Education of nurses, operators and technicians in hyperbaric facilities in Europe

EBAss/ECHM Resources manual

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Document prepared by
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Purpose

The purpose of this document is to describe the training, based on the European Committee for Hyperbaric Medicine (ECHM) recommendations, of nurses, operators and technicians working in a hyperbaric facility in Europe.

This document is intended to be a reference document for European countries for guidelines, regulations and standards in hyperbaric medicine.

This document was written by the members of the Education Committee of the European Baromedical Association for nurses, operators and technicians (EBAss).

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1. Responsibilities

Ref: ECHM 2004 European Code of Good Practice for Hyperbaric Oxygen Therapy

1.1 Multiplace chamber

Operators

- Operation of the internal and external devices of the Chamber.
- Control and operation of the mechanisms for compression and decompression, and for delivering gas mixtures and oxygen.
- Control and application of the safety regulations concerning prevention of fire, and oxygen toxicity.
- Calculation, application and control of compression and decompression schedules for all chamber occupants, applying decompression stops, when necessary.
- Be available for intervention inside the Chamber under pressure, in order to control or check the correct operation of determined parts of the circuits or devices.
- Adaptation and checking of the medical instruments carried by the patients before being introduced into the Chamber, in order to ensure their correct operation, and to avoid dangerous or undesirable effects.
- Control and checking of the operation of auxiliary facilities to the Chamber: air-compressors, sources of compressed air or medical gases, gas/air reserves, pneumatic circuits, control systems etc.
- Maintenance of the facility. Small repair jobs or technical interventions due to problems which occasionally might occur, and which do not require the intervention of highly specialised technical staff.
- Safe handling of technical emergency situations.
- Check the calibration of technical equipment relating to the hyperbaric facility.
- Steering, Controlling and documentation of the Hyperbaric Oxygen (HBO_2) Treatment according to prescribed procedure.
- Duties in emergency situations (locking in and out of personnel).
- Adherence to national law of the appropriate member state.

Nurses

- Nursing measures belonging to the common pathologies of the hyperbaric therapeutics to be applied to the patients in a hyperbaric chamber.
- Nursing assistance of patients inside the hyperbaric chamber, taking special care of the specific conditions of the hyperbaric environment.

- Where possible adaptation of conventional medical techniques and specific treatments of each illness to the hyperbaric environment, so that other treatments the patient is habitually receiving will not need to be interrupted while in the chamber.
- In some cases, operating the external controls of a Monoplace Hyperbaric chamber according to the compression and decompression schedules established. Care of patients including sporadic emergency treatments conducted either inside or outside of HBO_2 chamber.

Hyperbaric Nurses intensive care:

Nursing assistance of critical care patients during hyperbaric treatment.

Attendants NOT nurses:

- Patient care in non-invasive, non-specialised medical activities inside and outside the chamber.
- Accompanying patients who are receiving treatment inside the Multiplace Chamber, but who do not need special assistance by doctors and nurses, but only by way of support, control, and to give them confidence.
- Other activities to develop inside or outside the Chamber, directed by the Medical Director, Hyperbaric Physician or the Nurse.

1.2 Monoplace chamber

Minimum Team levels during a hyperbaric session for Monoplace chambers are described as one hyperbaric physician and one operator. (Abstract, European Code of Good Practice for HBO_2- page 5)

Chamber Operator:
Monoplace chambers are handled sometimes by nurses and doctors and/or hyperbaric specialists: (Abstract, European Code of Good Practice for HBO_2- page 25)

Nurses
In some cases, operating the external controls of a Monoplace Hyperbaric chamber according to the compression and decompression schedules established.
(Abstract, European Code of Good Practice for HBO_2- page 21)

Based on those concise requirements, we propose to verify what these personnel need to know.

Monoplace chamber
Operator

- Operation of the external devices of the Chamber.
- Control and operation of the mechanisms for compression and decompression, and for delivering gas mixtures and oxygen.
- Appreciation of appropriate gas laws.

- Control and application of the safety regulations concerning prevention of fire, and oxygen toxicity.
- Calculation, application and control of compression and decompression schedules for chamber occupant, applying decompression stops, when necessary.
- Adaptation and checking of the medical instruments carried by the patients before being introduced into the Chamber, in order to ensure their compatibility, correct operation, and to avoid dangerous or undesirable effects.
- Control and checking of the operation of auxiliary facilities to the Chamber: air-compressors (if air filled), sources of compressed air or medical gases, gas/air reserves, pneumatic circuits, control systems etc.
- Day to day technical maintenance of chambers in order to identify and repair and rectify minor technical issues.
- Safe handling of technical & medical emergency situations.
- Check the calibration of technical equipment relating to the hyperbaric facility.
- Steering, Controlling and documentation of the HBO_2 Treatment according to prescribed procedure.
- Adherence to national law of the appropriate member state.

If the operator is a nurse

- Nursing measures belonging to the common pathologies of the hyperbaric therapeutics to be applied to the patients in a hyperbaric chamber.
- Nursing assistance of patients taking special care of the specific conditions of the hyperbaric environment.
- Where possible adaptation of conventional medical techniques and specific treatments of each illness to the hyperbaric environment, so that other treatments the patient is habitually receiving will not need to be interrupted while in the chamber.
- Care of patients including sporadic emergency treatments conducted outside of HBO_2 chamber.

2. Entry levels.

2.1 For Multiplace chambers.

	Precondition	Competence will be lost	Recovering
Common Module for Chamber Operators and hyperbaric nurses (attendant)	- medically fit for working under hyperbaric conditions - Current Basic Life Support (BLS) certificate or higher (max. 1 year old). This must be to European Re-	If the individual does not progress to the appropriate specialist module within 12 month after graduation	

	suscitation Council guidelines (ERC), but may be taught by any organisation which works to these guidelines.		
Specific Module for Chamber operator	- Successful graduation of Common Moduleexcept in the case of recertification - medically fit to work under pressure	- Carries out less than 10 hyperbaric procedures or simulations a year, to operate under supervision - And carries out less than 10 hyperbaric treatments a year with patients, to operate autonomous. - no participation on a BLS course (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines) - Has not been working in a hyperbaric chamber as an operator for more than 5 years	- 10 autonomous steered treatments (under supervision). - Participation on a BLS course. (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines) - participate in hyperbaric operator training (hyperbaric operator module only)
Specific Module for Hyperbaric Nurse (Attendant)	- medically fit to work under pressure - Registered nurse - successful graduation of the Common Module except in the case of recertification	- no participation on a BLS course according to the ERC guidelines - Has not been working in a hyperbaric chamber as a nurse for more than 5 years	- participation on a BLS course participate in hyperbaric nurse training (hyperbaric nurse module only) (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these

			guidelines)
Specific Module for Hyperbaric Nurse in Intensive Care (HNIC) (attendant)	- medically fit to work under pressure - registered nurse (RN) - current qualification depending on the member states national legislation for accompany of intensive care patients - successful graduation of the Module Hyperbaric Nurseexcept in the case of recertification	- If the HNIC does not have the required ICU Nurse experience within the previous 18 months - If the HNIC does not work as an ICU nurse inside a hyperbaric chamber within the previous 18 months - no participation on an ILS course according to the ERC guidelines	- current requalification depending on the member states national legislation for accompany of intensive care patients - participate in HNIC training (HNIC module only) - participation on an ILS course according to the ERC guidelines
Module for hyperbaric attendant (Not Nurse)	- Medically fit to work under pressure. - Current BLS or higher (within the previous 12 months)(qualifications must be to ERC, but may be taught by any organisation which works to these guidelines)	- attends less than 10 hyperbaric-treatments a year inside the chamber with patients - no participation on a BLS course (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines)	- attends at least 3 hyperbaric treatments under supervision - participation on a BLS course (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines)

2.2 Entry levels for Monoplace chambers

	Precondition	Competence will be lost	Recovering
Module for Chamber operator not nurse	- Medically fit to work at atmospheric pressure unless being asked to enter the chamber when they would need to be fit to work under pressure- Current BLS or higher(qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines)	- Carries out less than 10 hyperbaric procedures or simulations a year, to operate under supervision - And carries out less than 10 hyperbaric treatments a year with patients, to operate autonomous. - no participation on a BLS course (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines) - Has not been working in a hyperbaric chamber as an operator for more than 5 years	- 10 autonomous steered treatments (under supervision). - Participation on a BLS course. (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines) - participate in hyperbaric operator training
Module for chamber operator Nurse	- Medically fit to work at atmospheric pressure unless being asked to enter the chamber when they would need to be fit to work under pressure - Registered nurse - Current BLS (certificate BLS or higher) (qualifications must be to ERCguidelines, but	- no participation on a BLS course according to the ERC guidelines - Has not been working in a hyperbaric chamber as a nurse for more than 5 years	- participation on a BLS course participate in hyperbaric nurse training (hyperbaric nurse module only) (qualifications must be to ERC guidelines, but may be taught by any organisation which works to these guidelines)

	may be taught by any organisation which works to these guidelines) - successful graduation of the Common Module except in the case of recertification		

3. The modules of education

3.1 Common Module for Operators and hyperbaric nurses (attendant) in hyperbaric chambers.

Theory	Level	Practical	Level
Overview	L1	**Hyperbaric chamber and devices**	L2
Types of hyperbaric facilities		Set up of chamber	
History of hyperbaric medicine		Driving chamber - pressure increase	
Hyperbaric facility organisation		Pressure decrease Patient problems (Lung damage, rupture of the middle ear, damage to the sinuses)	
Basic Technical overview		Locking (personnel and materials)	
Hyperbaric Chamber Technology	L1	Built in breathing system (BiBS)	
Basic chamber technology		Breathing masks and Hood-tent	
Basic understanding of Monoplace & Multiplace Chambers		Illumination and communication	
Hygiene		Disinfection of chamber and associated devices	
Generation of compressed Air (low and high pressure)		Post treatment shut down	
Oxygen supplies, Handling of oxygen		**Patient education**	L2
Oxygen Hazards		Introduction to the general rules	
Electrical supplies, routine and emergency	L2	Fitting of the breathing mask	
Physics and Physiology in a hyperbaric environment		Behaviour during chamber treatment	
Concepts of pressure		Behaviour in emergency situations	
Boyle, Dalton, Henry, and other General Gas Laws: Pressure/Volume/Temperature etc.	L2	Prohibited items and devices	
Physio- and Pathophysiology under hyperbaric conditions			
Air filled cavities, Pressure equalisation, Barotrauma, Oxygen toxicity, Arterial Gas Embolism, Decompression Illness.	L1	**Emergency training**	
Monitoring		Manual Handling	
ECG, NBP, TcPCO2/TcPO_2, ExO_2& CO_2	L2	CPR within a chamber	L2
O_2-Monitoring of the Chamber	L3	Fire	
Relative Humidity		Evacuation	
Safety, Risk Assessment and Management			
Fire Protection			
Prevention by limiting materials entering chamber			
Clothes and other possible fuels	L1		
Procedures in case of fire			

Fire extinguishing systems Practice of fire extinguishing **Treatment profiles and decompression tables for patients and personnel**			
Total: 16 Hr		Total: 16 Hr	

3.2 Specific Module for Chamber operator (Multiplace chamber)

Theory	Level	Practical	Level
Control panel Chamber steering, Chamber monitoring, Computer control, manual steer, Steering at the pneumatic control panel Communication, Video monitoring O_2, CO_2, Temperature & Relative Humidity – Monitoring, Patient Monitoring	L3	**Hyperbaric chamber** Daily checking, Starting and tag-out Set up of the hyperbaric chamber Steering of the chamber (Computer, manual, pneumatic) Documentation of the HBO_2 treatment Take care of an ASA 1 (otherwise healthy) patient, Locking (personnel)	L3
Prescriptions and documentation Awareness of relevant national laws Records of chamber operations Equipment maintenance records	L3	**Maintenance of the chamber** Technical failures, (emergency power supply), BiBS, Technical monitoring, Compressors, Emergency power supply	L3
Clinical-HBO_2 Therapeutic effects of the HBO_2 Indications	L2	**Recognition and necessary behaviour in emergency situations** Medical Emergencies (infiltrate and exit of personnel), General operating states (in case of fire, loss of computer control, loss of gas supply etc.) Understanding of each emergency operating procedure described in the European Code for good Practice Annex 4 point 3 which are:-	L3
Complications Barotrauma, Oxygen-Intoxication	L3	**EMERGENCY OPERATING PROCEDURES** **Medical** - cardio-respiratory complaints including procedures for safe defibrillation - loss of consciousness - convulsions - neuropsychological acute reactions (including panic, claustrophobia, aggression) - vomiting - dysbaric injuries to patients and staff:	L3

		- barotrauma - decompression illness / sickness **Chamber systems.** - uncontrolled change of pressure - loss of gas supplies - contamination of gas supplies - contaminated atmosphere inside chamber - high oxygen levels in the chamber atmosphere - inability to maintain adequate temperature - fire in the chamber - fire in the facility - loss of communications (visual, verbal) - power failure - internal equipment malfunction - medical device malfunction - BiBS malfunction - any external threats to the facility	
Total: 16 Hr		Total: 32 Hr	

3.3 Specific Module for Hyperbaric Nurses (Attendant) (Multiplace)

Theory	Level	Practical	Level
Effects of the HBO Therapy and oxygen Oedema reduction by vasoconstriction 'Squashing' of gas bubbles in case of gas embolism, Bacteriostatic effects (anaerobic organisms), Competitive displacement of CO Activation of fibroblast proliferation and collagen synthesis, Activation of osteoclasts Angio-neogenesis, Activation of macrophages	L2	**Pre-examination of patients** Suitability for HBO_2 Treatment (ECG, Pulmonary function etc.) **Practice of assisting patients with HBO_2Treatments** Before treatment Preparation of the chamber, Checking patients During treatment Accompanying of patients,	L3 L3
Physiology of hyperbaric exposure Functional Anatomy, Breathing, Ears Decompression, Thermoregulation, Immersion	L2	Caring during chamber treatment Specification of medication under hyperbaric conditions (for example - infusion),	
Hyperbaric Pathophysiology and complications Theory of decompression Acute decompression Illness Toxic effects of oxygen (Acute & Chronic) Effects of inert gas (HPNS)	L2	Drainage (i.e Redon, Colostomy etc.) After Treatment Documentation **EMERGENCY OPERATING PROCEDURES** **Medical**	L3
Suitability and contraindications for hyperbaric exposure Patients , HBO-staff	L3	- cardio-respiratory complaints including procedures for safe defibrillation	
HBO_2: Indications by Undersea Hyperbaric Medical Society **(UHMS) and ECHM** Indication in case of emergency, Approved Uses	L3	- loss of consciousness - convulsions - neuropsychological acute reactions (including panic, claustrophobia, aggression)	
Caring and leading of patients during chamber treatment Psychology, Professional-client relations Nursing & Medical records	L3	- vomiting - dysbaric injuries to patients and staff: - barotrauma - decompression illness	

Patient Care Plans **Hygiene in hyperbaric facilities** Specialities of disinfection in hyperbaric environment Requirements of disinfection and cleaning of the chamber fixtures and fittings MRSA and other infectious diseases in HBO_2 Self protection	L3	/ sickness **Chamber systems** - contaminated atmosphere inside chamber - high oxygen levels in the chamber atmosphere - fire in the chamber - loss of communications (visual, verbal) - power failure - internal equipment malfunction - medical device malfunction - BiBS malfunction 3 monitored attended treatments during practical training.	
Total: 16 Hr		Total: 32 Hr	

3.4 Specific Module for Hyperbaric Nurses in Intensive Care (attendant) (Multiplace)

Theory	Level	Practical	Level
Physiology and Pathophysiology under hyperbaric conditions e.g, Heart-circulation, Lungs, Kidney-function	L3	**Respirators, Ventilators & medical devices applicable for use under hyperbaric conditions**	L3
Extended Monitoring Expiratory oxygen measurement e.g, Online Blood gas analysis, $TcPCO_2$, IBP, ICP	L3	An awareness of the different types and their capabilities	
Legal prescription for operation of medical devices in hyperbaric chambers National or EU policies, EN norms.	L2	**Working practices** at a top level hyperbaric facility	L2
Medication e.g, Effects under hyperbaric conditions, Specific procedures & requirements for giving of medication under hyperbaric conditions	L3	**Hygiene** Preparation specialities of breathing devices and accessories The infectious patient	L3
Drainage systems e.g, Redon, Bülau, Ventrikel, NPWT, etc.	L3	**Giving critical intensive care of patients** (incl. 5 accompany of intensive critical care patients) e.g, Cuff pressure control, Bülau-Drainage	L3
Special requirements for mandatory ventilation in hyperbaric environment Volume measurement, Oxygen measurement, Open lung manoeuvre	L3	Intracranial pressure control, Complications	
Case examples and discussion of the examples e.g, CO Intoxication, Burns and smoke inhalation injury, Brain abscess, Anaemia Decompression illness, Emphysema	L2		
Total: 8 Hr		Total: 32 Hr	

3.5 Module for hyperbaric attendant (Not Nurse) (Multiplace)

Theory	Level	Practical	Level
Hyperbaric Chamber Technology	L1	**Hyperbaric chamber and devices**	L3
Physics in a hyperbaric environment	L1		
Physio- and Pathophysiology under hyperbaric conditions	L1	- Locking (personnel and material)	
Safety	L1	- BiBS	
Fire Protection	L2	- Breathing masks and Hood-tent	
Prevention by limiting materials entering chamber		- Illumination and communication	
		Patient education	
Clothes and other possible fuels		**Chamber hygiene**	L2
Procedures in case of fire		**Emergency training**	L2
Fire extinguishing systems			L2
Practice of fire extinguishing		3 accompanied treatment sessions.(in addition to 8hrs practical)	
	L1		
Treatment profiles and decompression tables for patients and personnel			
Total: 8 Hr		Total: 8 Hr	

3.6 Module for operators and nurses (Monoplace chamber)

Theory	Level	Practical	Level
Overview Types of hyperbaric facilities History of hyperbaric medicine Hyperbaric facility organisation Basic Technical overview	L1	**Hyperbaric chamber and devices** Daily checking, Starting and tag-out Set up of chamber	L2
Hyperbaric Chamber Technology Basic chamber technology Monoplace - Multiplace Chamber Hygiene Generation of compressed Air (low and high pressure) Oxygen supplies, Handling of oxygen Oxygen Hazards Electrical supplies, routine and emergency	L1	Steering of the chamber (Computer, manual, pneumatic) Documentation of the HBO_2 treatment BiBS Breathing masks and Hood-tent Illumination and communication Disinfection of chamber and associated devices Post treatment shut down	L2
Physics and Physiology in a hyperbaric environment Concepts of pressure Boyle, Dalton, Henry, and other General Gas Laws: Pressure/Volume/Temperature etc.	L2	**Patient education** Introduction to the general rules Fitting of the breathing mask Behaviour during chamber treatment Behaviour in emergency situations	
Physio- and Pathophysiology under hyperbaric conditions Air filled cavities, Pressure equalisation, Barotrauma, Oxygen toxicity, Arterial Gas Embolism, Decompression Illness.	L2	Prohibited items and devices **Emergency training** Manual Handling Fire	L3
Control panel Chamber steering, Chamber monitoring, Computer control, manual steer, Steering at the pneumatic control panel Communication, Video monitoring O_2, CO_2, Temperature & Relative Humidity – Monitoring Patient Monitoring	L3	Evacuation Understanding of each emergency operating procedure described in the European **EMERGENCY OPERATING PROCEDURES** **Medical** - cardio-respiratory complaints including procedures for safe defibrillation - loss of consciousness - convulsions - neuropsychological acute	L3
Prescriptions and documentation Awareness of relevant national laws Records of chamber operations Equipment maintenance records	L2		

Clinical-HBO_2 Therapeutic effects of the HBO_2 Indications **Complications** Barotrauma, Oxygen-Intoxication **Monitoring** ECG, NBP, TcPCO2/TcPO_2, ExO_2 & CO_2 O_2-Monitoring of the Chamber Relative Humidity **Safety, Risk Assessment and Management** **Fire Protection** Prevention by limiting materials entering chamber Clothes and other possible fuels Prohibited items, materials and equipment Procedures in case of fire Fire extinguishing systems Practice of fire extinguishing **Treatment profiles and decompression tables for patients**	L2 L3 L1 L2 L3 L1	reactions (including panic, claustrophobia, aggression) - vomiting - dysbaric injuries to patients - barotrauma - decompression illness / sickness **System** - uncontrolled change of pressure - loss of gas supplies - contamination of gas supplies - contaminated atmosphere inside chamber - high oxygen levels in the chamber atmosphere - inability to maintain adequate temperature - fire in the chamber - fire in the facility - loss of communications (visual, verbal) - power failure - internal equipment malfunction - medical device malfunction - BiBS malfunction - any external threats to the facility	
Total: 16 Hr.		Total: 16 Hr	

3.7 Additional module for nurses (Monoplace chambers)

Theory	Level	Practical	Level
Effects of the HBO_2 Therapy and oxygen Oedema reduction by vasoconstriction 'Squashing' of gas bubbles in case of gas embolism, Bacteriostatic effects (anaerobic organisms), Competitive displacement of CO Activation of fibroblast proliferation and collagen synthesis, Activation of osteoclasts Angio-neogenesis, Activation of macrophages	L2	**Pre-examination of patients** Suitability for HBO-Treatment (ECG, Pulmonary function etc.)	L3
Physiology of hyperbaric exposure Functional Anatomy, Breathing, Ears Decompression, Thermoregulation,	L2	**Practice of assisting patients with HBO_2-Treatments** Before treatment Preparation of the chamber, Checking patients During treatment Accompanying of patients, Caring during chamber treatment Specification of medication under hyperbaric conditions (for example - infusion), Drainage (i.e Redon, Colostomy etc.)	L3
Hyperbaric Pathophysiology and complications Theory of decompression Acute decompression Illness Toxic effects of oxygen (Acute & Chronic) Effects of inert gas (HPNS)	L2	After Treatment Documentation	
Suitability and contraindications for hyperbaric exposure Patients	L3	3 monitored attended treatments during practical training.	L3
HBO_2: Indications by UHMS and ECHM Indication in case of emergency, Approved Uses	L3		
Caring and leading of patients during chamber treatment Psychology, Professional-client relations Nursing & Medical records Patient Care Plans	L3		

Hygiene in hyperbaric facilities Specialities of disinfection in hyper-baric environment Requirements of disinfection and cleaning of the chamber fixtures and fittings MRSA and other infectious diseases in HBO_2 Self protection	L3		
Total 16 Hr		Total: 16 Hr	

4. Level of Knowledge

Source:
CERTIFICATION SCHEME FOR WELDING AND INSPECTION PERSONNEL
DOCUMENT NO.CSWIP-DIV-9-03
Requirements for General Inspectors of Offshore Facilities
3rd. Edition November 2004
Appendix 1: Examination Syllabus, S. 9
http://www.cswip.com/pdfs/cswipdiv903.pdf

"The level of knowledge required by the candidate varies according to topic. To ensure comprehension by all parties the following terms have been defined to demonstrate an increasing level of knowledge.

DEFINITIONS

OUTLINE KNOWLEDGE:
The candidate must be familiar with the subject in outline terms.
He/She should know that the topic exists and what it is applied to. In the context of hyperbaric methods/techniques the candidate would be expected to know the „what it is, what it does "but would not be expected to know the finer points of application of the technique.

KNOWLEDGE:
The candidate must have a working knowledge of the subject and be able to apply it.

DETAILED KNOWLEDGE:
The candidate must have a depth of knowledge sufficient to enable him/her to exercise judgment. "

Level 1 = Outline Knowledge = L 1
Level 2 = Knowledge = L 2
Level 3 = Detailed Knowledge = L 3

5. Resources and manuals.

Handbook on hyperbaric medicine / Ed. Daniel Mathieu / Springer

Recommendations of the ECHM consensus conferences

European Code of good practice for Hyperbaric Oxygen Therapy

EN 14931: Pressure vessels for human occupancy (PVHO). Multi-place pressure chambers for hyperbaric therapy. Performance, safety requirements and testing

EN 16081: Hyperbaric chambers. Specific requirements for fire extinguishing systems. Performance, installation and testing

6. Levels of lecturer's competence.

For level 1 (Outline Knowledge) and Level 2 (Knowledge) depending the topic (medical or technical) a recognised operator or nurse, member of an HBO_2 team.
For level 3 (Detailed Knowledge) on medical topic, a hyperbaric physician (ECHM level IIb or equivalent) or, under the responsibilities of the hyperbaric physician (level IIb or equivalent), a registered nurse specialised on HBO_2.
For level 3 (Detailed Knowledge) on technical and safety topics, a safety manager or a medical director (ECHM level III).

7. Safety Manager.

Introduction
There is a need to develop a formal standardized management team within European hyperbaric facilities, Management of the team as a whole is important and safety should be a major part of this team for any Hyperbaric Unit. The medical director has a right and specific requirement to have a competent individual as part of this team who can be relied on to ensure the safety of the hyperbaric facility .This person will be ultimately responsible to the medical director for this role.

7.1The functions of the safety manager are:-

a. The Safety Manager will be qualified and experienced to the specific unit they are to manage and will be appointed by the Medical Director.
b. There must always be a designated Safety Manager who has a sound professional relationship with the Medical Director.
c. The Safety Manager is to ensure there is no confusion between personnel, responsibilities and boundaries.

d. The Safety Manager will support the Medical Director as a competent individual who will be able to help with complex safety decisions.
e. To ensure a "Global" approach to management of safety and education within the team.
f. Responsible for implementing or accepting effective Safety Management and Quality Assurance systems, including risk assessment and incident/accident reporting procedures within the Hyperbaric Center.
g. Responsible for implementing or accepting effective Safety Management and Quality Assurance systems are provided to include risk assessment and incident/accident reporting procedures within the Hyperbaric Centre.
h. Responsible for implementing or accepting effective operational, emergency procedures and internal guidelines for all aspects of safety.
i. Responsible for implementing or accepting and monitoring an effective maintenance programme for the hyperbaric system(s).
j. Responsible for implementing or accepting and monitoring an effective regular re-evaluation of the safety management system (including internal audits).
k. Responsible for implementing or accepting and monitoring effective internal and external education programs; including requirements for continuous professional development (CPD) for all members of the hyperbaric team. (European Code of Good Practice for Hyperbaric Oxygen Therapy 3.2 Competencies and Education)
l. Responsible for ensuring continuous professional development (CPD) and skills training for all members of the hyperbaric team under the direct supervision of the medical director. (European Code of Good Practice for HBO_2Therapy 3.2 Competencies and Education)
m. To ensure that the hyperbaric units policies and procedures comply with local, national and European directives.

7.2 Education of the Safety manager

a. Safety Manager will have in addition to the basic hyperbaric education (ECB Certification, ECHCO or ECHRN) received specific and recognized advanced education related to the hyperbaric fields (i.e., safety director, firefighting course, detailed knowledge of rules and regulations, safety culture in Healthcare etc.) and has presented or is working towards presentation of work related to safety at a scientific congress on Hyperbaric Medicine.
b. Will have received education in the fields of Risk Assessment/Management, general Health and Safety management and Quality Assurance management.

c. Will have a working knowledge of all aspects of Hyperbaric Systems including management of infection control.

7.3. Profile of the safety manager

a. Will be appointed by the Medical Director.
b. Will have appropriate education.
c. Will have received certification as a safety manager from ECB/EBAss
d. Maintain ongoing continuing professional development in advanced hyperbaric safety.
e. Will have appropriate experience; and will have worked at least 3 years in the last 5 years in a Hyperbaric Centre treating the ECHM indications regularly as Operator, Nurse or Doctor.
f. Recommended that the individual will have attended a recognized HBO_2 national or international congress within the last 5 years.

7.4 Certification of Safety Manager.

ECB/EBAss will realize specific certification for European Hyperbaric Safety Manager. Candidates will provide evidence of their qualifications, experience and competence to the EBAss accreditation committee for assessment and recommendation to ECB.

8. Examination of the candidates for Operators and Nurses and Attendants

The examination of the candidates concerns operators and nurses attendants.
For hyperbaric nurses in Intensive Care (attendant), final evaluation will be done by their local Medical Director.
The examination of the candidate is in two steps: theory and practical.
The theory examination is based on multiple choice questions each with four possible answers as recommended by ECB/EBAss. All questions will be at the required level for the qualification according to the EBAss resource manual.
Before progressing to the practical examination, the candidate must achieve at least 70% of the points for the theory examination.

The practical examination is of situations or problems that the candidate will be required to solve. These situations are listed in the European Code of Good Practice for HBO Annex 4 point 3 emergency operating procedures. References should be made to the modules of education in the previous paragraphs for the relevant type of chamber.

Following successful completion of the above the candidate can apply for certification of the ECB/EBAss.

Successful completion of the examination opens the possibility for the candidate to introduce his/her candidature as European certified personnel. This pathway is fully described on the EBAss website.

9. Abbreviations

ASA: Physical Status (PS) Classification System

ASA 1: A normal healthy patient (No organic, physiologic, or psychiatric disturbance; excludes the very young and very old; healthy with good exercise tolerance)

BiBS: Built in Breathing System

BLS: Basic Life Support

CO: Carbon Monoxide

CO_2: Carbon Dioxide

CPD: Continuous Professional Development

CPR: Cardiopulmonary Resuscitation

EBAss: European Baromedical Association for nurses, operators and technicians

ECB: The European College of Baromedicine

ECG: Electrocardiography

ECHCO: European Certified Hyperbaric Chamber Operator

ECHM: European Committee for Hyperbaric Medicine

ECHRN: European Certified Hyperbaric Registered Nurse

ERC: European Resuscitation Council

EN norms: European Norms (European Standards)

EU policies: European Policies

ExO2: Expiration Oxygen

HBO_2: Hyperbaric Oxygen

HNIC: Hyperbaric Nurse in Intensive Care

HPNS: Hyper Nervous System

IBP: Invasive blood pressure

IC: Intensive Care

ICU: Intensive Care Unit

ICP: Intracranial Pressure

ILS: Immediate Life Support

MRSA: Methicillin-resistant Staphylococcus Aureus

NBP: Non-invasive Blood Pressure

NPWT: Negative Pressure Wound Therapy

PVHO: Pressure Vessels for Human Occupancy

RN: Registered Nurse

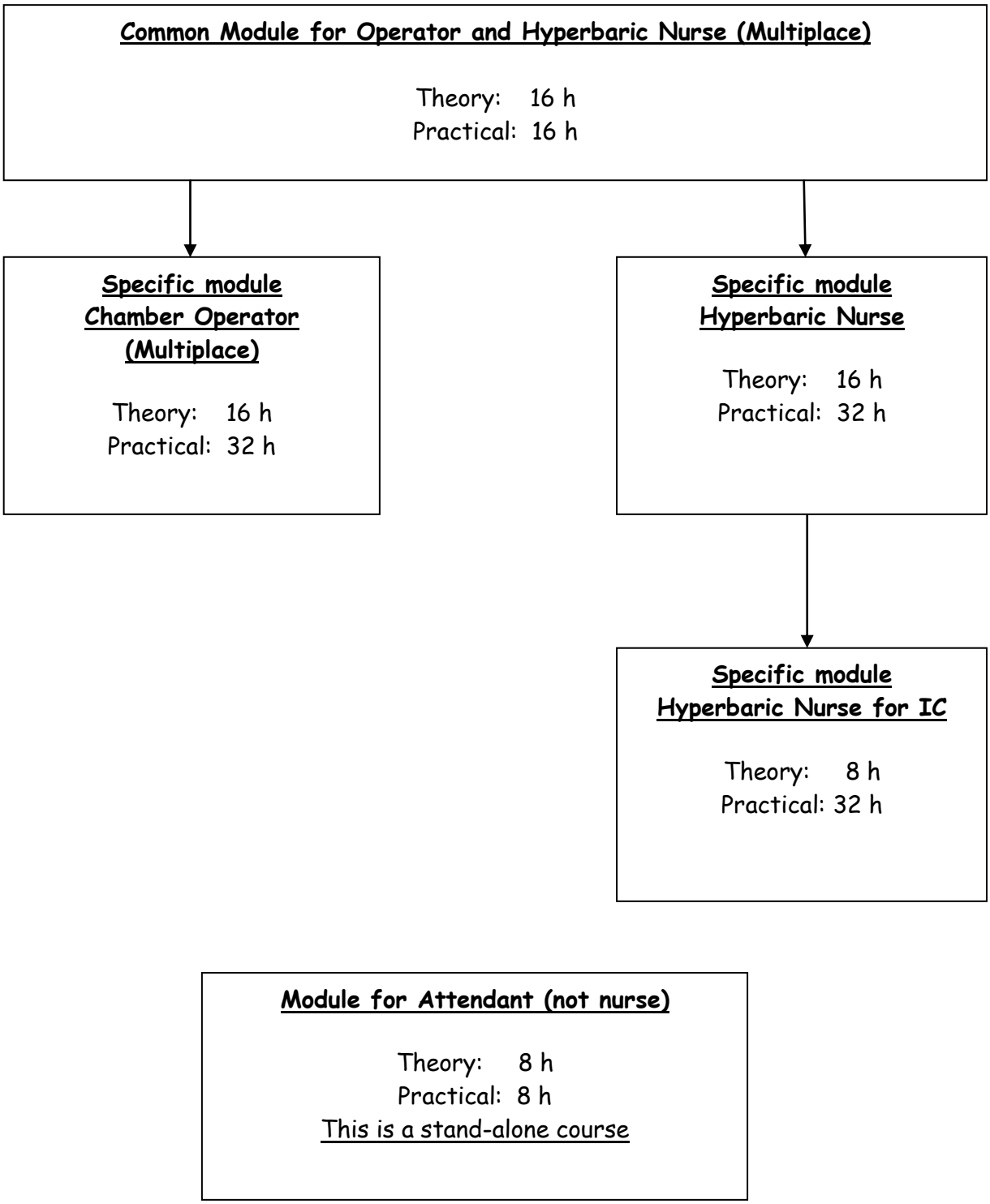
TcPCO2: Transcutaneous Carbon Dioxide Pressure

TcPO2: Transcutaneous Oxygen Pressure

UHMS: Undersea Hyperbaric Medical Society

Annex: Principles of the Modules

1. Multiplace Chambers



Module for Attendant (not nurse)

Theory: 8 h
Practical: 8 h
This is a stand-alone course

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2. Monoplace Chambers