

Certified Diver Medic[®]

Resource Manual



July 2011

National Board of Diving & Hyperbaric Medical Technology
NBDHMT.org

Diver Medic Technician (DMT[®]) Certification

An individual wishing to certify as a DMT through the NBDHMT approval process must complete a diver medic training course taught by an NBDHMT approved instructor and/or facility. This training course is commonly referred to as "Module 16". Further, the applicant for certification as a DMT must provide:

1. A fitness to work in a pressurized setting certificate. The applicant does not have to be deemed fit to "dive", per se. Rather, they should be considered fit to pressure – up in a recompression chamber.
2. A copy of an emergency medicine training completion certification.
3. A copy of a NBDHMT approved DMT training course completion certificate.
4. A completed Instructor Evaluation Form - www.nbdhmt.org/forms/instructor-evaluation.pdf
5. A completed Diver Medic Certification Form - www.nbdhmt.org/forms/DMT-certification-application.pdf

Diver Medic Technician Recertification

Recertification is required every two years. There is no single way for every DMT[®] to meet recertification requirements, as much depends on the needs of the individual medic. In order to be recertified, the diver medic must accumulate 24 hours of additional training during a two-year certification

period, plus a minimum of 24 hours of ambulance/emergency room observation time.

NOTE: Those DMT[®]s performing duties off-shore may satisfy their ambulance/emergency room time by documenting emergency cases managed/attended by them during that time. This documentation must be attested to by the medic's supervisor.

In planning course attendance, medics should consider their particular setting and plan refresher training around the accidents they are likely to encounter and the training resources available. Instructors should likewise consider the needs of the students and their own special experience and knowledge.

The following principles should be kept in mind:

1. The twin goals in recertification are to maintain acceptable competence and provide for enhanced skill levels. Therefore, each two-year period should include review of previous skills and knowledge as well as exposure to new material.
2. Exposure to actual emergencies is most desirable, so medics should try to obtain more than the 24 hours minimum emergency room ambulance time.
3. Requirements for each two-year period may be met by one course, or a series of short courses.
4. Courses should be practical and oriented toward the setting of field treatment of diving accidents.

To obtain credit for recertification training, the following policies apply:

1. At least four hours in each two-year period must be specifically in diving medicine and taught by an instructor approved by the NBDHMT (Appendix III). For instructors not already on record with the NBDHMT, approval must be obtained in advance of the course.
2. At least sixteen (16) hours in each two-year period must be in general emergency medicine, at the basic EMT level or higher. This training may be obtained from any recognized agency, such as certified EMS instructors, community colleges, or Red Cross.

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3. The remaining four hours may be in any area reasonably related to general emergency medicine, remote duty medicine, hyperbaric medicine, or diving medicine. These hours must be taught by instructors or agencies as in 1, and 2 above.
 4. The DMT® must furnish the following as evidence of training:
 - a. Each course or topic covered
 - b. Amount of time per each topic
 - c. Date(s) of training
 - d. Signature of the instructor and a statement that the DMT® passed the course. Where multiple instructors are involved in a specific course, one must be clearly designated as the course director or coordinator and provide the required signature (although all instructors may sign).
 5. For ER or ambulance time, provide the following:
 - a. Location or activity
 - b. Date and hours spent
 - c. Signature and title of person-in-charge (head nurse, crew chief, shift supervisor, etc.)

Evidence of training hours may be sent to the Board as they are earned or saved until the end of the two-year period, according to your preference. DMT®s with questions about training or recertification not answered in this manual may call Board headquarters for clarification.

DMT® Recertification Requirements

1. Provide medical "fitness to undergo compression" (fitness to dive) certificate
2. Provide documentation showing Emergency Medicine Training
3. Provide evidence of 24 CEU's related to emergency-related training/education.
4. Provide evidence of 24 hours of diving medicine/other emergency related experience.
5. Provide a completed Diver Medic Certification or Recertification form (download at NBDHMT.org)
6. Send all of the above to the NBDHMT headquarters with your payment in the amount of \$75.00, payable to NBDHMT

NBDHMT Approved Course Content

This content outline addresses the core aspects of diving medicine and related operations. It represents the scope of information that should be taught. The outline summarizes a standardized curriculum in diving accident management. It is designed to prepare the prospective DMT to evaluate and initiate treatment of diving accidents and injuries.

Introduction

- a. Preview of skill and knowledge objectives, major topics in course
- b. Preview of demonstrations and sham treatments
- c. Attendance, grading, evaluation and examination policies
- d. Review of gas laws, diving physics and physiology (optional)

Role of the Medic

- a. Responsibilities
 - i. Responsibilities as a diver (where applicable)
 - follow safe practice standards
 - set example
 - teach and instruct others
 - ii. Responsibilities as a medic
 - emergency care, basic life support, stabilize
 - report accidents and treatment to medical authority
 - perform tasks and give aid as directed by proper authority
 - in absence of orders, carry out treatment and triage according to training and ability

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- encourage fitness in diving community
 - maintain proficiency in diving and emergency medicine
 - keep accurate, informative records (send with patient as applicable)
- b. Liaison with others
- i. Knowledgeable physicians in medic's own area - protocols, standing orders
 - ii. Local hospitals and chamber facilities
 - iii. Local EMS system
 - iv. Law enforcement, fire departments, U.S. Coast Guard, etc.
 - v. Communications system
 - vi. Divers Alert Network (DAN)

Records and Fitness (variable according to medic's status, industry, and employer)

- a. Baseline records
- i. Knowledge of disqualifying conditions (permanent and temporary)
 - ii. Review of diver's medical history or previous physicals
 - iii. Record family and emergency data
 - iv. Routine exam (basic)
 - vital signs
 - ENT
 - heart and lungs
- b. Pre-dive evaluation (where applicable)
- i. Current or recent medical conditions
 - ii. Current drugs or medications
 - iii. Recent lifestyle or personal habits
 - iv. Recent dive history
 - v. Brief physical exam (vital signs, ENT, heart and lungs)
- c. Post-dive evaluation (where applicable)
- i. Dive and decompression history
 - ii. Brief physical
 - iii. Neuro and mental status evaluation

Decompression Sickness (DCS)

- a. Pathophysiology
- i. Evolution of inert gas from soluble phase to gas phase
 - intravascular bubbles
 - tissue/extravascular bubbles
 - ii. Bubble effects
 - direct – possible obstructed blood flow, ischemia; possible effects on tissue, neural tissue, local chemical mediators
 - indirect – hematological reactions to bubble surface, platelet and other cellular effects, capillary permeability, hemoconcentration, edema, hypovolemia
 - iii. Complications
 - cardiopulmonary – bubbles clogging pulmonary artery, right-to-left shunting of bubbles, tachypnea, possible congestion of epidural veins, reduced cardiac output
 - neurological – possible cerebral and spinal emboli
- b. Predisposing factors – concept of lowered resistance to decompression sickness
- i. Dehydration
 - ii. Poor physical fitness
 - iii. Related illnesses
 - iv. Role of exercise during dive and decompression

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- v. Increasing age
 - vi. Temperature variances
 - vii. Rapid gas switching
- c. Signs and Symptoms
- i. "Type I" – minor
 - pain only – musculo-skeletal pain (not central or peripheral nervous system), normal neuro exam
 - skin – itching, mild rash, 'cutis marmorata'
 - ii. "Type II" – serious
 - sensory abnormalities, radicular pain
 - weakness, paralysis
 - vestibular symptoms – hearing, balance
 - mood, intellect, personality changes
 - visual symptoms
 - i. Vague, generalized symptoms
 - flu-like symptoms
 - marked fatigue
 - headache, disorganized, difficulty concentrating
 - DCS as "great imitator" – may mimic everyday illness
 - index of suspicion
- d. Treatment
- i. Treatment tables
 - USN tables – 5, 6, 6-A, 7,9 and saturation decompression sickness tables
 - Comex 30
 - concept that treatment tables are specialized decompression, treatment table is dose of medicine (oxygen) different tables represent treatments for variable severity of DCS
 - ii. Fluids and drugs
 - importance of hydration – oral or IV fluids, good urine output
 - possible role of drugs, usual doses (Valium, Decadron, Dextran, etc)
 - emphasize basic treatment for DCS is pressure, oxygen, fluids, and time; proper role of medications is debated; given by medic on direct or standing order
 - iii. In-water oxygen treatment (controversies)
 - iv. Role of the monoplace hyperbaric chamber, limitations, etc (optional)

Barotrauma

- a. Squeeze
- i. Sinus – signs and symptoms, need approximately 3-10 days to resolve; possible secondary sinus infection
 - ii. Middle ear – signs and symptoms; perforation of eardrum; possible secondary otitis media other squeeze – suit, "reverse" squeeze, etc
 - iii. Inner ear (differential diagnosis)
 - iv. Other squeeze – suit, "reverse" squeeze, etc.
- b. Lung overpressure
- i. Review usual causes- rapid ascent, pressure reduction and wave surge, panic and breath holding; lung diseases
 - ii. Pathology – rupture alveolus, expanding air transects to pleural surface, or tracks along tissue planes, or enters pulmonary circulation and left ventricle
 - iii. Mediastinal emphysema
 - air tracks along lung tissue planes and ruptures into mediastinal space or pericardial sac

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- signs and symptoms – midchest pain or pressure, resonant or crunching heart sounds, cardiac tamponade (distended veins, narrow pulse pressure, low blood pressure and cardiac output), possible mild cyanosis, irregular pulse
 - treatment – varies from none (observation), to breathing oxygen, to recompression (seldom), according to patient's status and symptoms
- iv. Subcutaneous emphysema
- burst upper lung leads to air tracking along upper bronchi, into tissue around neck and clavicle
 - signs and symptoms – pain or ache in neck or upper chest "sore throat", pain with swallowing, change in voice, palpable air under skin ("rice crispies")
 - treatment – same as 3.c (recompression seldom needed, minimal depth only)
- v. Pneumothorax
- expanding air ruptures through lung surface; free air present in chest cavity, outside lung
 - small leak and/or occurring near surface will be simple pneumothorax
 - if not near surface, any simple pneumothorax during decompression may become a tension pneumothorax
 - signs and symptoms of simple and tension pneumothorax same as from non-diving causes (chest pain, splinting, dyspnea, shortness-of-breath, cyanosis, tracheal deviation, hypotension diminished breath sounds); *improves with compression*
 - treatment of simple pneumothorax – varies from observation only to 100% oxygen (recompression seldom needed)
 - treatment of tension pneumothorax:
 - recompression to depths of significant relief
 - needle decompression
 - after compression, use of saturated decompression schedule and oxygen breathing to resorb trapped air (avoids chest wall puncture)
 - insertion of indwelling cannula or chest tube with seal or one-way valve
- vi. Cerebral arterial gas embolism
- expanding alveolar air enters tributaries of pulmonary vein, transported to left heart, into aorta and cerebral arteries, causing stroke-like injury
 - signs and symptoms – usually rapid and dramatic; unconsciousness; convulsion; apnea; paralysis and hemiparesis; hemiplegia; hemoptysis
 - possible occurrence of both air embolism and pneumothorax
 - treatment standards

Oxygen Toxicity

- a. A. Current, generally accepted concepts of oxygen
- b. Concepts of oxygen limits
 - i. Lung vs. CNS
 - ii. Dry vs. in-water, working vs. at-rest
- c. Pulmonary toxicity
 - i. Disruption of alveolar surfactant, small airway and alveolar closure, lung edema, disrupts gas transfer by lung
 - ii. Results are similar to pneumonia or respiratory distress syndrome

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- iii. Signs and symptoms
 - iv. Varies from mild tracheal irritation, cough, painful breathing, dyspnea, cyanosis, death
 - v. Lungs sound relatively normal until advanced
 - vi. Treatment – lower pO₂ unless end of treatment or decompression is near
 - vii. UPTD (optional)
 - concept – amount of damage from 100% oxygen at 1 ATA for one minute
 - typical UPTD dose causing reduced of vital capacity, relationship to usual treatment tables
 - UPTD is only additive; role of air breaks in permitting high-dose oxygen treatment
 - clinically, an historic concept, rarely incorporated into modern treatment decisions
- d. CNS toxicity
- i. State of cerebral irritability
 - ii. Sign and symptoms – restlessness, irritability, twitching, tingling, visual symptoms, nausea, hiccups, convulsion; “VENTED”
 - iii. Management – remove mask/lower pO₂, protect from harm during seizure, resume treatment fifteen minutes after resolution

Optional Material

The following are examples of subject matter which the instructor may wish to include in the basic diving medicine training, refresher classes, or both. Suitability for these options will depend on previous training, geographic location, ability to learn quickly, employer and industry, and interest in peripheral material. Instructors should try to keep the training relevant to the needs and abilities of each class

Options should not be included at the expense of core lecture material, practice sessions and sham treatments. The instructor should be satisfied that the class is mastering basic material and save options for students with special needs, or where the pace of instruction is clearly moving faster than expected, or allow extra time in scheduling the entire course

Marine Hazards

- a. common marine hazards in the local area
- b. signs, symptoms, acute treatment of each

Environmental Accidents

- a. emergency management of near-drowning
- b. emergency management of hyper-, hypo-thermia
- c. Carbon Dioxide Toxicity

Tropical Medicine

Ear Hygiene, Otitis Externa

Review of Basic Life Support, Non-diving Emergency Medicine

Review of Gas Laws, Diving Physics and Physiology

Concerning review material, the instructor may prefer to utilize assignments sent to the students prior to class, particularly for diving physics and gas laws

Knowledge Objectives

These knowledge and skills objectives indicate what each student is expected to know upon successful completion of the Diving Medicine Module 16. End of course testing policies are left to the discretion of the instructor staff. Testing should, however, be flexible enough to assess each individual fairly, rigorous enough to ensure an adequate understanding of course content and how it will be put into practice, and adequately balanced between didactic and practical skills. Regarding the latter, DMT training should be field-oriented, practical, and directed towards hands-on treatment of diving accidents. Academic teaching should be sufficient that the student understands the correctness of what he is to do, but should not cause confusion or doubt. Matters of scientific controversy or research interest may be introduced for variety and stimulation, but, as much in diving medicine is not fully understood even by experts, the goal should be standardized and orthodoxy at the medic or paramedic level. Where the instructor has developed strong personal preferences or practices, they should point this out and present other viewpoints, when appropriate.

In organizing and scheduling the course, the instructor should keep these learning goals in mind regarding the objectives and be flexible enough to satisfy the needs of each class. After the period of instruction and rigorous, balanced, examination process, the student should satisfy the instructor that they understand the following:

Role of the Diver Medic

- a. similarities and differences compared to non-diving
- b. record keeping
- c. relationship to diving physicians and others in the medical support system

Medical/Fitness to Dive

- a. baseline, pre- and post-dive exams
- b. disqualifying conditions, temporary and permanent

Decompression sickness

- a. possible predisposing conditions, concept of susceptibility to an environmentally-caused disease
- b. physiologic events leading to DCS, initial and later phases of DCS, hematologic and other effects of tissue and intravascular bubbles
- c. common and unusual signs and symptoms of DCS, mild (Type I) and serious (Type II) DCS, major forms of DCS (skin, vestibular, joint, CNS, pulmonary, saturation)
- d. the test of pressure and its proper use in approaching the uncertain case of DCS
- e. concept of treatment table as a treatment or medication (ie, a dose); tables USN 5, USN 6, USN 6-A, Royal Navy 71 and 72, Comex 30 and 30-A, saturation tables; usual application of the treatment tables; follow-up after treatment

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- f. the flow chart from Field Guide for the Diver Medic (or similar chart) and ability to sketch or form a general treatment plan and various options
 - g. the role of drugs in treatment (adjunctive), fluids, and those which diving physicians may use

Barotrauma

- a. anatomy and physiology of the air-containing spaces, mechanism of squeeze and pulmonary over-inflation (air embolism, pneumothorax, mediastinal emphysema, subcutaneous emphysema)
- b. the principle signs and symptoms of squeeze and overpressure injuries and distinguishing features between them
- c. routine and emergency management of squeeze and over-pressure understanding of tension pneumothorax as encountered while diving

Oxygen Toxicity

- a. simple concepts of causes of oxygen toxicity, signs and symptoms of CNS and pulmonary toxicity, usual CNS and pulmonary oxygen limits
- b. understanding the difference between oxygen percentage and oxygen partial pressure

Skills Objective

The student should satisfy the instructor that they have mastered the following:

Physical Examinations

- a. an adequate emergency baseline assessment, obtain and evaluate vital signs, provide basic life support, properly use basic equipment such as pen light, stethoscope, blood pressure cuff, otoscope
- b. use of the otoscope in performing a simple ear exam
- c. ability to keep adequate records of exams and treatments

Neurological Exams (student or instructor posing as patient)

- a. the ability to do an adequate field neuro exam covering; state of consciousness and
- b. intellectual functions, cranial nerves, sensory function, motor function, and balance/coordination
- c. ability to do exam inside and outside chamber and as follow-up to treatment

Sham Treatments (student or instructor posing as accident victim)

- a. ability to elicit symptoms of simulated DCS or barotrauma case
- b. ability to discover signs of same
- c. ability to use basic medical kit and equipment properly, at surface and in chamber
- d. ability to function effectively while in chamber
- e. ability to formulate and conduct a basic treatment plan
- f. ability to keep adequate records and make accurate reports to a diving physician or other appropriate authority
- g. ability to observe and maintain proper oxygen limits, recognize and manage simulated symptoms of toxicity

Chamber Operations Module

The usual role of a DMT is to attend to the medical needs of the injured diver. Therefore, the primary goal of DMT training is providing emergency medical care in and outside the chamber; there is no primary intent to make the medic an expert on chamber operations or related hardware

Since chambers in many areas are thinly staffed, perhaps by persons of unknown competence, the major goal of the Chamber Operations Module is to enable the DMT to see to their safety and the safety of the patient while in the chamber. Secondly, the DMT is taught the rudiments of hands-on chamber operations, time-keeping, dive recording, pre- and post-dive checklists, and the conduct of a simple chamber treatment

A Sample Course Schedule is not given, as the additional time required will vary. Much of chamber operations can be incorporated into the Medical Module (e.g, oxygen analyzers with oxygen toxicity, chamber ventilation with sham treatments) and a few hours of lecture will suffice for the rest. As with Diving Medicine, much will probably depend on the individual instructor and the needs of each class

Knowledge Objectives

The student should be able to demonstrate clear understanding of the following:

Chamber Safety

- a. The main codes and standards relating to chamber operations, safe handling of gases used in diving, and sources of information
- b. The factors necessary for occurrence of chamber fires, extreme hazard of chamber fires, oxygen percentage versus oxygen partial pressure, various ignition sources, flammability of ordinary materials in chambers, zone of combustion, need for proper clothing and oil-free environment
- c. The role of electrical systems as possible sources of fire, electrical failure as threat to safe operation of chamber
- d. The various ways fire can be extinguished
- e. The methods for maintaining safe levels of oxygen and carbon dioxide, ventilation requirements, use of individual oxygen breathing systems, use of analyzers, dangers and sources of carbon monoxide
- f. The need to protect ears from high noise levels, safe use of medical equipment in chamber, avoiding injury to medic and patient
- g. The function of carbon dioxide scrubbers, avoidance of caustic injury

Chambers

- a. The main general types of chambers and main uses for each
- b. The basics of chamber construction, basic terminology of chamber operations
- c. An understanding of gas requirements for typical treatments, backup supplies, emergency procedures for supply failure; definition of treatment and emergency gases

Pre-Dive Checklist

- a. Prepare a basic checklist and show how each item relates to the safe operation of the chamber. DMT trainee should not omit any significant item.

Post-Dive Checklist

- a. The essential steps necessary to ensure the chamber is left ready for safe use, properly equipped and supplied

Chamber

- a. The ability to perform the essential functions of chamber operation and conduct a simulated treatment under supervision

Appendix I

Essential Invasive Skills (*Required* for DMT certification)

Intravenous access

- b. Fluid infusions
- c. Drug administration
- d. Blood draws

Intramuscular injection

Subcutaneous injection

Insertion of urinary catheter

Insertion of nasogastric/orogastric tube

Manual or battery powered oropharynx/orogastric suction

Airway control; one or more of the following:

- e. Laryngeal mask airway
- f. Pharyngeal-tracheal lumen
- g. Endotracheal intubation
- h. Needle cricothyroidotomy

Chest decompression capability; one or both of the following:

- i. Pneumothorax needle
- j. Chest tube

Basic Life Support

Valuable Optional Skills (*Not required* for DMT certification)

Use of the 'Easy IO Drill'

Simple suture repairs or alternate of wound closure option, e.g.,

- k. Dermagel / Dermabond
- l. Quickclot
- m. Celox gauze

Splinting of simple dislocations and fractures

Advanced Cardiac Life Support

CO2 scrubber installation for chamber under pressure

Operation of a CO2 analyzer

Appendix IV

DMT[®] Approved Training Facilities and Instructors

California

Catalina Hyperbaric Chamber
Karl Huggins
huggins@usc.edu
PO Box 5069
Avalon, California 90704-5069
(310) 510-0811

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Thomas R. Murray, MD
8137 N. Main Street
Jacksonville, FL 32208
(904) 766-7736

Naval Diving & Salvage Training
Chief Blair Dell
350 S. Cragg Road
Panama City, Florida 32407
(850) 636-6176

NOAA Undersea Research Center /
Aquarius
Roger Garcia
garciar@uncw.edu
515 Caribbean Drive
Key Largo, FL 33037
(305) 451-0233 ext. 207
(305) 453-9719 FAX

Louisiana

Pharma-Safe Industries
Glenn Peltier
300 Adams Street
Franklin, Louisiana 70538
(800) 364-9709

West Jefferson Medical Center
Keith Van Meter, MD
1101 Medical Center Boulevard
Marrero, LA 70072
Contact: Keri Kieger
(504) 349-6688

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Divers Alert Network
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Poseidon International
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(512) 924-4266

Virginia

Prime Time Training
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