules to portable, air inflated "soft" chambers that can operate at between 0.3 and 0.5 bars (4.4 and 7.3 psi) above atmospheric pressure with no supplemental oxygen and longitudinal zipper closure. A flexible chamber may be pressurised directly from a compressor or from storage cylinders.

Under these Guidelines flexible (inflatable) Hyperbaric Chambers are not allowed except in exceptional circumstances.

In the larger Multiplace chambers, patients inside the chamber breathe from either "oxygen hoods" – flexible, transparent soft plastic hoods with a seal around the neck similar to a space suit helmet – or tightly fitting oxygen masks, which supply pure oxygen and may be designed to directly exhaust the exhaled gas from the chamber. During treatment patients breathe 100% oxygen most of the time to maximise the effectiveness of their treatment but have periodic "air breaks" during which they breathe chamber air (21% oxygen) to reduce the risk of oxygen toxicity. The exhaled treatment gas must be removed from the chamber to prevent the build-up of oxygen, which could present a fire risk. Attendants may also breathe oxygen some of the time to reduce their risk of decompression sickness when they leave the chamber. The pressure inside the chamber is increased by opening valves allowing high-pressure air to enter from storage cylinders, which are filled by an air compressor. Chamber air oxygen content is kept between 19% and 23% to control fire risk (US Navy maximum 25%). If the chamber does not have a scrubber system to remove carbon dioxide from the chamber gas, the chamber must be isobarically ventilated to keep the CO<sub>2</sub> within acceptable limits.

Smaller "Monoplace" chambers can only accommodate the patient and no medical staff can enter. The chamber may be pressurized with pure oxygen or compressed air. If pure oxygen is used, no oxygen breathing mask or helmet is needed but the cost of using pure oxygen is much higher than by using compressed air. If compressed air is used, then an oxygen mask or hood is needed as in a Multiplace chamber.

Most Monoplace chambers can be fitted with a demand breathing system for air breaks. In low pressure soft chambers, treatment schedules may not require air breaks because the risk of oxygen toxicity is low due to the lower oxygen partial pressures used (usually 1.3 ATA) and short duration of treatment.

For those patients who are alert and cooperative the air breaks provided by mask are more effective than changing the chamber gas because they provide a quicker gas change and a more reliable gas composition both during the break and treatment periods.

## Hyperbaric Chamber Therapy Unit

All the HBOT equipment must be installed and operated according to the manufacturing specifications. The equipment must be regularly maintained and all necessary parts shall be changed as per equipment manufacturer's recommendation. Careful records of maintenance must be kept.

### **Patient Treatment Areas**

The design of the HBOT Treatment Area/ Room follows the recommendations of any of the following Safety Committees and Guidelines:

- Part E – Engineering of these Guidelines
- National Fire Protection Association (NFPA) Standard for Health Care Facilities (HBOT Chapter)
- American Society of Mechanical Engineers
- Compressed Gas Association
- UHMS Hyperbaric Oxygen Therapy: A Committee Report.

The following design criteria should be observed:

- Hyperbaric Units may only be provided as stand-alone facilities or within other facilities. For example Hyperbaric facilities may not be provided within residential buildings, shopping malls, medical centres, polyclinics or industrial areas.
- Ensure that the floor can support the weight of the Hyperbaric Chamber and all ancillary equipment, both when moving the chamber into place and under operating conditions.
- HBOT treatment area/ room should be large enough for not only the chamber but also patient support and staff activities.
- Hyperbaric Chamber placement within the room should ensure adequate space for chamber operations, patient loading and support equipment.
- Multiplace Chambers shall be located on the ground floor or a level with direct and easy access to the outside.
- If the Hyperbaric chamber is placed near a wall it shall not hamper the controls or viewports of the chamber.

In any Hyperbaric unit within the Treatment Area or within a very short distance the following equipment must be available in perfectly working order:

- Oxygen resuscitation equipment which can supply 100% oxygen to a nonbreathing patient.
- Intubation-kit to be ready at all time incase of an urgent intubation to maintain ventilation of a patient.
- A set of apparatus to enable pleurocentesis to be performed.
- A system to call the doctor in case of an emergency. This call device shall be simple to operate with an uninterruptable path to the doctor who is required to respond within five minutes.
- Therapeutic equipment such as cervical traction for cervical spine injuries.
- Gas analysis system calibrated in accordance with the manufacturer's instructions.

For multi-chamber facilities the facility shall have available and maintain some of the equipment inside as well as outside the chambers. This includes but is not limited to:

- Apparatus to measure blood pressure with an appropriately sized cuff
- Equipment for electrocardiographic monitoring
- IV supplies and accessory equipment such as syringes, needles, tape, etc
- Emergency drugs and supplies with procedures to review expiry date.

## ***Environmental Considerations***

### **Acoustics**

The Outpatients Unit should be designed to minimise the ambient noise level within the unit and transmission of sound between consult/ treatment areas, staff areas and public areas. The transfer of sound between clinical spaces should be minimised to reduce the potential of staff error from disruptions and miscommunication and to increase patient safety as well as privacy.

Acoustic treatment is required to the following:

- Consult/ Examination Rooms
- Interview and Meeting Rooms
- HBOT Treatment Areas
- Staff Rooms.

Solutions to be considered include:

- Location of the Unit
- Selection of sound absorbing materials and finishes
- Use of sound isolating construction
- Planning to separate quiet areas from noisy areas
- Review of operational management and patient/ client flows. This may include separate areas for patients with special needs and paediatrics.

Refer to Part G – Acoustics of these Guidelines for more information.

### **Natural Light**

It is preferable that the use of natural light throughout the Unit is maximised although this is not mandatory. Windows are an important aspect of sensory orientation and psychological well-being of patients and staff in order to reduce discomfort and stress. Windows are particularly desirable in Waiting Areas and Staff Lounges. If windows cannot be provided, alternatives such as skylights may be considered. In each of the models provided the majority of the consultation rooms is to utilise the lighting provided by natural light.

Although the provision of natural light to the Treatment area is desirable, direct penetration of natural light into the HBOT chambers is undesirable and provisions should be made for shielding.

### **Privacy**

The design of the Unit needs to consider patient privacy and confidentiality incorporating the following:

- Discreet discussion spaces and non-public access to medical records
- An adequate number of rooms for discreet discussions to occur whenever required
- Privacy screening to all Examination Bays and Patient Bed Bays
- In treatment rooms with multiple chambers, provide privacy screens between the chambers
- In monoplace chambers provide privacy screens between male and female patients. Alternatively ensure time separation between male and female patients.
- The location of doors to avoid patient exposure in Consultation/ Examination Rooms.

### **Accessibility**

There should be a weatherproof vehicle drop-off zone with easy access for less-mobile patients and wheelchair bound patients.

## Hyperbaric Chamber Therapy Unit

Design should provide ease of access for wheelchair bound patients in all Patient Areas including Consult Rooms and Waiting Areas. Waiting Areas should include spaces for wheelchairs (with power outlets for charging electric mobility equipment) and suitable seating for patients with disabilities or mobility aids.

The Unit may require provision for bariatric patients depending on the service plan.

### **Doors**

Doors should be sufficiently wide to allow the transportation of certain patients on beds or trolleys.

Similarly, any doors which may be used by patients or staff must be wide enough to comply with Accessibility standards. Also refer to Part C – Access, Mobility and OH&S of these Guidelines.

### **Size of the Unit**

The size of the overall Unit is determined by a Clinical Services Plan taking into consideration:

- The size of the population served by the Unit
- The number of clinical practitioners available
- The average length of consultation or treatment
- The number of referrals and transfers from other facilities
- The number of other facilities serving the same area
- The facilities which may be shared with other adjacent functional units within a Hospital or Clinic.

A typical Schedules of Accommodation has been provided for a stand-alone Hyperbaric Unit as a guide for customisation by the users.

### **Safety and Security**

The Hyperbaric Unit shall provide a safe and secure environment for patients, staff and visitors, while remaining a non-threatening and supportive atmosphere.

Security issues are important due to the increasing prevalence of violence and theft in healthcare facilities. The facility, furniture, fittings and equipment must be designed and constructed in such a way that all users of the facility are not exposed to avoidable risks of injury.

The arrangement of spaces and zones shall offer a high standard of security through the grouping of like functions, control over access and egress from the Unit and the provision of optimum observation for staff. The perimeter of the Unit should be secured and consideration given to electronic access. Access to Public Areas shall be carefully planned so that the safety and security of staff areas within the Unit are not compromised. Zones within the Unit may need to be lockable when not in use, preferably electronically.

Internally within the Hyperbaric Unit all offices and all store rooms for files, records and equipment should be lockable.

### **Finishes**

Finishes including fabrics, floor, wall and ceiling finishes, should be inviting and non-Institutional as far as possible. The following additional factors should be considered in the selection of finishes:

- Ease of cleaning
- Infection control
- Acoustic properties

## Hyperbaric Chamber Therapy Unit

- Durability
- Fire safety
- Movement of equipment and impact resistance.

In areas where clinical observation is critical such as Consultation and Treatment Rooms, lighting and colours selected must not impede the accurate assessment of skin tones. Walls shall be painted with lead free paint.

The floor finishes in all Consult and Treatment Areas should have a non-slip surface and be impermeable to water and body fluids. Carpet cannot be installed in Examination and Treatment Rooms. The floor of the HBOT treatment room shall be seamless and anti-static.

The ceiling of the HBOT treatment room shall be seamless such as set gypsum plasterboard with paint finish. Drop-in tiled ceilings in the treatment room shall be avoided.

Refer also to Part C – Access, Mobility, OH&S and Part D - Infection Prevention and Control of these Guidelines.

### ***Curtains / Blinds***

Window treatments should be durable and easy to clean. Consideration may be given to use of blinds, shutters, tinted glass, reflective glass, exterior overhangs or louvers to control the level of lighting. If blinds are to be used instead of curtains, the following applies:

- Vertical blinds and Holland blinds are preferred over Horizontal blinds as they do not provide numerous surfaces for collecting dust
- Horizontal blinds may be used within a double-glazed window assembly with a knob control on the internal side.

Privacy screens should be provided between the chambers and around any bed bays used for holding or examining patients.

Privacy bed screens must be washable, fireproof and cleanly maintained at all times. Disposable bed screens may also be considered.

### ***Building Services Requirements***

This section identifies unit specific services briefing requirements only and must be read in conjunction with Part E - Engineering Services for the detailed parameters and standards applicable.

### **Information and Communication Technology**

Unit design should address the following Information Technology/ Communications issues:

- Electronic Health Records (EHR) which may form part of the Health Information System (HIS)
- Hand-held tablets and other smart devices
- Picture Archiving Communication System (PACS)
- DECT system
- Paging and personal telephones replacing some aspects of call systems
- Data entry including scripts and investigation requests
- Bar coding for supplies and records
- Data and communication outlets, servers and communication room requirements
- Optional availability of Wi-Fi for staff, patients and waiting visitors

### Staff Call

Hospitals must provide an electronic call system next to each treatment space including Consult, Examination, Procedure, Treatment Rooms and Patient Areas (including toilets) to allow for patients to alert staff in a discreet manner at all times.

All calls are to be registered at the Staff Station and must be audible within the service areas of the Unit including Clean Utilities and Dirty Utilities. If calls are not answered the call system should escalate the alert accordingly. The Staff Call system may also use mobile paging systems or SMS to notify staff of a call.

### Heating Ventilation and Air-conditioning (HVAC)

The Unit should be air-conditioned with adjustable temperature and humidity in all Consult and Treatment Rooms for patient and staff comfort.

All HVAC requirements are to comply with services identified in Standard Components and Part E – Engineering Services.

### Medical Gases

Medical gas is intended to administer for a patient during the treatment, diagnosis or resuscitation. Medical gases shall be installed and readily available in Consult/ Treatment and Procedure Rooms and Patient Bays according to the quantities noted in the Standard Components Room Data Sheets and as required by the facility's Operational Policy.

Refer to Standard Components RDS and RLS, and Part E - Engineering Services in these Guidelines for Medical Gases technical requirements.

### Pneumatic Tube Systems

The Outpatients Unit may include a Pneumatic Tube System as determined by the facility Operational Policy. If provided the station should be located in close proximity to the Staff Station or under direct staff supervision.

### Hydraulics

Warm water shall be supplied to all areas accessed by patients within the Unit. This requirement includes all staff handbasins and sinks located within patient accessible areas. Sinks in Staff Areas shall be provided with hot and cold water services.

For further information and details refer to Part E – Engineering Services in these Guidelines.

### ***Infection Control***

Infectious patients and immune-suppressed patients may be sharing the same treatment space at the different times of the same day. The design of all aspects for the Unit should take into consideration the need to ensure a high level of infection control in all aspects of clinical and non-clinical practice.

### Hand Basins

Handwashing facilities shall be provided in Consult/ Examination Rooms and located conveniently to patient Bed Bays. Handbasins suitable for scrubbing procedures shall be provided for each Procedure and Treatment Room, as specified by the Standard Components. Where a handbasin is provided there shall also be liquid soap, disposable paper towels and waste bin provided.



## Hyperbaric Chamber Therapy Unit

One handwashing basin shall be provided for up to 4 Hyperbaric chambers, if they are located in the same room. One handwashing basin shall be provided at any staff station, unless it is in the same room as the Hyperbaric chambers. One handwashing basin shall be provided in close proximity to any bed bay used for the holding or examination of a patient.

Handwashing facilities shall not impact on minimum clear corridor widths. At least one Handwashing Bay is to be conveniently accessible to the Staff Station. Handbasins are to comply with Standard Components - Bay - Handwashing and Part D - Infection Prevention and Control in these Guidelines.

### Antiseptic Hand Rubs

Antiseptic Hand Rubs should be located so they are readily available for use at points of care, at the end of patient examination couches and in high traffic areas.

The placement of Antiseptic Hand Rubs should be consistent and reliable throughout facilities. Antiseptic Hand Rubs are to comply with Part D - Infection Prevention and Control, in these Guidelines.

Antiseptic Hand Rubs although very useful and welcome, cannot fully replace Hand Wash Bays. Both are required.

### Staffing Requirements

All healthcare facilities providing HBOT should comply with the following requirements.

Ensure that the multi-disciplinary teams comprise of all licensed personnel necessary to deliver services in accordance with this Standard and that HBOT Providers:

- Have in place a nominated Director/ Chair of HBOT services.
- Employ the sufficient number of certified and experienced licensed staff as per each type of used chamber in the facility and the patient's condition by meeting the minimum staffing requirements.
- Ensure that HBOT multi-disciplinary team includes:
  - HBOT Physicians
  - HBOT Technicians (Chamber Operators)
  - Registered Nurses (Chamber Attendants)

Ensure that employed staff meet the qualification and training requirements.

Ensure that the HBOT Technician (Chamber operator) or any of the licensed healthcare professionals employed in the HBOT facility can manage the roles and responsibilities of the facility's safety officer and fire marshal.

Ensure that all staff are medically checked for fitness to be involved in HBOT. The medical check-up shall be conducted annually and in a third part facility.

All personnel shall complete equipment-specific training for the system and equipment which they will be operating.

At all times while a patient is under pressure, there shall be a minimum of two persons outside the chamber and within the hyperbaric facility.

Every Multiplace chamber should have minimum of two chamber operators or one chamber operator and one chamber supervisor during the operating hours of the facility.

Every two Monoplace Chambers should have a minimum of one chamber operator during the operating hours of the facility.

## 6 Components of the Unit

### Standard Components

Standard Components are typical rooms within a health facility, each represented by a Room Data Sheet (RDS) and a Room Layout Sheet (RLS).

The Room Data Sheets are written descriptions representing the minimum briefing requirements of each room type, described under various categories:

- Room Primary Information; includes Briefed Area, Occupancy, Room Description and relationships, and special room requirements
- Building Fabric and Finishes; identifies the fabric and finish required for the room ceiling, floor, walls, doors, and glazing requirements
- Furniture and Fittings; lists all the fittings and furniture typically located in the room; Furniture and Fittings are identified with a group number indicating who is responsible for providing the item according to a widely accepted description as follows:

Group	Description
1	Provided and installed by the Builder/ Contractor
2	Provided by the Client and installed by the Builder/Contractor
3	Provided and installed by the Client

- Fixtures and Equipment; includes all the serviced equipment typically located in the room along with the services required such as power, data and hydraulics; Fixtures and Equipment are also identified with a group number as above indicating who is responsible for provision
- Building Services; indicates the requirement for communications, power, Heating, Ventilation and Air conditioning (HVAC), medical gases, nurse/ emergency call and lighting along with quantities and types where appropriate. Provision of all services items listed is mandatory

The Room Layout Sheets (RLS's) are indicative plan layouts and elevations illustrating an example of good design. The RLS indicated are deemed to satisfy these Guidelines. Alternative layouts and innovative planning shall be deemed to comply with these Guidelines provided that the following criteria are met:

- Compliance with the text of these Guidelines
- Minimum floor areas as shown in the schedule of accommodation
- Clearances and accessibility around various objects shown or implied
- Inclusion of all mandatory items identified in the RDS

Hyperbaric Unit will contain Standard Components to comply with details in the Standard Components described in these Guidelines. Refer to Standard Components Room Data Sheets and Room Layout Sheets.

### Non-Standard Components

Non-standard rooms are those which have not yet been standardised within these Guidelines. As such there are very few Non-standard Rooms. These are identified in the Schedules of Accommodation as NS and are separately covered below.

### Treatment Room

The treatment room is the only Non-Standard Room within the unit. It includes:

- Space for the Hyperbaric Chamber either Monoplace or Multiplace
- Movement space around the chamber for patient access (if necessary via a transfer trolley)
- Space for the staff including technicians and clinicians to observe and control the chamber
- Space for the visitors if necessary.

## 7 Schedule of Accommodation

The Schedule of Accommodation (SOA) provided below represents generic requirements for this Unit. It identifies the rooms required along with the room quantities and the recommended room areas. The sum of the room areas is shown as the Sub Total as the Net Area. The Total area is the Sub Total plus the circulation percentage. The circulation percentage represents the minimum recommended target area for corridors within the Unit in an efficient and appropriate design.

Within the SOA room sizes are indicated for typical units and are organised into the functional zones. Not all rooms identified are mandatory therefore, optional rooms are indicated in the Remarks. These guidelines do not dictate the size of the facilities, therefore, the SOA provided represents a limited sample based on assumed unit sizes. The actual size of the facilities is determined by Service Planning or Feasibility Studies. Quantities of rooms need to be proportionally adjusted to suit the desired unit size and service needs.

The Schedule of Accommodation are developed for particular levels of services known as Role Delineation Level (RDL) and numbered from 1 to 6. Refer to the full Role Delineation Framework (Part A - Appendix 6) in these guidelines for a full description of RDL's.

The table below shows a typical stand-alone Hyperbaric Unit at RDL 2.

Any proposed deviations from the mandatory requirements, justified by innovative and alternative operational models may be proposed within the departure forms included in Part A of these guidelines for consideration by the health authority for approval.

### Hyperbaric Unit

ROOM/ SPACE	Standard Component Room Codes	RDL 2-6 Qty x m <sup>2</sup>			RDL 2-6 Qty x m <sup>2</sup>			Remarks
		2 Chambers			4 Chambers			
<b>Entry / Reception</b>								
Reception/ Clerical	recl-10-i similar recl-15-i similar	1	x	10	1	x	10	May include space for self-registration of patients
Waiting	wait-10-i wait-20-i similar	2	x	10	2	x	15	Divide into Male/ Female areas; Part may be provided as Sub Waiting near Consult rooms; Min. 4 seats per Consult
Play Area	plap-10-i similar				1	x	8	Optional

## Hyperbaric Chamber Therapy Unit

ROOM/ SPACE	Standard Component Room Codes	RDL 2-6 Qty x m <sup>2</sup>			RDL 2-6 Qty x m <sup>2</sup>			Remarks
		2 Chambers			4 Chambers			
Bay - Wheelchair Park	bwc-i	1	x	2	1	x	2	May share with Main facility if located close
Interview Room - Family	intf-i	1	x	2	1	x	12	Optional
Store - Files	stfs-10-i similar	1	x	8	1	x	8	For clinical records, optional if electronic records used
Toilet - Accessible	wcac-i	1	x	6	1	x	6	May share with Main facility if located close
Toilet - Public	wcpu-3-i	2	x	3	2	x	3	May share with Main facility if located close
<b>Consult Areas</b>								
Consult Room	cons-i	1	x	13	2	x	13	Combined Consult/ Examination Room. Consult /Office and Examination Area may be separated in to two rooms with an interconnected door.
Treatment Room	trmt-12-i	1	x	12	1	x	14	Optional for RDL2/4 and Mandatory for 5/6
Meeting Room - Small	meet-9-i				1	x	9	Optional; Interviews, private discussions, team meetings
Vital Signs Room	NS	1	x	8	1	x	8	Optional- Consult room can also be used
Bay - Handwashing, Type B	bhws-b-i	1	x	1	2	x	1	In corridors and staff work areas. Also refer to the minimum requirements in the text.
Bay – Linen	blin-i	1	x	2	1	x	2	
Bay - Mobile Equipment	bmeq-4-i	1	x	4	1	x	4	For scales, lifting equipment

## Hyperbaric Chamber Therapy Unit

ROOM/ SPACE	Standard Component Room Codes	RDL 2-6 Qty x m <sup>2</sup>			RDL 2-6 Qty x m <sup>2</sup>			Remarks
		2 Chambers			4 Chambers			
Bay - Resuscitation Trolley	bres-i	1	x	1.5	1	x	1.5	Share the bay provided in the chamber room
Clean Utility	clur-8-i clur-12-i clum-14-i	1	x	8	1	x	8	Minimum sub-clean utility required. Shared with chamber room
Dirty Utility	dtur-s-i dtur-12-i similar	1	x	8	1	x	8	Minimum sub-dirty utility required Shared with Chamber room
Staff Station	sstn-5-i sstn-14-i similar	1	x	4	1	x	4	Act as reception to the facility also
Store - Equipment	steq-10-i steq-14-i	1	x	10	1	x	10	Optional
Store - General	stgn-8-i similar stgn-14-i similar	1	x	9	1	x	12	May be combined with Equipment Store in one room
Toilet - Accessible	wcac-i	2	x	6	2	x	6	Designated as Male or Female
<b>Therapy Areas</b>								<b>Optional – Dependent on Service Plan</b>
Holding Bay - Holding	pbtr-h10-i	2	x	10	4	x	10	Provide at a ratio of one per chamber Also acts as changing room. Provide privacy screens between bays.
Hyperbaric Chamber room	hbot-1-i or hbot-2-i or hbot-4-i	1	x	60	1	x	105	For more chambers, add 30 m2 per chamber
Bay Handwashing	bhws-a-i	1	x	1	1	x	1	For Bed Bays, ratio 1: 4 bays, refer to Part D
Bay - Linen	blin-i	1	x	2	1	x	2	
Bay - Resuscitation Trolley	bres-i	1	x	1.5	1	x	1.5	may be shared if located conveniently

## Hyperbaric Chamber Therapy Unit

ROOM/ SPACE	Standard Component Room Codes	RDL 2-6 Qty x m <sup>2</sup>			RDL 2-6 Qty x m <sup>2</sup>			Remarks
		2 Chambers			4 Chambers			
Staff Station	sstn-5-i sstn-14-i similar	1	x	5	1	x	5	Minimum sub-statin required within the chamber room or immediately adjacent
Staff Station/ Clean Utility	sscu-i	1	x	9	1	x	9	Suitable for small procedures areas
Toilet - Accessible, Patient	wcac-i	1	x	6	1	x	6	Optional, May be shared with the Consult Area if located close.
<b>Staff and Support Areas</b>								
Office - Single Person	off-s9-i	Shared			1	x	9	For centre administration only
Communications Room	comm-12-i similar	Shared			1	x	*	*Size dependant on IT equipment; area is part of Engineering
Cleaners Room	clrm-6-i	Shared			1	x	6	May be shared with adjacent Unit
Disposal Room	disp-8-i similar	Shared			1	x	5	May combine with Dirty Utility
Property Bay - Staff	prop-3-i similar	Shared			1	x	2	May be shared with adjacent Unit
Staff Room	srm-15-i srm-25-i similar	1	x	15	1	x	15	Includes Beverage Bay; may be shared with adjacent Unit
Toilet - Staff, (M/F)	wcst-i	2	x	3	2	x	3	May be shared with adjacent Unit
Gas Cylinder Room	NS	1	x	8	1	x	8	Follow equipment supplier's recommendations
Compressor Room	NS	1	x	8	1	x	8	Follow equipment supplier's recommendations
<b>Sub Total</b>		<b>163.5</b>			<b>214.5</b>			
<b>Circulation %</b>		<b>32%</b>			<b>32%</b>			
<b>Area Total</b>		<b>216</b>			<b>283</b>			

## Hyperbaric Chamber Therapy Unit

Please note the following:

- Areas noted in Schedules of Accommodation take precedence over all other areas noted in the Standard Components
- Rooms indicated in the schedule reflect the typical arrangement according to the sample chamber numbers
- All the areas shown in the SOA follow the No-Gap system described elsewhere in these Guidelines
- Exact requirements for room quantities and sizes shall reflect Key Planning Units (KPU) identified in the Clinical Service Plan and the Operational Policies of the Unit
- Room sizes indicated should be viewed as a minimum requirement; variations are acceptable to reflect the needs of individual Unit
- Offices are to be provided according to the number of approved full-time positions within the unit



## 8 Further Reading

In addition to Sections referenced in this FPU, i.e. Part C- Access, Mobility, OH&S, Part D - Infection Prevention and Control, and Part E - Engineering Services, Part G-Acoustics readers may find the following helpful:

- DOH Standard for Hyperbaric Oxygen Therapy, Abu Dhabi, UAE  
[doh\\_standard\\_for\\_hyperbaric\\_oxygen\\_therapy.pdf](#)
- Dubai Health Authority, Hyperbaric Oxygen Therapy (HBOT) Service Standards, 2016  
[https://www.dha.gov.ae/Documents/HRD/RegulationsandStandards/guidelines/Hyperbaric%20Oxygen%20Therapy%20\(HBOT\)%20Service%20Standards.pdf](https://www.dha.gov.ae/Documents/HRD/RegulationsandStandards/guidelines/Hyperbaric%20Oxygen%20Therapy%20(HBOT)%20Service%20Standards.pdf)
- Mayo Clinic, Hyperbaric oxygen therapy  
<https://www.mayoclinic.org/tests-procedures/hyperbaric-oxygen-therapy/about/pac-20394380>
- Wikipedia, Hyperbaric Medicine  
[https://en.wikipedia.org/wiki/Hyperbaric\\_medicine](https://en.wikipedia.org/wiki/Hyperbaric_medicine)
- Johns Hopkins Medicine, Hyperbaric Oxygen Therapy  
<https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/hyperbaric-oxygen-therapy>
- Medical News Today, What is hyperbaric oxygen therapy good for?  
<https://www.medicalnewstoday.com/articles/313155>
- NHS James Paget University Hospitals, Hyperbaric Chamber  
<https://www.medicalnewstoday.com/articles/313155>