



Scientific Diving Safety Manual



University of Illinois Urbana-Champaign

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GENERAL POLICY

Purpose

The University of Illinois Scientific Diving Standards

The purpose of these scientific diving standards is to ensure that all scientific diving under the auspices of the University of Illinois Urbana-Champaign, is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness. Fulfillment of these purposes must be consistent with the furtherance of research and safety.

Liability

In adopting the policies set forth in this manual, the university assumes no liability not otherwise imposed by law.

The University of Illinois Urbana Champaign Scientific Diving Manual

The purpose of the University of Illinois Urbana Champaign's scientific diving manual is to provide for the implementation of policies and procedures that will enable us to meet requirements of local environments and conditions.

The University of Illinois Urbana-Champaign Scientific Diving Manual includes:

1. For each diving mode engaged in: (i.e., SCUBA, surface-supplied air, or other dive modes)
 - a. Safety procedures for the diving operation
 - b. Responsibilities of the dive team members
 - c. Equipment use and maintenance procedures
 - d. Emergency procedures
2. Emergency evacuation and medical treatment procedures: For each diving location, a procedure must be established to locate and transport a diver to an operational hyperbaric chamber when dive conditions could allow for saturation diving. All dive applications will include the name, address, and route to the nearest medical facility. This information is to be carried by the diving party. The Divers Alert Network (aka DAN) at Duke University Medical Center may be of assistance in determining the location and current status of recompression chambers. Phone (919) 684-9111.

Review of Standards

An annual report and review of diving activities must be prepared by the Diving Control Board (DCB) and submitted to the Vice Chancellor for Research and Innovation, University of Illinois Urbana-Champaign.

Control

Scientific Diving Defined

All diving performed by individuals necessary to and part of a scientific, research, or educational activity, in conjunction with a project or study under the jurisdiction of any public or private organization, department or group.

University of Illinois Urbana-Champaign Auspices Defined

For these standards the auspices of the University include any scientific diving operation in which the University of Illinois Urbana-Champaign is connected because of ownership of any equipment used, locations selected or relationship with the individual(s) concerned. This includes all cases involving the operations of employees of the university and affiliated State Agencies [Illinois], where such employees are acting within the scope of their employment, and the operations of other persons, including students, who are engaged in scientific diving of university or affiliated State Agencies [Illinois].

Certification Types

The University of Illinois Urbana Champaign requires that no person will engage in scientific diving unless that person holds a valid diving certificate issued by a recognized diver certification agency. Two examples of such recognized agencies are:

NAUI	National Association of Underwater Instructors P. O. Box 14650 Montclair, CA 91763
PADI	Professional Association of Diving Instructors P. O. Box 25010 Santa Ana, CA 92799-5010

Other certification agencies will be considered by the Diving Control Board.

Equipment

All diving equipment used by certified scientific divers and trainees, regardless of ownership, must conform to the standards set forth in this manual.

Sites

The regulations herein must be observed at all locations where scientific diving is conducted.

The Diving Control Board

The Vice Chancellor for Research and Innovation appoints a Diving Control Board (DCB) to review all proposed scientific diving expeditions performed under the University of Illinois Urbana-Champaign auspices.

1. The voting members of the DCB will include experienced divers and certified divers.
2. Others may be appointed to the DCB, with or without voting privileges, who can bring to it special areas of expertise.

3. The DCB has absolute authority to disapprove a proposed scientific diving expedition for reasons it deems sufficient.
4. DCB approval of any scientific diving expedition will be advisory to the Vice Chancellor for Research and Innovation, who has the ultimate authority for the campus scientific diving program.
5. The DCB develops and revises a campus Scientific Diving Safety Manual and recommends to the Vice Chancellor for Research and Innovation for implementation of the manual.
6. The DCB will recommend to the Vice Chancellor for Research the suspension of any diving project that it considers unsafe or unwise.
7. The DCB sits as a Board of Investigation to inquire into the nature and cause of diving accidents or violations of the University of Illinois Urbana-Champaign Scientific Diving Safety Manual.

Medical Examination

All certified divers must have passed a medical examination within the 12 months before beginning a scientific diving expedition. Continued medical examinations will follow the schedule according to standards defined in the medical requirements defined in this manual. After each illness or injury requiring hospitalization of more than 24 hours or after an episode of unconsciousness related to diving activity or after treatment in a hyperbaric chamber following a diving accident or other serious illness, certified divers must submit to a medical interview or examination appropriate to the nature and extent of the injury or illness as determined by the examining physician before resuming diving activities.

DEFINITIONS

Terms

Bail-out Bottle: Emergency tank of breathing gas. (See Diver-Carried Reserve Breathing Gas, below)

Bounce Dive: A dive of relatively short duration; generally, less than 10 minutes.

Bottom Time: The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins a direct ascent to the surface.

Breath-hold Diving: A diving mode in which the diver uses no self-contained or surface supplied air or oxygen supply.

Buddy Breathing: The sharing of a single air source between divers.

Buddy Diver: Accompanying diver(s) in contact.

Buoyancy Control Device (BC): equipment worn by divers to establish neutral buoyancy while underwater and positive buoyancy at the surface.

Buoyant Ascent: An ascent made using some form of positive buoyancy such as a wet suit without weight belt, vest or inflated BC, done more rapidly than a normal ascent.

Burst Pressure: The pressure at which a pressure containment device would fail structurally.

Certified Diver: A diver who holds a recognized valid diver certification.

Compression Chamber: A pressure vessel for human occupancy also called a Hyperbaric Chamber. (See Recompression Chamber and Decompression Chamber, below)

Controlled Ascent: Any one of the several kinds of ascents including normal, swimming and buddy breathing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.

Cylinder: A pressure vessel for the storage of gasses. (See Tank, below)

Decompression Chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving systems used to decompress divers and to treat decompression sickness.

Decompression Sickness: A condition with a variety of symptoms which may result from gas and bubbles in the tissues of divers after pressure reduction.

Decompression Table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed by a specific depth-time exposure or exposures. (See Dive Table)

Dive: A descent into the water, an underwater diving activity utilizing compressed gas, an ascent and return to the surface.

Dive Location: The geographic location from which a diving operation is conducted.

Dive-Location Reserve Breathing Gas: A supply system of air or mixed gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during any planned decompression dive.

Dive Table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed by a specific depth-time exposure or exposures.

Diver: An individual in the water who uses any apparatus, including snorkels, which supplies breathing gas at ambient pressure.

Diver-in-Training: An individual who is gaining experience and training in additional diving activities under supervision. An individual who has had at least 8 supervised dives, a minimum of 40 hours of training and possesses a nationally recognized diving certificate [e.g., from PADI, NAUI, or other accredited agency].

Diver-Carried Reserve Breathing Gas: A diver-carried independent supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver [see bail-out bottle, above].

Dive Team: Divers and support individuals who are exposed to or control the exposure of others to hyperbaric conditions.

Diving Control Board (DCB): The Diving Control Board is an administrative committee appointed by the Vice Chancellor for Research. It is composed of three or more voting members, the majority of whom are experienced, certified divers.

Diving Mode: A type of diving requiring specific equipment, procedures, and techniques (SCUBA, surface-supplied air, or mixed gas).

Diving Project Application: A request for approval by the DCB of persons, places, and modes of diving.

Emergency Ascent: An ascent made when the diver is low or out of air. May also be used to refer to an ascent made when the diver is under excessive stress.

FSW: Feet of sea water, fresh water, or equivalent static pressure head.

Hookah Diving: A type of shallow water surface supplied diving where air is supplied by compression or compressed air tanks at the surface.

Hyperbaric Chamber: A pressure vessel for human occupancy. See compression chamber, recompression chamber, decompression chamber.

Hyperbaric Conditions: Pressure conditions in excess of normal atmospheric pressure at the dive location.

Lead Diver: The certified scientific diver with experience and training to conduct the diving operation and who has been designated to oversee the diving operation on the diving project application.

Maximum Working Pressure: The maximum pressure to which a pressure vessel may be exposed under standard operating conditions.

Mixed-Gas Diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

MSW: Meters of sea water, fresh water, or equivalent static pressure head.

No-Decompression Limits: The depth-time limits of the "no-decompression limits and repetitive dive group designations table for no-decompression air dives" in Canadian Forces Air Diving Tables or equivalent limits which can be demonstrated to be equally effective.

Normal Ascent: An ascent made with an adequate air supply at a rate of 60 feet or less per minute.

Pressure-Related Injury: An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure such as: decompression sickness, pneumothorax, mediastinal emphysema, air embolism, or subcutaneous emphysema.

Pressure Vessel: See cylinder or tank.

Psig: Pounds per square inch gauge.

Recompression Chamber: A pressure vessel for human occupancy such as a surface recompression chamber, closed bell, or deep diving systems used to recompress divers and to treat decompression sickness.

Regulator: device that allows divers to breath air delivered from an air tank.

First stage – Attaches to the scuba tank valve, reduces tank air pressure to an intermediate pressure and routes it to one or more hoses that provide air to the second stage, mouthpiece, and also to equipment such as a spare mouthpiece, buoyancy devices, air tools, and blow out valves.

Second stage - mouthpiece that the diver breathes from and provides air at exact pressure needed when the diver demands it by inhaling.

Alternate air source – spare mouthpiece that provides access to another diver if buddy breathing is needed.

Saturation Diving: when the inert gas breathed by a diver dissolves into the body's tissues and reaches equilibrium with the ambient pressure at the diver's depth (i.e., no more gas can be absorbed by the tissues — they're fully saturated)

Scientific Diving: All diving performed by individuals necessary to and part of a scientific, research, or educational activity; in conjunction with a project or study under the jurisdiction of any public or private research or educational institution or similarly recognized organization, department, or group.

SCUBA Diving: A diving mode independent of surface supply in which the diver uses open circuit Self-Contained Underwater Breathing Apparatus.

Standby Diver: A diver at the dive location capable of rendering assistance to a diver in the water.

Surface-Supplied Diving: A diving mode in which the diver in the water is supplied from the dive location with compressed gas for breathing and is in voice contact with a surface tender.

Swimming Ascent: An ascent which can be done under normal, or emergency conditions accomplished by simply swimming to the surface at a rate of 60 ft/min or less. May be aided by use of positive buoyancy control device.

Tank: A pressure vessel for the storage of gasses. (See Cylinder)

Treatment Table: A depth-time and breathing gas profile designed to treat decompression sickness or air embolism.

Umbilical: The composite hose bundle between a dive location or dive staging site (support boat, platform, shoreline) and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, and/or heat as appropriate to the diving mode or conditions and inclusive of a safety line between the diver and the dive location.

Volume Tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Weight Belt: belts with weights (lead) used to offset tendency of divers to float. A quick release mechanism allows divers to drop weight and float in emergency situations.

Working Pressure: The normal pressure at which the air distribution system is designed to operate.

DIVING REGULATIONS

General Policy

No person may engage in scientific diving operations under the auspices of the University of Illinois Urbana-Champaign Scientific Diving Program unless the prospective diver holds a current certificate recognized by the Diving Control Board (e.g., from PADI, NAUI, military duty training, or other accredited agencies).

Scientific diving must not be conducted unless procedures have been established for emergency evacuation of the diver(s) to a hyperbaric chamber or appropriate medical facility.

Diving Procedures

Solo Diving Prohibition

All diving conducted under the auspices of the University of Illinois Urbana-Champaign must be planned and executed in such a manner as to ensure that every diver involved maintains constant, effective communication (e. g., eye contact, tether, audio) with at least one other certified scientific diver in the water (or standby diver in the case of shallow, zero visibility dive conditions) comparably equipped. This buddy system is based upon mutual assistance, especially in the case of an emergency. Dives should be planned around the competency of the least experienced diver. If loss of effective communication occurs within a buddy team, all divers must surface and re-establish contact except as specified in Section 3.30, Surface-Supplied Diving.

Enclosed or Confined Spaces

Where an enclosed or confined space is not large enough for two divers, a diver must be stationed at the underwater point of entry and an orientation line will be used from that point to the diver in the confined space.

Diver's Flag

A diver's flag must be displayed prominently whenever diving is conducted under circumstances where required or where water traffic is probable. In addition to the red-and-white Diver Down flag, the blue-and-white international code Alpha flag should also be flown when working in waters with commercial boat traffic. Dive flags must be of sufficient size to be easily observed by passing boat traffic.

Flotation Devices

Each diver will on every dive possess the capability of attaining and maintaining positive buoyancy.

Timing Devices and Depth and Pressure Gauges

All divers must have an underwater time-keeping device, an approved depth indicator and submersible tank pressure gauge, monitored by the diver or the surface support team. A set of appropriate Diving Tables must be available at the dive location. These tables must be at least as explicitly restrictive as the Canadian Forces Air Diving Tables (i.e., in allowing hyperbaric exposure times).

Depth Limits

A certified diver diving under the auspices of the University of Illinois Urbana-Champaign must not exceed the diver's depth certification, except by one step only AND if accompanied by a diver certified to the greater depth. Any dive plan submitted for Diving Control Board review must explicitly reference scenarios at dive sites that may require diving to depths that exceed a diver's certification.

Termination of Dive

1. It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever the diver feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.
2. The dive must be terminated while there is still sufficient tank pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional air source at the decompression station.

Refusal to Dive

1. The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever the diver feels it is unsafe for them to make the dive [see 3.63(1)].
2. Safety: Ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in the diver's judgment, conditions are unsafe or unfavorable, or if the diver would be violating the precepts of the diver's training or the regulations in this guide.

Closed and Semi-Closed-Circuit SCUBA

Closed and semi-closed-circuit SCUBA (rebreathers) will be considered for scientific diving on a case-by-case basis; current certification of training and experience using closed and semi-closed-circuit SCUBA must be included in the dive application package for all divers and supporting personnel.

Surface-Supplied and Hookah

Hookah and other forms of surface-supplied diving must comply with all SCUBA (except Section 3.21) diving procedures in this manual. Surface-supplied diving may not be conducted at depths greater than 190 fsw (58 msw).

1. Divers using the surface-supplied mode must be equipped with a diver-carried independent reserve breathing gas supply equipped with a pressure relief valve.
2. Each surface-supplied diver must be hose-tended by a separate dive team member while in the water.
3. Divers using the surface-supplied mode must maintain voice communications with the surface tender.
4. The surface-supplied breathing gas supply must be sufficient to support all surface-supplied divers in the water for the duration of the planned dive, including decompression.
5. During surface-supplied diving operations when only one diver is in the water there must be a standby diver in attendance at the dive location.

Saturation Diving

Saturation diving must comply with a protocol approved by the Diving Control Board. (See Canadian Dive Tables)

Diving Operations

Lead Diver

For each dive, one individual must be designated as the lead diver. This person must be at the dive location or the dive site during the diving operation. The lead diver will be responsible for:

1. **Coordination:** Diving must be coordinated with other known activities in the vicinity which are likely to interfere with diving operations.
2. **Briefing:** The dive team members must be briefed on:
 - a. Dive objectives and procedures
 - b. Any unusual hazards or environmental conditions likely to affect the safety of the diving operation
 - c. Any modifications to diving or emergency procedures necessitated by the specific diving operation
 - d. Immediately reporting any physical problems or adverse physiological effects including symptoms of pressure related injuries
 - e. Determine the competency of the dive team.

3. **Dive Planning:** Planning of a diving operation must include considerations of the safety and health aspects of the following – for all personnel involved:
 - a. Diving mode
 - b. Surface and underwater conditions and hazards
 - c. Breathing gas supply (*when surface supply air is used consider distance of air intake from boat motor exhaust or if diving in areas subject to polluted air blown from power plants/other industrial facilities*)
 - d. Thermal protection
 - e. Diving equipment
 - f. Dive team assignments
 - g. Residual inert gas status of dive team members
 - h. Decompression schedules and altitude corrections
 - i. Emergency procedures and nearby medical facility locations and/or hyperbaric chambers; and
 - j. Chemical/biological hazards

Dive Plans

Before conducting any diving operations, the lead diver must consider the following information:

1. Other divers involved, and their qualifications/competence and the type of certificate/permit held by each participating diver.
2. Name, telephone number and relationship of person to be contacted for each diver and support personnel in the event of an emergency.
3. Approximate number of proposed dives.
4. Location(s) of proposed dive(s).
5. Estimated depth(s) and bottom time(s) anticipated.
6. Proposed work, equipment, and boats to be employed, repetitive dives, if required, and details of any hazardous conditions anticipated.
7. Roles and conditions for support personnel on the surface – those on primary dive boat or platform, in adjacent support boats or platforms, and at adjacent staging area(s).

Pre-Dive Safety Checks

1. Diver's Responsibility
 - a. Each scientific diver must conduct a functional check of the diver's diving equipment in the presence of the Diving Buddy or Tender
 - b. It is the diver's responsibility and duty to refuse to dive if, in the diver's judgment, conditions are unfavorable or if the diver would be violating the precepts of his/her training, or this manual.

- c. No dive team member will be required to be exposed to hyperbaric conditions against the diver's will, except when necessary to prevent or treat a pressure-related injury.
 - d. No dive team member will be permitted to dive for the duration of any known condition which is likely to adversely affect the safety and health of the diver or other dive team members.
 - e. The diver must terminate the dive while there is still sufficient tank pressure to permit the diver to safely reach the surface including decompression – irrespective of bail-out bottle volume/pressure.
2. Equipment Requirements
 - a. Each SCUBA diver must have submersible pressure gauge for monitoring SCUBA tank pressure, capable of being monitored by the diver during the dive, as well as a depth gauge, timer, and positive buoyancy device.
 - b. Surface-supplied divers must have a tether, timer, and depth gauge that may be monitored.
 - c. If mixed gas is used as the breathing media, appropriate diving tables must be used.

3. Diver's Qualifications

Each scientific diver must be certified, trained, and qualified for the diving mode being used and each dive team member must have experience or training in the following:

- a. The use of the instruments and equipment appropriate to the diving activity to be conducted.
- b. Dive planning and emergency procedures.
- c. Dive teams must include at least one member (exclusive of the diver) who is currently certified in cardiopulmonary resuscitation, and AED. Dive rescue and oxygen therapy training is also recommended.
- d. Dive team members who are exposed to or control the exposure of others to hyperbaric conditions must be trained in diving-related physics and physiology and recognition of pressure related injuries.

Post-Dive Safety Checks

1. After the completion of a dive each diver must report any physical problems, symptoms of decompression sickness or equipment malfunctions.
2. When diving outside of the no-decompression limits (i.e., bottom times greater than no-decompression limits) the divers should remain awake for at least one hour after diving and in the company of a dive team member who is prepared to transport the diver to a hyperbaric chamber if necessary.

Emergencies - Deviation from Regulations

During the conduct of an approved dive program, any diver may deviate from the requirements of this manual or the dive plan submitted to and approved by the University of Illinois Urbana-Champaign Diving Control Board to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage. A written

report of such actions must be submitted to the University of Illinois Urbana-Champaign Diving Control Board, as soon as possible, explaining the circumstances and justifications for such action.

Consequences of Violation of Regulations by Scientific Divers

Failure by a diver to comply with the regulations of the University of Illinois Urbana-Champaign Scientific Diving Safety Manual may be cause for the future disapproval by the Diving Control Board of any diving expeditions that include that diver.

Recordkeeping and Requirements

Personal Diving Log

1. Each certified scientific diver must log every dive made under the auspices of the campus program and is encouraged to log all other dives. These logs must be made available to the Diving Control Board. Copies of the logs of all dives performed under the University of Illinois Urbana-Champaign auspices must be submitted to the Vice Chancellor for Research and Innovation.
2. If pressure-related injuries are suspected or if symptoms are evident the following additional information must be recorded and retained by the university with the record of dives for a period of 5 years.
 - a. Description of symptoms - including depth and time of onset; and
 - b. Description and results of treatment.
3. The Diving Control Board will investigate and document any incident of pressure-related injury and prepare a report which is to be submitted to the Vice Chancellor for Research and Innovation.

Record Maintenance

The Office of the Vice Chancellor for Research and Innovation will maintain permanent records for each approved scientific diving expedition performed under the University of Illinois Urbana-Champaign auspices. The file will include evidence of diver certification, log sheets, results of current physical examination, current waiver, reports of disciplinary actions by the University of Illinois Urbana-Champaign Diving Control Board, and other pertinent information deemed necessary.

1. Availability of Records:
 - a. Medical records will be available to the attending physician of a diver or former diver when released in writing by the diver.
 - b. Medical waivers required by this standard must be retained by the Division of Research Safety for the following period:
 - (1) Physician's written reports of medical examinations for dive team members - 30 years after termination of employment.
 - c. Other documents required by this standard must be retained by the Office of the Vice Chancellor for Research and Innovation for the following periods:

- (1) Manual(s) for diving safety - permanently
 - (3) Record of dive - 1 year, except 5 years where there has been an incident of pressure-related injury
 - (4) Pressure-related injury assessment - 5 years
2. If scientific diving ceases at the University of Illinois Urbana-Champaign, copies of all applicable records maintained under the requirements of this section will be held until the expiration date.

Required Accident Reporting

All diving accidents requiring recompression or resulting in serious injury must be reported to the University of Illinois Urbana-Champaign's Diving Control Board. The campus regular procedures for accident reporting must be followed (for further information on routine accident reporting requirements, contact the Office of Claims Management at (217) 333-1080). Additional information deemed necessary may be required. In addition, the University must meet the following reporting requirements:

1. The University of Illinois Urbana-Champaign must record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code Section.
2. The University of Illinois Urbana-Champaign must record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, or after an episode of unconsciousness related to diving activity, or after treatment in a compression chamber following a diving accident; specifying the circumstances of the incident and the extent of any injuries or illnesses.
3. Illinois law requires additional reporting to the Illinois Department of Labor any fatality or accident in which 3 or more individuals are hospitalized for the same accident. This notification must be within 24 hours (Illinois Title 56, Chapter I, b, Subpart B, 350.210). The Division of Environmental Health and Safety can facilitate such notification. Otherwise:

Illinois Department of Labor
 Division of Safety Inspection and Education
 #1 West Old State Capitol Plaza, Room 300
 (217) 782-9386 (voice)
 (217) 782-0596 (fax)

DIVING EQUIPMENT

Diving Equipment Inspection

All inspections, tests, and maintenance must be accomplished by a manufacturer certified technician or facility. Divers must inspect equipment prior to each dive activity to ensure proper function.

Record keeping: Each equipment modification, repair, test, calibration, or maintenance service must be logged including the date and nature of work performed for the following equipment:

Compressors

Regulators
Buoyancy devices
SCUBA tanks
Diving helmets
Masks and snorkels
Diving suits
Weight belts
Submersible breathing masks
Air storage cylinders
Submersible pressure gauges
Depth gauges
Tank valves
Gas control panels
Analytical instruments
Air filtration systems

Regulators

1. Inspection and Testing: SCUBA regulators used in the Scientific Diving Program must be inspected and tested prior to their first use during each diving event.

Breathing Masks and Helmets

Breathing masks and helmets must have:

1. If diving under surface-supplied conditions, a one-way valve at the attachment point between the air-supply hose and the helmet or mask that must close readily and positively.
2. Breathing masks and helmets must have a minimum ventilation rate capable of maintaining the diver at the depth to which they are diving.

Auxiliary Equipment

1. Compressed air cylinders must:
 - a. Be hydrostatically tested in accordance with DOT standards
 - b. Have an internal visual inspection at intervals not to exceed 12 months.
 - c. Be functionally tested at intervals not to exceed 12 months.
2. Backpacks and Weight Systems: Backpacks and weight systems must be regularly examined by the persons using them.
3. Gauges: Gauges must be inspected and tested before first use and every 12 months thereafter. A record of inspections, tests, and repairs must be maintained.

4. Quick Release Devices: All weight systems and SCUBA backpacks worn by the diver must be equipped with quick release devices designed to permit jettisoning the entire gear. The quick release device must operate easily with a single motion from either hand.
5. Personal flotation systems, buoyancy compensators, dry suits or other variable volume buoyancy compensation device must be equipped with an exhaust valve. These devices must be functionally inspected before each use and tested at intervals not to exceed 12 months.
6. First-Aid Supplies:
 - a. A first-aid kit adequate for the diving operation must be available at the dive location. A medical oxygen unit capable of delivering 6 liters/minute for 45 minutes is recommended.
 - b. When used in a hyperbaric chamber or bell, the first-aid kit must be suitable for use under hyperbaric conditions.
 - c. If using an automated external defibrillator (AED), divers and/or dive support personnel must be trained and certified to use the AED.

BREATHING AIR

Minimal Standards

Breathing air for SCUBA must meet the following specifications:

Minimum Oxygen - atmospheric

Oxygen Content - special mixtures must be specified by advice of competent authority and approved by the Diving Control Board.

Maximum Carbon Monoxide

Decompression dives - 0.001% (10 ppm)

Non-decompression dives - 0.002% (20 ppm)

Maximum Carbon Dioxide - 0.10% (1000 ppm)

Dust and Droplets of Oil and Water - Absent

Odors and Vapors - Absent

Compressor Systems - University Controlled

1. Design and Location of Compressor
 - a. Low pressure compressors used to supply air free of particulate and pollutants to the diver must be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.
 - b. All air compressor intakes must be located away from areas containing exhaust or other contaminants. If possible, surface supply diving should be conducted when sources of exhaust (boat motors) are absent (boat motors static).
2. Compressor Operation and Air Test Records

- a. Gas analyses and air tests must be performed on each breathing air compressor at regular intervals of no more than 100 hours of operation or 12 months, whichever occurs first. The results of these tests must be entered in a formal log and be maintained.
- b. A log must be maintained showing operation, repair, overhaul, filter maintenance and temperature adjustment for each compressor.

MEDICAL STANDARDS

Medical Requirements of Dive Team

General

1. The University of Illinois Urbana-Champaign Diving Control Board will determine whether dive members who are, or are likely to be, exposed to hyperbaric conditions have passed a current physical examination and have been declared medically fit to engage in diving activities.
2. All medical examinations required by this standard must be performed by, or under the direction of, a licensed physician.
3. The diver should be free of chronic disabling diseases or injury, demonstrate good ability to perform all gross and minute tasks, and exhibit normal reflexes.

Frequency of Medical Examinations

Medical examinations must be completed:

1. Before a diver may dive, unless an equivalent medical examination has been given within the preceding 12 months
2. At defined intervals from the date of initial examination or last equivalent examination
 - a. Every 2 years if over 60 years old
 - b. Every 3 years if aged 40-59 years old
 - c. Every 5 years if under 40 years old
3. After an injury or illness requiring hospitalization of more than 24 hours
4. After an episode of unconsciousness – whether related to diving activity or not
5. After any diving accident requiring treatment in a recompression chamber

Information Provided Examining Physician

The University of Illinois Urbana-Champaign will provide a copy of the medical requirements of this standard to the examining physician.

Content of Medical Examinations

Medical examinations conducted initially and annually will consist of the following:

1. General medical history
2. Diving-related medical history
3. Basic physical examination

4. The tests required by Section 6.15; and
5. Any further tests deemed necessary by the physician such as EKG and/or stress test, Pulmonary function test.

Diving Medical Examination

UNDER AGE 40:

- Medical history
- Complete physical exam, with emphasis on neurological and otological components
- Urinalysis
- Any further tests deemed necessary by the physician

ADDITIONAL TESTS FOR AGE 40 AND OVER:

- Chest x-ray (*Required only during first exam over age 40*)
- Resting EKG
- Assessment of coronary artery disease using Multiple-Risk-Factor Assessment¹ (age, lipid profile, blood pressure, diabetic screening, smoking)
Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment
- Any further tests deemed necessary by the physician

Medical Examination Following Injury, Unconsciousness or Recompression Treatment

Medical examinations conducted after an injury or illness requiring hospitalization of more than 24 hours or after an episode of unconsciousness related to diving activity or after treatment in a recompression chamber following a diving accident must be appropriate to the nature and extent of the injury or illness as determined by the examining physician.

Physician's Written Report

After any medical examination required by this standard, the University of Illinois Urbana-Champaign Diving Control Board will obtain a written waiver prepared by the examining physician which must contain the examining physician's opinion of the individual's fitness to dive, including any recommended restrictions or limitations.

Contra-indications to Diving

The following conditions may be examples of either absolute or relative contra-indications to diving clearances; or at least may require special consultations and waivers, both medical and possibly legal.

1. Persons subject to spontaneous pneumothorax.
2. Persons subject to epileptic seizures or syncopal attacks.
3. Lung cysts or definite air-trapping lesions on chest X-ray.
4. Perforated ear drum.
5. Active asthma.
6. Drug addiction.

7. Diabetes where individual is subject to insulin shock or diabetic coma.
8. Ear surgery with placement of plastic strut in air-conduction chain.
9. Pregnancy.
10. History of myocardial infarction.
11. Decreased pulmonary reserve from any cause.
12. Malignancies (active) unless treated and without recurrence for 5 years.
13. Gross obesity in diving requiring decompression.
14. History of thoracotomy.
15. Impaired vision or blindness in one eye.
16. Chronic inability to equalize sinus and/or middle ear pressure.
17. Impaired organ function caused by alcohol or drug use.
18. Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood-altering drugs, or insulin).
19. Meniere's disease.
20. Hemoglobinopathies.
21. Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).
22. Juxta-articular osteonecrosis.
23. Any lingering effects from the consumption of alcohol.