OCCUPATIONAL SAFETY AND
HEALTH STANDARDS FOR
GREAT LAKES COMMERCIAL
DIVING OPERATIONS
SECTION 1: Purpose, Scope and Application

1.1 Purpose
The purpose of this standard is to provide guidelines which shall be considered as minimum reasonable requirements of safety in shallow-water commercial and industrial diving. It is not intended that provisions in this standard are to supercede and governmental regulations, present or proposed.

1.2 Scope

1.2.1 This standard applies to every place of employment within the inland and territorial waters of the United States defined as the Great Lakes Basin where diving and related operations are carried out.

1.2.2 This standard applies to shallow-water diving operations in which the diver's working depth does not exceed 220 fsw and compressed air is the primary breathing gas.

1.2.3 This standard establishes minimum requirements for the safety of divers in commercial and industrial diving work and employments, including industry, construction, ship repair, shipbuilding, ship-breaking, and longshoring.

1.2.4 This standard does not apply to any diving operation:

1.2.4.1 Performed solely for instructional purposes, using open-circuit, compressed-air scuba and conducted within the no-decompression limits;

1.2.4.2 Performed solely for recreational purposes;

1.2.4.3 Performed solely for scientific/educational purposes;

1.2.4.4 Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

1.2.4.5 Governed by 45 CFT Part 46 (Protection of Human Subjects, U.S. Department of Health, Education, and Welfare) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.
1.3 Applications in emergencies

An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

1.3.1 Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

1.3.2 Upon request from the Area Director, submits such information in writing.
SECTION 2: Definitions

As used in this standard, the listed terms are defined as follows:

**Acute alcoholism:** an episode of repeated or continuous excessive consumption of alcoholic beverages over a relatively short period of time.

**Acute gastrointestinal syndrome:** refers to nausea, vomiting, diarrhea, or any combination, with abrupt onset and persisting a few days or less.

**Air diver:** a diver who, while executing his diving duties, utilizes air as a breathing medium.

**Air diving supervisor:** an individual qualified to supervise air diving operations and a diving team functioning on an underwater project and who is currently, or has formerly been, a qualified diver.

**Ascent time:** the time interval between starting ascent and arriving at surface pressure.

**ASME:** refers to the American Society of Mechanical Engineers.

**ATA:** an abbreviation for atmospheres absolute, a unit of pressure equivalent to ambient gauge pressure in atmospheres plus 1 atmosphere.

**ATM:** an abbreviation for atmosphere, a unit of pressure equivalent to 760 millimeters of mercury (mm Hg) or 14.7 pounds per square inch (psi).

**Bottom time:** the time interval between leaving the surface and beginning ascent back to the surface.

**Burst pressure:** the pressure at which the containment vessel will structurally fail.

**Chronic:** existing for a prolonged period of time.

**Chronic alcoholism:** repeated or continuous excessive consumption of alcoholic beverages over a prolonged period of time.
Closed-circuit: a system by which the diver breathes a gas supply that is recirculated through a carbon dioxide absorbent with periodic manual or automatic replenishing of oxygen.

Commercial diving: diving which is performed as a part of general industry, construction, ship repairing, shipbuilding, shipbreaking, and longshoring.

Cystic: an adjective meaning an enclosed hollow space.

Decompression: the reduction of environmental or ambient pressure to atmospheric pressure.

Decompression dive: a dive during which the diver must stop at a given depth or depths in accordance with U.S. Navy Decompression Tables and cannot proceed directly to the surface at the prescribed rate.

Decompression schedule: a time-depth profile with a specific bottom time and depth, for which a specific pressure reduction or decompression time sequence has been calculated.

Decompression sickness: a physiological condition with a variety of symptoms which may result from the formation of gas or gas bubbles in the blood or body tissues of divers during or subsequent to ascent or other pressure reduction.

Decompression table: a set of decompression schedules computed on common parameters.

Demand system: a gas-supply system that supplies gas to the diver only when the diver inhales.

Diabetes: a physiological condition involving excess sugar in the blood.

Disconnect switch: a safety switch, located at the surface, by which power can be quickly removed from the underwater cutting/welding lead.

Diver: an employee engaged in work using underwater breathing apparatus which supplies compressed breathing gas at ambient pressure from a self-contained or remote source.

Diver/tender: an individual qualified to conduct limited underwater work under the supervision of a full qualified diving personnel and tend divers.

Diving bell (open): an open vessel designed for transporting the diver to and from the work site and not designed to be operated with an internal pressure differential.
Diving bell (pressurized): a closed pressure vessel designed for transporting the diver to and from the underwater work site and operated with an internal differential pressure at least as great as the pressure at the working depth.

Diving harness: a harness assembly which the diver wears to which his umbilical unit connects and by which he can be lifted, with the harness distributing the load.

Diving supervisor: the person responsible for planning the dive, instructing the crew, making certain all necessary equipment is available and functioning properly, taking all necessary precautions against foreseeable contingencies, and is responsible for safety of the operation.

DOT: refers to the Department of Transportation (formerly designated on cylinders as ICC).

Drug addiction: the inability, either physiologically or psychologically, to function without the use of a drug or medication.

Drug intoxication: ill or undesirable effects caused by excessive use of a drug or medication.

Dry suit (variable volume): a diving suit capable of being inflated for buoyancy or insulation which maintains the diver's body essentially dry.

Epileptiform disease: a disease characterized by convulsive seizures.

Field experience: field days (offshore, inland lakes, harbors, rivers) directly participating as a diver, supervising divers, operating diving equipment or surface tending divers engaged in underwater operations.

Filter: a device used in gas supply systems to remove moisture, oil, and particulate matter from the breathing gas.

Free-flow system: a gas supply system that supplies gas to the diver by continuous flow.

FSW: the abbreviation for feet of seawater, a unit of pressure generally defined as 1/33 of a standard atmosphere, which represents the pressure exerted by a foot of seawater having a specific gravity of 1.027, equal to approximately 445 pounds per square inch. This pressure unit is used in freshwater diving since most diver's gauges and decompression tables use fsw as the standard unit. In freshwater the pressure at 34 feet is equal to that at 33 feet in seawater.
Hard piping: rigid permanent or semi-permanent piping, as
distinguished from temporary, flexible hoses.

Heart disease: any abnormal or morbid condition of the heart.

Heavy-gear diving: diving which employs the use of con-
ventional deep sea dress, including helmet and breastplate,
suit of rubberized canvas, and heavy weighted shoes.

Helmet: diving apparatus constructed of hard material which
completely encloses the diver's head and keeps it dry.

High pressure air: air supplied at a pressure in excess of
500 psi.

Hyperbaric chamber (also recompression chamber or decom-
pression chamber): a pressure vessel suitable for, and
in used in, recompression-decompression of divers.

Hyperbaric conditions: refers to pressure conditions in
excess of surface pressure.

Lead diver (diver in charge): a diver who by virtue of
experience and proficiency is qualified and responsible
for the conduct of a diving operation when a designated
supervisor is not assigned or present.

Life-support equipment: equipment designed to provide the
diver with an appropriate respirable atmosphere and other
protection as required.

Live boating: refers to a diver working from a boat which
is under power and not anchored. The diver may be under
tow on a diver's plane or shot line or he may be followed
by the boat to which he is tethered while swimming or
walking on the bottom.

Low pressure air: air supplied at a pressure of less than
500 psi.

Mask: a breathing and protective apparatus which covers
the diver's face and is secured to the diver's head by a
strap or harness assembly.

Mixed gas: refers to a mixture of oxygen and an inert gas
appropriate for diver breathing at a given depth range and
with given apparatus. Unless otherwise specified all
breathing gas referred to in this document shall be air.

Mixed-gas diver: a diver who, while executing his diving
duties, utilizes mixed gas as a breathing medium.
Mixed-gas diving: a diving mode in which the diver is supplied with a gas mixture other than air.

Mixed-gas supervisor: an individual qualified to supervise mixed-gas diving operations and a diving team functioning on an underwater project and who is currently, or has formerly been, a qualified diver.

Neurological decompression sickness: decompression sickness involving the brain, spinal cord, or nerves.

No-decompression limit: the time-depth combination which indicates that a diver can safely ascend to the surface at a prescribed rate without stopping to decompress.

Non-return valve: a one-way check valve installed at the hose-helmet or mask attachment point or elsewhere in the diving system, which is designed to prevent pressure loss should the hose be severed or the gas supply be interrupted.

Obesity: a conduct of excessive body weight and fat content, generally accepted as 20% over the recommended level for a given height, weight, age, body type, and sex.

Open circuit: a system by which the diver inhales breathing gas directly from the supply and exhales or exhausts directly into the surrounding water.

OSHA: refers to the Occupational Safety and Health Administration.

Oxygen cleaning: a special cleaning procedure to remove contamination in apparatus used in supplying oxygen under pressure. This is a precaution used to prevent oxygen related ignition or explosion.

Oxygen compatibility: the ability of a substance to come into contact with high-pressure oxygen without ignition.

Oxygen service equipment: equipment or components which store or convey a gas having an oxygen concentration of 40% or greater.

Oxygen toxicity: the adverse physiological response to excessive partial pressure of oxygen.

P.A. Projections: a standard x-ray technique wherein the x-rays are emitted from behind the individual toward the front.

Partial pressure: that portion of the total gas pressure exerted by a particular constituent of the gas mixture.
Personnel lock: a chamber compartment through which personnel pass from air pressure environment to another.

Pneumofathometer: a depth measuring device indicating depth in fsw, consisting of an open-ended hose fixed to the diver or diving bell, with the other end connected to an air supply and pressure gauge at the surface.

Pressure: defined as force per unit area. In diving, pressure denotes an exposure greater than surface pressure (1 ATA).

PVHO: the abbreviation for "pressure vessel for human occupancy", a pressure vessel designed to contain human beings.

Qualified diver: a person medically fit for diving, trained or experienced in diving who possesses the mechanical skills and technical knowledge required for safe and satisfactory completion of a given underwater task. The diver must be able to show satisfactory proof of training and/or experience. He shall possess a diving logbook with recorded diving experience and/or letters from past employers or instructors attesting to his diving proficiency and experience. He must comply with the certification requirements given in this standard.

Rack/console operator: an individual qualified to operate a gas rack/console.

Receiver: a pressure vessel designed for the storage of gas. In conventional diving this is generally a low-pressure reserve tank located between the breathing gas source and the diver's hose connection.

Safety factor: the ratio of burst pressure to working pressure when used in reference to pressure vessels, piping, hose, and other pressure containing apparatus common to diving.

Saturation dive: refers to a dive during which the personnel have been exposed to a given pressure for a sufficient amount of time for a state of equilibrium to be established between the body and the breathing atmosphere.

Saturation habitat: a fixed or movable system of single or multiple PVHO's in which divers live under saturation conditions on the sea floor and from which they make working excursions.

SCUBA: a self-contained underwater breathing apparatus.
Self-contained diving (or scuba diving): a diving mode which allows the diver to carry his own breathing gas supply and be independent of the surface with regard to breathing gas.

Semi-closed circuit: a system by which the diver breathes a gas partially from the supply and recirculated gas from a breathing bag or canister after it has passed through a carbon dioxide absorbent.

Standby diver: a qualified diver who is suited up and prepared with proper equipment for the dive involved to enter the water immediately in the event of an emergency or upon orders of the diving supervisor.

Surface decompression: a special diver decompression procedure conducted in a deck decompression chamber in accordance with procedures given in the U.S. Navy Manual.

Surface supplied: refers to a system by which the diver is supplied with breathing gas through a hose from the surface.

Tender: a person possessing the mechanical skills and technical knowledge of setting up and operating the diver's gas supply (compressor and/or gas storage unit) and all other diving equipment. He shall be conversant with the use of appropriate decompression and repetitive dive tables and familiar with various diving injuries and appropriate first aid. He shall be skilled in tending the diver's hose assembly while the diver is submerged and sending and receiving hand (line) signals.

Timekeeper: a person responsible for keeping the diver's time and completing the information required for the diving record.

Treatment table: a time-pressure-gas profile which is calculated to eliminate the symptoms of decompression sickness.

Umbilical assembly (life-support hose bundle): a composite of hoses/cables or separate cables extending from the surface to the diver or diving bell which supplies breathing gas, power, heat, depth measurement, safety line and/or communications, as necessary.

Weight belt: a belt worn by the diver to which weights are attached to adjust buoyancy or provide negative buoyancy.

Working pressure: the normal maximum operating pressure exerted by a medium such as a breathing mixture.

Work site: a vessel or surface structure from which dives are supported and/or the underwater location where work is performed.
SECTION 3: Personnel Qualifications

3.1 General

3.1.1 Each dive team member shall have the training and/or experience necessary to perform tasks assigned in a safe and proper manner.

3.1.2 Each dive team member shall have training and/or experience in the following:

3.1.2.1 Techniques of the assigned diving mode;

3.1.2.2 The use of equipment, systems, and tools relevant to the assigned task; and

3.1.2.3 Diving operations and emergency procedures.

3.1.3 All dive team members shall be trained in cardiopulmonary resuscitation and first aid.

3.1.4 Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

3.2 Assignments

3.2.1 Each dive team member shall be assigned tasks in accordance with the employee's experience and/or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

3.2.2 The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

3.2.3 The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.
3.3 Designated person-in-charge

3.3.1 The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

3.3.2 The designated person-in-charge shall have the experience and training in the conduct of the assigned diving operation.

3.4 Employee responsibility

3.4.1 It shall be the individual diver's responsibility to maintain himself/herself in good physical condition and at a high level of diving proficiency.

3.4.2 Each diver has the responsibility and privilege to refuse to dive if, in his/her judgement:

3.4.2.1 Conditions are unfavorable;

3.4.2.2 He/she is not in proper physical or mental condition for diving;

3.4.2.3 He/she would violate the dictates of proper diving safety procedures or this standard.

3.4.3 The employee is responsible for reporting immediately to the designated person-in-charge any equipment malfunction or discrepancy in safety procedures.

3.5 Diving after illness or injury

3.5.1 No diver shall be allowed to dive following decompression sickness exhibiting CNS or vestibular symptoms or following a pulmonary barotrauma unless he/she has received medical clearance for diving from a physician recognized as qualified by the employer.

3.5.2 No diver shall be allowed to dive following extended hospitalization or illness unless he/she has received medical clearance for diving from a physician.
SECTION 4: Medical Requirements

4.1 General

4.1.1 The employer shall determine that dive team members who are, or are likely to be, exposed to hyperbaric conditions are medically fit to perform assigned tasks in a safe and healthful manner.

4.1.2 The employer shall verify that each dive team member who is, or is likely to be, exposed to hyperbaric conditions has complied with all medical examinations required by this standard.

4.1.3 All medical examinations required by this standard shall be performed by, or under the direction of, a qualified physician.

4.1.4 The medical examination requirements of this standard shall be provided for in the following manner:

4.1.4.1 The employer shall provide each dive team member who is, or is likely to be, exposed to hyperbaric conditions with all medical examinations required by this standard at no cost to the employee; or

4.1.4.2 The employee shall provide a current certified or notarized copy of his/her current annual medical examination report as required by this standard before exposure to hyperbaric conditions.

4.1.5 The employer and the employees or their designated representatives shall determine the policy for medical examination payment.

4.1.6 The employer shall bear the cost of any test specified by the employer which is beyond the requirements of this standard.

4.2 Physician qualifications

4.2.1 Examining physicians shall be familiar with the physical requirements and medical aspects of diving.
4.3 Frequency of medical examinations

4.3.1 Medical examinations shall be provided:

4.3.1.1 Prior to initial hyperbaric exposure with the employer, unless an equivalent medical examination has been given within the preceding 12 months and the employer has obtained the results of the examination and an opinion from the examining physician of the employee’s medical fitness to dive or to be otherwise exposed to hyperbaric conditions;

4.3.1.2 At one year intervals from the date of initial examination or last equivalent examination;

4.3.1.3 After an injury or illness requiring hospitalization of more than twenty-four (24) hours;

4.3.1.4 Following decompression sickness with vestibular or central nervous system involvement or pulmonary barotrauma; or

4.3.1.5 If the employer has doubts as to the employee’s medical qualification to continue diving.

4.4 Information provided to examining physician:

4.4.1 A copy of the medical requirements of this standard; and

4.4.2 A summary of the nature and extent of hyperbaric conditions to which the dive team member will be exposed, including diving modes and types of work to be assigned.

4.4.3 A summary of the examiner’s diving-related work history; and

4.4.4 A medical history provided by the diver.

4.5 Content of medical examination:

4.5.1 Medical examinations conducted initially and annually shall consist of the following:

4.5.1.1 Medical history;

4.5.1.2 Diving-related work history;
4.5.1.3 Basic diver's physical examination;
4.5.1.4 The test required in Table I;
4.5.1.5 Any additional tests or requirements imposed by the employer as dictated by specific activities and
4.5.1.6 Any additional tests that the physician considers necessary.
4.5.2 Medical examinations conducted after an injury or illness requiring hospitalization of more than 24 hours shall be appropriate to the nature and extent of the injury or illness as determined by the examining physician.

4.6 **Physician's written report**

4.6.1 After any medical examination required by this standard, the employer shall obtain a written report prepared by the examining physician containing:

4.6.1.1 The date and location of the medical examination;
4.6.1.2 The results of the medical examination; and
4.6.1.3 The examining physician's opinion of the employee's fitness to be exposed to hyperbaric conditions, including any recommended restrictions or limitations to such exposure (see Appendix A).

4.6.2 The employer shall provide the employee with a copy of the physician's written report.

4.7 **Determination of employee fitness**

4.7.1 The employer shall determine the extent and nature of the dive team member's fitness to engage in diving or be otherwise exposed to hyperbaric conditions consistent with the recommendations of the examining physician's report.
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<td>Bone and joint x-ray series</td>
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(1) If medically indicated; at physician's discretion.
(2) Required at 3 year intervals.
(3) Annually over the age of 35.
(4) If required by employer for specific diving activities.
SECTION 5: General Operations Requirements

5.1 Safe Practices Manual

5.1.1 The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

5.1.2 Contents

5.1.2.1 The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

5.1.2.2 For each diving mode engaged in, the safe practices manual shall include:

5.1.2.2.1 Safety procedures for diving operations;

5.1.2.2.2 Equipment procedures;

5.1.2.2.3 Assignments and responsibilities of diving team members;

5.1.2.2.4 Emergency procedures for fire, equipment failure, adverse environmental conditions, illness and injury.

5.2 Pre-Dive Procedures

5.2.1 The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

5.2.2 A competent designated person-in-charge (lead diver or diving supervisor) shall be delegated the authority to take charge of each diving operation at the dive location.

5.2.2.1 The designated person-in-charge shall:

5.2.2.1.1 Maintain the provisions of this standard;

5.2.2.1.2 Maintain additional safety provisions specifically established by the employer;

5.2.2.1.3 Assure that all diving is conducted in accordance with accepted procedures and practices; and

5.2.2.1.4 Under no circumstances tolerate violation of these standards or other designated/accepted diving safety practices.
5.2.3 Emergency Aid

5.2.3.1 A list shall be maintained at the dive location of the telephone or call the number and location of the following:

5.2.3.2 Primary and alternate decompression chambers (if not at the diving location);

5.2.3.3 Accessible hospitals;

5.2.3.4 Available physicians;

5.2.3.5 Available means of transportation;

5.2.3.6 The nearest U.S. Coast Guard Rescue Coordination Center and facilities;

5.2.3.7 Employer offices;

5.2.3.8 Name, location, and telephone number of nearest relative of each employee; and

5.2.3.9 Other emergency facilities in area of operation.

5.2.4 First aid supplies:

5.2.5.1 A first aid kit appropriate for the diving operation and location shall be available at the dive location.

5.2.4.2 When used in a decompression chamber, the first aid kit shall be suitable for use under hyperbaric conditions.

5.2.4.3 An American Red Cross Standard First Aid Manual or equivalent and a manual or specific instructions on first aid for diving accidents shall be available at the dive location.

5.2.4.4 An emergency oxygen breathing unit shall be available at all dive locations.

5.2.5 Planning and assessment;

5.2.5.1 Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

5.2.5.1.1 Diving mode;

5.2.5.1.2 Surface and underwater conditions and anticipated hazards;
5.2.5.1.3 Breathing gas supply including source, purity, quantity, and reserves;

5.2.5.1.4 Thermal protection requirements;

5.2.5.1.5 Diving equipment and system;

5.2.5.1.6 Dive team assignments and physical status of dive team members;

5.2.5.1.7 Repetitive dive designation or residual inert gas status of dive team members;

5.2.5.1.8 Decompression and treatment procedures (including altitude corrections); and

5.2.5.1.9 Emergency procedures.

5.2.5.2 The designated person-in-charge shall inform the vessel's master, work site foreman, and/or designated personnel of all diving operations to be conducted from the vessel or structure, emphasizing pertinent safety factors and coordination with other activities.

5.2.0 Hazard activities.

5.2.6.1 To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

5.2.7 Employee briefing.

5.2.7.1 Dive team members shall be briefed on:

5.2.7.1.1 The task to be undertaken;

5.2.7.1.2 Safety procedures for the diving mode;

5.2.7.1.3 Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;

5.2.7.1.4 Emergency aid procedures; and

5.2.7.1.5 Any modification to operating procedures necessitated by the specific diving operation.
5.2.7.2 Prior to making individual dive team member assignments, the employer or designated person-in-charge shall inquire into the diving team member's current state of physical fitness, restrict diving activities of individuals suffering from obvious illness or abnormal physical conditions contraindicated in diving.

5.2.7.3 Dive team members shall be informed of the procedures for reporting physical problems or adverse physiological effects during and after the dive.

5.2.8 Equipment.

5.2.8.1 Equipment to be used must meet the specifications set forth in this standard.

5.2.8.2 All life-support and associated equipment including mask, helmets, umbilical assemblies, thermal protection, scuba, floatation units, and compressors shall be inspected and determined to be in proper operating condition prior to each dive.

5.2.8.3 An adequate and appropriate primary and contingency air supply shall be available for the diving operation.

5.2.8.4 All hoses supplying the diver's life support equipment shall be protected against probable damage.

5.2.8.5 Except when heavy gear is worn or in scuba diving (not line tended), each diver shall wear a safety harness.

5.2.8.6 Adequate thermal protection provisions shall be made to minimize body heat loss or gain during the dive.

5.2.8.7 A multi-lock decompression chamber capable of recompressing a diver at the surface to a minimum depth of 165 fsw shall be available at the dive location or within 2 hours travel time from the dive location for:

5.2.8.7.1 Surface-supplied or scuba air dives to depths deeper than 130 fsw; and
5.2.8.7.2 Dives beyond the no-decompression limit.

5.2.8.7.3 If stage decompression in excess of 30 minutes is required, a decompression chamber must be available and ready for use at the work site.

5.2.8.8 Protective clothing shall be worn by divers whenever marine life, sharp objects, or abrasive surfaces present a potential hazard.

5.2.8.9 Surface personnel shall wear approved personal flotation equipment, safety hats, and safety shoes whenever the nature of the operation demands.

5.2.8.10 A sharp knife shall be carried by the diver either closed or in an appropriate scabbard at all times while in the water.

5.2.8.11 A safe means of entering and exiting the water appropriate to the dive platform, environmental conditions, and nature of the dive shall be provided.

5.2.9 Warning signal.

5.2.9.1 An appropriate warning shall be displayed at the dive location in a manner which allows all-round visibility, and it shall be illuminated at night when divers are operating in areas capable of supporting marine traffic.

5.2.10 Diving station.

5.2.10.1 Adequate diving stations from which safe diving operations can be conducted shall be provided at the entry/exit location on all platforms, structures, or vessels used for diving operations.

5.2.10.2 Platforms, structures, or vessels used for diving operations shall be determined as adequate and safe by the designated person-in-charge.

5.3 Procedures during dive

5.3.1 The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.
5.3.2 Water entry and exit.

5.3.2.1 A means capable of supporting the diver shall be provided for entering and exiting the water.

5.3.2.2 The means provided for exiting the water shall extend below the water surface.

5.3.2.3 A means shall be provided to assist an injured diver from the water.

5.3.3 Communications.

5.3.3.1 An operational diver - surface voice communications system shall be used for all surface-supplied dives.

5.3.3.2 An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

5.3.4 Overhead work and lifting operations.

5.3.4.1 For all lifting operations conducted while a diver is in the water, a workable communications system must be established between the dive team and the crane or winch operator.

5.3.4.2 The crane or winch operator shall accept instructions only from a designated person.

5.3.4.3 The diver in the water shall be advised prior to any movement of the load.

5.3.4.4 For all crane operations in which the diving team member giving instructions to the diver in the water is out of visual contact with the crane operator, and on all cranes of 100 tons or more capacity, an audio communications system shall be established between the two parties.

5.3.4.5 Under normal conditions, divers will not be required to dive if work is being performed by other personnel directly over the diver unless the dive team is satisfied that the overhead work does not pose a hazard.

5.3.5 In-water welding and burning.

5.3.5.1 Personnel designated to operate welding and burning equipment shall be properly instructed and familiar with all precautions necessary for safe in-water welding and burning.
5.3.5.2 A positive operating current supply switch to interrupt the current flow to the welding or burning electrode shall be:

5.3.5.2.1 Tended by a dive team member in voice communication with the diver performing the welding or burning; and

5.3.5.2.2 Kept in the open position except when the diver is welding or burning;

5.3.5.2.3 Of adequate capacity to handle the maximum electrical current of the power supply and be enclosed to prevent electric shock to the operator.

5.3.5.3 The welding machine shall be grounded and a ground wire shall connect the machine directly to the work.

5.3.5.4 Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

5.3.5.5 Precautions shall be taken to prevent contact between power supply cables and welding cables in such a way as to create a potential short.

5.3.5.6 A.C. power supplies of less than 500 Hz output shall not be used for welding or burning.

5.3.5.7 Rubber gloves or other insulated gloves shall be used by divers performing welding and burning operations.

5.3.5.8 Welding and burning gas supplies.

5.3.5.8.1 Compressed gas cylinders shall be handled in accordance with accepted safety procedures and properly secured to prevent damage to cylinders and valves or injury to personnel.

5.3.5.8.2 Regulators shall be used only for the gas for which they were intended.

5.3.5.8.3 Regulators shall be maintained and tested by qualified personnel.

5.3.5.9 Prior to welding or burning on closed compartments, structures, or pipes which may contain a flammable or unknown vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded or purged with a mixture of gases which will not support combustion, except for hot tap operations.
5.3.6 Underwater electrical equipment.

5.3.6.1 When electrical apparatus is employed underwater which requires operating potential in excess of 36 volts, ground fault interrupters shall be installed, where practical, on the electrical supply circuit.

5.3.6.2 When technical considerations preclude the use of ground fault interrupters on underwater electrical circuits in excess of 36 volts, isolation transformers shall be installed on the electrical supply circuit.

5.3.7 Hand-held power tools and equipment.

5.3.7.1 Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

5.3.7.2 Hand-held power tools shall not be supplied with power from the dive station until requested by the diver.

5.3.8 Explosives.

5.3.8.1 Explosives shall be handled only by specially qualified and appropriately licensed personnel.

5.3.8.2 Explosives shall be transported, stored, and used in accordance with this section and the applicable provisions of sections 1910.109 and 1926.912 of Title 29 of the Code of Federal Regulations.

5.3.8.3 Blasting caps shall not be connected to the primacord until the diver is out of the water.

5.3.8.4 Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

5.3.8.5 Explosives shall not be detonated while the diver is in the water.

5.3.9 Decompression tables.

5.3.9.1 Decompression, repetitive, and no-decompression dive tables (as appropriate) shall be available at the dive station.
5.3.10 Dive profiles.

5.3.10.1 A depth-time profile, including when appropriate, any breathing gas changes, shall be maintained for each diver during the dive including decompression.

5.3.11 Liveboating.

5.3.11.1 Employers engaged in diving operations involving liveboating shall comply with the following requirements:

5.3.11.1.1 Limits.

5.3.11.1.1.1 Diving operations involving liveboating shall not be conducted:

5.3.11.1.1.2 With an in-water decompression time of greater than 120 minutes;

5.3.11.1.1.3 In rough seas (beyond sea state 3);

5.3.11.1.1.4 In other than daylight hours; or

5.3.11.1.1.5 From a vessel of insufficient maneuverability.

5.3.11.2 Procedures.

5.3.11.2.1 The propeller of the vessel shall be stopped before the diver enters or exits the water.

5.3.11.2.2 A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

5.3.11.2.3 Precautions shall be taken to properly lead the diver's hose away from the vicinity of the vessel's propellers and to prevent loss of the depth control in the event of loss of vessel control.

5.3.11.2.4 Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.
5.3.11.1.2.5
The tender shall be specifically qualified in liveboating tending.

5.3.11.1.2.6
A standby diver shall be available while a diver is in the water.

5.3.11.1.2.7
A self-contained emergency breathing air supply shall be carried by each diver engaging in liveboating operations.

5.3.11.1.2.8
The vessel operator shall be qualified to the satisfaction of the designated person-in-charge.

5.4
Post-dive procedures

5.4.1
The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

5.4.2
Precautions.

5.4.2.1
After the completion of any dive, the employer shall:

5.4.2.1.1
Check the physical condition of the diver;

5.4.2.1.2
Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

5.4.2.1.3
Advise the diver of the location of a decompression chamber which is ready for use; and

5.4.2.1.4
Alert the diver to the potential hazards of flying after diving.

5.4.2.2
A diver shall remain awake for at least one hour after completion of any dive.

5.4.2.3
For any dive beyond the no-decompression limits or deeper than 100 fsw, the employer shall instruct the diver to remain within access of a decompression chamber and competent operator for at least two hours following completion of the dive.
5.4.2.4 Flying after diving shall be limited to:

5.4.2.4.1 No flying for a minimum of two hours following a no-decompression dive providing that all dives performed in the previous 12 hours were also no-decompression dives.

5.4.2.4.2 A maximum of 800 feet altitude during the first 12 hours following a no-decompression dive.

5.4.2.4.3 No flying for a minimum of 24 hours following a decompression dive.

5.4.3 Record of dive.

5.4.3.1 The following information shall be recorded and maintained for each diving operation pressure exposure by both the employer and the employee:

5.4.3.1.1 Name of dive team member including designated person-in-charge and member assignments;

5.4.3.1.2 Date, time, and location;

5.4.3.1.3 Diving modes and equipment used;

5.4.3.1.4 General nature of work performed;

5.4.3.1.5 Estimated underwater and surface conditions (visibility, water temperature, sea state, current, and atmospheric temperature and conditions);

5.4.3.1.6 Maximum depth and bottom time for each diver;

5.4.3.1.7 Repetitive dive group designations or time of last pressure exposure;

5.4.3.1.8 Any unusual conditions;

5.4.3.1.9 Signature of designated person-in-charge; and

5.4.3.1.10 Employer's name and address.

5.4.3.2 For each dive beyond the no-decompression limit or deeper than 100 fsw, the following additional information shall be recorded and maintained:
5.4.3.2.1 Depth-time and breathing gas profiles;

5.4.3.2.2 Decompression tables designation (including modification, if any); and

5.4.3.2.3 Elapsed time since last pressure less than 24 hours or repetitive dive group designation for each diver.

5.4.3.3 For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information will be recorded and maintained:

5.4.3.3.1 Description of decompression sickness symptoms (including depth and time of onset); and

5.4.3.3.2 Description and results of treatment.

5.4.4 Decompression procedure assessment.

5.4.4.1 The employer shall:

5.4.4.1.1 Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of the decompression schedule used, and individual susceptibility;

5.4.4.1.2 Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

5.4.4.1.3 Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.
SECTION 6: Self-Contained Air Diving

6.1 Requirements

6.1.1 Employees engaged in scuba diving using compressed air breathing medium shall comply with the following requirements, unless otherwise specified.

6.2 Limits

6.2.1 Scuba diving shall not be conducted:

6.2.2 At depths greater than 190 fsw;

6.2.3 At depths greater than 130 fsw or beyond the no-decompression limits unless a decompression chamber is available and ready for use within 2 hours travel time from the diving location; or

6.2.4 If stage decompression in excess of 30 minutes is required unless a decompression chamber is available and ready for use at the work location.

6.3 Equipment

6.3.1 Scuba regulators shall comply with the following requirements:

6.3.1.1 All demand regulator components shall be of sufficient design and construction to operate at the maximum pressure of the cylinder unit on which the regulator is used.

6.3.1.2 All scuba regulators shall be inspected and designated satisfactory annually by an approved/qualified person, or more frequently if the regulator is used for deep or unusual diving operations or exhibits signs of malfunction.

6.3.2 All scuba shall be equipped with a submersible pressure readout gauge. The submersible pressure gauge shall comply with the following requirements:

6.3.2.1 Be within ± 5% of full scale accuracy over the entire gauge pressure range;

6.3.2.2 Be equipped with a means of relieving internal case over pressure without explosively ejecting the gauge lens or bursting the case; and

6.3.2.3 The pressure hose shall not show signs of cuts or abrasions extending to the hose reinforcing braid and not leak air through the braid fiber.
6.3.3 All scuba shall include a low-pressure warning device or reserve breathing gas supply consisting of:

6.3.3.1 A manually activated reserve;

6.3.3.2 A submersible pressure gauge;

6.3.3.3 An independent reserve cylinder with separate regulator or connected to the breathing apparatus; or

6.3.3.4 An audible low-pressure warning mechanism; and

6.3.3.5 If the scuba is equipped with an integral low-pressure warning mechanism, the mechanism shall activate at a cylinder pressure of not less than 250 psig.

6.3.4 High-pressure cylinders used for scuba shall comply with the following:

6.3.4.1 Cylinders shall be designed, constructed, maintained, and stamped in accordance with the requirements of the U.S. Department of Transportation for transportable high-pressure cylinders (applicable provisions of 29 CFR, Sections 1910.166-171).

6.3.4.2 Scuba cylinders shall have safety relief devices in accordance with applicable Department of Labor and/or Department of Transportation specified safety codes.

6.3.4.3 Scuba cylinders shall be inspected internally and externally for rust, corrosion, and damage annually in accordance with C.G.A. Pamphlet C-6, and hydrostatically tested in accordance with DOT specifications every five years or more frequently if subjected to damage or signs of significant rust or corrosion are evident.

6.3.4.4 Scuba cylinders shall be inspected/tested by an approved/qualified person.

6.3.4.5 Scuba cylinders shall be stored in a ventilated area and protected from excessive heat.

6.3.4.6 Scuba cylinders shall be secured from falling.
6.3.5 An approved emergency gas inflatable, floatation device or buoyancy compensator shall be required for all scuba dives. Emergency floatation units shall comply with the following requirements:

6.3.5.1 Provide a minimum buoyancy of 25 lbs when fully inflated at the surface;

6.3.5.2 Be gas tight and capable of holding a pressure of 2 psig for 2 hours when the over-pressure relief valve is blocked;

6.3.5.3 Be equipped with a device for manual inflation from a compressed gas supply and an oral inflation-deflation tube;

6.3.5.4 Be equipped with an over-pressure relief valve capable of relieving a fully inflated unit when released by itself from 33 fsw without sustaining structural damage to the unit;

6.3.5.5 Be so designed that it will turn an unconscious diver into a face-up position and support the head out of the water;

6.3.5.6 Be equipped with an inflation source separate from the breathing gas supply;

6.3.5.7 Be inflated by manual activation of the inflation system at least once every 6 months or 30 dives, whichever comes first, and must hold full inflation for 2 hours.

6.3.6 All depth gauges used for scuba shall be selected so that the maximum scale depth is at least 30 fsw in excess of the intended use depth. The depth indicator shall comply with the following requirements:

6.3.6.1 Each depth gauge shall comply with an accuracy of ± 1 percent of full scale depth at 20 fsw and not exceed ± 3 percent of full scale the maximum at maximum depth;

6.3.6.2 Each depth gauge shall be calibrated against a master reference gauge of ± .25% accuracy when new, every six months thereafter, and when there is a discrepancy greater than 2% of full scale between any two equivalent gauges.
6.3.7 All scuba used for dives in excess of 100 fsw, in enclosed or physically confining spaces, or around nets shall be equipped with an auxiliary breathing unit.

6.3.8 All scuba harnesses and weight belts shall be equipped with a quick release device which allows the scuba or weights to be rapidly jettisoned with either hand in an emergency, unless otherwise specified.

6.3.9 Scuba divers shall have a knife in their possession at all times while diving. The knife shall be carried in a suitable scabbard or in a closed position when not in use.

6.3.10 Air compressors and supply systems for charging scuba cylinders shall have:

6.3.10.1 Operation and maintenance in accordance with the manufacturer's instructions and specifications unless such instructions or specifications shall result in infraction of the purity standards for breathable compressed air.

6.3.10.2 An operation and maintenance record maintained for all compressors including operating time, repairs, type and number of filters used, oil consumption and changes, filter replacements, air analysis and other pertinent details.

6.3.10.3 Air pressure fittings, hoses, plumbing, and pressure system components with a maximum burst pressure rating specified as four times the maximum intended working pressure.

6.3.10.4 The air intake to the compressor so located as to prevent contamination of the air by noxious gases or materials.

6.3.10.5 Filters and separators incorporated into the diver air supply system to remove moisture, oil-mist, particulates, and noxious orders.

6.3.10.6 Respired air supplied to a diver shall not contain:
6.3.10.6.1 A level of carbon monoxide (CO) in excess of 20 ppm;
6.3.10.6.2 A level of carbon dioxide (CO₂) in excess of 1000 ppm;
6.3.10.6.3 A level of oil mist in excess of 5 milligrams per cubic meter;
6.3.10.6.4 Detectable gross moisture, dust, or particulates; and
6.3.10.6.5 A noxious or pronounced order.

6.3.10.7 The output of air compressor systems shall be tested for carbon monoxide, odor, and oil droplets every six months or 25 hours of operation, whichever comes first, by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

6.3.10.8 Compressed gas cylinders shall:
6.3.10.8.1 Be designed, constructed and maintained in accordance with the appropriate provisions of 29 CFR, Sections 1910.166-171;
6.3.10.8.2 Be stored in ventilated area and protected from excessive heat;
6.3.10.8.3 Be secured from falling; and
6.3.10.8.4 Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded (scuba diving cylinders excluded).

6.4 Procedures
6.4.1 Self-contained divers shall use only open-circuit scuba and air or equivalent breathing media.
6.4.2 A scuba diver shall be accompanied by another diver in the water in continuous visual contact during the diving operation except as provided for below:
6.4.2.1 When visibility is limited and continuous visual contact is impossible, the divers shall be linked together by a short line; and
6.4.2.2 A single scuba diver may dive to a depth of 15 fsw using a surface-tended line providing that the water is clear enough for the diver to be seen from the surface at all times.

6.4.3 Surface tended scuba divers shall wear a safety harness with:

6.4.3.1 A positive buckling device; and

6.4.3.2 An attachment point for the surface tended line.

6.4.4 A depth indicator and watch/timeing device shall be required for all scuba dives to depths exceeding 50 fsw.

6.4.5 The scuba cylinder pressure shall be determined immediately before each dive.

6.4.6 The planned time of a scuba dive (including decompression) shall not exceed the gas supply duration of the apparatus in use, exclusive of reserves.

6.4.7 For any mid-water scuba dives where the bottom depth exceeds 130 feet, the diver must be equipped with a buoyancy compensator and a depth gauge and a marked line shall be suspended from a boat or surface float.

6.4.8 During open-sea or open-lake scuba dives (beyond normal swimmer distance from shore), a small boat shall tend the divers.
SECTION 7: Surface-Supplied Air Diving

7.1 General

7.1.1 Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

7.2 Limits

7.2.1 Surface-supplied air diving shall not be conducted:

7.2.1.1 At depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

7.2.1.2 At depths greater than 130 fsw or beyond the no-decompression limits unless a decompression chamber is available and ready for use within two hours travel time from the diving location; Or

7.2.1.3 If stage decompression in excess of 30 minutes is required unless a decompression chamber is available and ready for use at the work location.

7.3 Equipment

7.3.1 Air compressor and supply systems.

7.3.1.1 Compressors used to supply air to the diver must be independent of any other operation, unless an adequate contingency air supply is maintained under direct control of the diver's tenders.

7.3.1.2 The air supply system shall be of sufficient design and capacity to provide a minimum supply of 4.5 cfm measured at the diver's working depth.

7.3.1.3 The system shall supply air at a hose pressure of at least 50 psi over ambient pressure for dives to less than 100 fsw and 100 psi over ambient pressure for depths in excess of 100 fsw.

7.3.1.4 A compressor used to supply divers air shall be equipped with an air receiver or volume tank.
7.3.1.5 The air receiver or volume tank shall be equipped with a check valve on the inlet line, a pressure gauge, a pressure relief valve, and a drain valve.

7.3.1.6 Air receivers and volume tanks and safety relief devices used with compressed air systems shall conform to ASME and/or other required and applicable codes and certifications; they shall conform to U.S. Coast Guard specifications and be so certified when used on job sites within U.S.C.G. jurisdiction.

7.3.1.7 All pressure fittings, hoses, plumbing, and pressure system components shall comply with a maximum burst pressure rating specified as four times the maximum intended working pressure.

7.3.1.8 Air compressors shall be operated and maintained in accordance with the manufacturer's instructions and specifications unless such instructions or specifications shall result in infraction of the purity standards for breathable compressed air.

7.3.1.9 An operation and maintenance record shall be maintained for all compressors and shall include operating time, repairs, type and number of filters used, oil consumption and changes, filter replacements, air analysis and other pertinent details.

7.3.1.10 The air intake to the compressor shall be so located as to prevent contamination of the air by noxious gases or materials.

7.3.1.11 Filters and separators shall be incorporated into the diver air supply system to remove moisture, oil-mist, particulates, and noxious odors.

7.3.1.12 Respired air supplied to a diver shall not contain:

7.3.1.12.1 A level of carbon monoxide (CO) in excess of 20 ppm;

7.3.1.12.2 A level of carbon dioxide (CO₂) in excess of 1000 ppm;

7.3.1.12.3 A level of oil mist in excess of 5 milligrams per cubic meter;

7.3.1.12.4 Detectable gross moisture, dust, or particulates; And

7.3.1.12.5 A noxious or pronounced odor.
7.3.1.13 The output of air compressor systems shall be tested for carbon monoxide, odor, and oil droplets every six months or 50 hours of operation, whichever comes first, by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

7.3.1.14 When air for surface-supplied diving is supplied from a high-pressure cylinder system, the volume of air contained must be sufficient to complete the dive with a minimum of 30% safety factor without requiring recharge.

7.3.1.15 For any surface-supplied dive, a secondary supply of sufficient capacity to complete the diver's decompression must be available at the surface to be used in event of the failure of the primary supply.

7.3.1.16 Compressed gas cylinders shall:

7.3.1.16.1 Be designed, constructed and maintained in accordance with the appropriate provisions of 29 CFR, Sections 1910.166-171;

7.3.1.16.2 Be stored in a ventilated area and protected from excessive heat;

7.3.1.16.3 Be secured from falling; and

7.3.1.16.4 Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded (scuba diving cylinders excluded).

7.3.2 Helmets and masks shall comply with the following requirements:

7.3.2.1 Helmets and masks shall be used in accordance with the limitations specified by the manufacturer of the equipment unless the equipment is tested under new conditions in a manner equal to or more rigid than performed by the manufacturer.

7.3.2.2 Helmets and masks shall be equipped with non-return valves made of materials resistant to corrosion in sea water between the air supply hose and the helmet or mask to prevent sudden loss of air pressure if the hose is severed.
7.3.2.3 All control, non-return, and exhaust valves in the diving unit when properly supplied and used in accordance with the manufacturer's specifications shall be capable of passing air at a rate of 4.5 acfm.

7.3.2.4 Helmets and masks except for oral-nasal masks, shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated.

7.3.2.5 Helmets and masks attached directly to "dry-type" diving dress shall be equipped with manually operated exhaust valves to facilitate rapid discharge of air in order to minimize the possibility of blow-up.

7.3.2.6 All modifications which may affect the performance of the helmet or mask must be approved by the employer or the manufacturer of the equipment prior to use and verified by tests equal to or more rigid than those performed by the manufacturer.

7.3.2.7 Helmets and masks shall be equipped with reliable surface-diver oral communications equipment.

7.3.3 Dive air supply hoses and umbilical assembly.

7.3.3.1 Breathing air hoses shall:

7.3.3.1.1 Have a bursting-pressure at least equal to four times the working pressure;

7.3.3.1.2 Have a minimum working pressure of 100 psig plus the maximum ambient pressure at the depth of the dive;

7.3.3.1.3 Be of a size capable of the required flow rates for the system or equipment used;

7.3.3.1.4 Be kink resistant;

7.3.3.1.5 Be marked with a serial number for record purposes;

7.3.3.1.6 Be taped, capped, or plugged when not in use to eliminate the possibility of foreign material entering the hose.
7.3.3.2 Hose fittings shall:

7.3.3.2.1 Be constructed of sea water corrosion resistant materials;

7.3.3.2.2 Have connections of a type that are resistant to accidental disengagement from the compressor or air source;

7.3.3.2.3 Be attached to the hose with clamps or devices that are constructed of sea water resistant materials and that cannot be accidentally loosened;

7.3.3.2.4 Be capable of sustaining a 200 lb tensile load on the hose attached to the fitting without showing signs of slippage; and

7.3.3.2.5 Have a working pressure at least equal to the working pressure of the hose to which they are attached.

7.3.3.3 Umbilical assemblies shall:

7.3.3.3.1 Be marked at ten foot intervals to a length of 100 feet beginning at the diver's end and at 50 foot intervals thereafter;

7.3.3.3.2 Be constructed of kink-resistant components;

7.3.3.3.3 Include a pneumofathometer hose when used for diving in excess of 30 fsw;

7.3.3.3.4 Be fitted with a device for attaching the assembly to the diver's harness.

7.3.3.4 Umbilical assembly inspection and testing shall include:

7.3.3.4.1 Visual inspection for abrasion of the outer cover, exposed reinforcement, fitting slippage or misalignment, fitting damage, fitting corrosion shall be performed prior to each diving day and following exposure to unusual stresses or abuse.

7.3.3.4.2 Pressure testing of breathing air hoses at least once annually to the rated working pressure.

7.3.4 Gauges and timekeeping devices.
7.3.4.1 Gauges indicating diver depth which can be read at the dive station shall be used for all dives greater than 30 fsw.

7.3.4.2 All gauges used to determine diver's depth shall have at least a ± 1% of full scale accuracy.

7.3.4.3 Each depth gauge shall be dead weight tested or calibrated against a master reference gauge every six months or when there is a discrepancy greater than 2% of full scale between any two equivalent gauges.

7.3.4.4 A timekeeping device shall be available at each dive station.

7.3.5 Weights and harness.

7.3.5.1 Except when heavy gear (deep sea diving outfit) is worn, divers shall be equipped with a weight belt or assembly capable of quick release designed to prevent accidental release.

7.3.5.2 Except when heavy gear (deep sea diving outfit) is worn, each diver shall wear a safety harness with:

7.3.5.2.1 A positive buckling device;

7.3.5.2.2 An attachment point for the umbilical assembly to prevent strain on the mask or helmet;

7.3.5.2.3 A lifting point to distribute the pull force of the line over the diver's body.

7.3.5.2.4 Capability to withstand a minimum of 500 lbs. linear pull.

7.3.6 Buoyancy control equipment.

7.3.6.1 A dry suit or other buoyancy changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

7.3.6.2 Exhaust valves used on buoyancy control equipment must be capable of exhausting the full volume of the suit or vest plus 10% during an ascent rate of 60 fpm.
7.3.7 Self-contained emergency air supply systems.

7.3.7.1 Self-contained emergency air supply systems shall be of a capacity sufficient to provide at least five minutes at working depth and must function independently of surface control or surface reserve supply.

7.3.7.2 The first stage of regulators attached to on-off valves on masks or helmets shall be equipped with an over-pressure relief valve.

7.4 Procedures

7.4.1 The minimum personnel requirements for surface-supplied air diving are as follows, unless otherwise specified:

7.4.1.1 One diver and one tender shall be required for dives to 100 fsw or less.

7.4.1.2 A standby diver and tender shall be required for dives to depths greater than 100 fsw or beyond the no-decompression limits.

7.4.2 A diver shall be stationed at the underwater entry point when diving is conducted in enclosed or physically confining spaces.

7.4.3 For dives deeper than 60 fsw or beyond the no-decompression limits:

7.4.3.1 A secondary surface air reserve shall be provided which will insure the diver of a minimum of five minutes continuous operation at working depth in the event of primary supply failure.

7.4.3.2 The diver shall be equipped with a self-contained reserve air supply which will provide five minutes of air at working depth, except when heavy gear is worn.

7.4.4 Except when heavy gear is worn, a self-contained air supply shall be carried by the diver whenever the configuration of the dive prevents ascending directly to the surface.
7.4.4.1 The self-contained air supply shall be of sufficient capacity to permit exit from the structure and completion of decompression.

7.4.5 For heavy gear diving deeper than 100 fsw or beyond the no-decompression limits:

7.4.5.1 An extra breathing air hose capable of supplying air to the diver in the water shall be available to the standby diver.

7.4.5.2 An in-water stage shall be provided to divers in the water.

7.4.6 Satisfactory surface-diver voice communications shall be provided for all surface-supplied dives.

7.4.6.1 A standby communication system shall be available for dives deeper than 100 fsw or beyond the no-decompression limits.

7.4.7 A protective hard-hat type safety helmet shall be worn by divers using a mask where overhead hazards or obstructions are evident.
SECTION 8: Decompression Chambers

8.1 Decompression chamber design and construction

8.1.1 Decompression chambers manufactured after the effective date of this standard shall be constructed in accordance with applicable ASME Unfired Pressure Vessel Codes.

8.1.2 Decompression chambers used on vessels and structures within the U.S. Coast Guard jurisdiction shall be U.S.C.G. certified and shall be tested and inspected as required by the jurisdictional authority.

8.1.3 Except for small portable emergency chambers a decompression chamber shall:

8.1.3.1 Have a minimum inside diameter of 48 inches except existing chambers with a minimum diameter of 40 inches may be used until 1982;

8.1.3.2 Have at least two compartments or locks designed so as to permit transfer of personnel and supplies to the outside while the main compartment remains pressurized;

8.1.3.3 Accommodate more than one person; and

8.1.3.4 Be capable of recompressing the diver at the surface to a minimum depth equivalent of 165 fsw.

8.1.4 Piping, tubing, and fittings shall comply to the following unless otherwise specified:

8.1.4.1 All permanently installed piping or tubing shall have a design bursting pressure of at least four times the working pressure.

8.1.4.2 Each chamber compartment shall be equipped with appropriate valves to enable the outside attendant to control the supply and discharge of compressed air and oxygen.

8.1.4.3 Chamber piping and valves shall be so located as to provide adequate ventilation and eliminate dead air spaces.

8.1.4.4 The inner compartment or working compartment of the chamber shall be fitted with an emergency safety pressure relief device which may be activated by the compartment occupants in event of overpressurization or disability of the outside attendants. The use of automatic pressure relief devices is optional.
8.1.4.5 The inner compartment or working compartment of the chamber shall be fitted with an emergency safety pressure relief device to prevent damage from over pressurization.

8.1.4.6 Internal exhaust outlets shall be fitted with an antisuction device or positioned to prevent suction of hands or materials into the exhaust system.

8.1.4.7 Air pressurization line outlets inside the chamber and exhaust lines inside and outside the chamber shall be equipped with noise muffling devices.

8.1.5 Oxygen piping and fittings.

8.1.5.1 Oxygen piping and fittings shall conform to the following requirements unless otherwise specified:

8.1.5.1.1 Equipment used with oxygen or mixtures containing more than 40% oxygen by volume shall be designed for oxygen service.

8.1.5.1.2 Components exposed to oxygen or mixtures containing more than 40% oxygen by volume shall be cleaned of flammable materials before use.

8.1.5.1.3 Hard piping, fittings, and tubing in oxygen service shall be of corrosion resistant materials.

8.1.5.1.4 Oxygen systems over 125 psig shall have slow-opening type on-off valves.

8.1.6 Decompression chamber equipment.

8.1.6.1 Each decompression chamber shall be equipped with:

8.1.6.1.1 A view port at least four inches in diameter located in such a position so as to permit observation of all occupants of each habitable compartment from the outside.

8.1.6.1.2 An externally mounted depth indicator (gauge) for each habitable compartment visible at the operating station.

8.1.6.1.3 An inner or working compartment depth indicator (gauge) for each habitable compartment visible to the occupants.

8.1.6.1.4 An effective means of oral communication between the outside attendant and the occupants of the chamber.
8.1.6.1.5 A means to maintain the atmosphere below a level of 25% oxygen by volume.

8.1.6.1.6 A built-in breathing system with a minimum of one mask per occupant.

8.1.6.1.7 Illumination capability to light the interior.

8.1.6.1.8 A means for extinguishing fire.

8.1.7 Fire prevention.

8.1.7.1 Fire prevention measures shall include:

8.1.7.1.1 Equipment, fixtures and furnishings used inside hyperbaric chambers constructed of non-combustible materials whenever possible.

8.1.7.1.2 Chamber lighting equipment designed to eliminate possibility of electrical malfunction leading to ignition of components or chamber atmosphere contamination.

8.1.7.1.3 Only fire retarding paint used on the interior of the chamber.

8.1.7.1.4 Combustible accessory equipment used in decompression chambers being kept to an absolute minimum.

8.2 Decompression chamber pressurization and ventilation system

8.2.1 The primary pressurization system for a hyperbaric chamber shall be of sufficient capacity to allow pressurization to a depth of 33 fsw within one minute under actual working conditions.

8.2.2 The system shall be capable of ventilation at a rate of four acfm per occupant at depth in an air breathing atmosphere.

8.2.3 A chamber used for pressurizing personnel shall have two independent and separate sources of air. One air source shall be independent of primary electrical power. The secondary source may consist of a low pressure air compressor powered by an internal combustion engine or generator system or a high pressure air storage system.

8.2.4 An emergency or secondary system shall be of sufficient capacity to pressurize the chamber to 165 fsw and ventilate the chamber for one hour in accordance with the specified minimum ventilation rates for one patient and one attendant.
8.2.5 The emergency or secondary air supply system shall be periodically activated to insure workability of the equipment in an emergency. The pressure of the high pressure storage system shall be periodically checked and must be retained within 10% of the total capacity of the system.

8.2.6 The air intake of compressors used for pressurizing and ventilating hyperbaric systems shall be maintained in the same fashion prescribed for diving compressors.

8.2.7 Hyperbaric chamber air supplies shall be periodically analyzed to insure that the air is within the limits designated for diving in this standard and a record shall be maintained of all tests.

8.3 Decompression chamber maintenance

8.3.1 Hyperbaric chambers shall be maintained free of refuse, discarded materials, grease, dirt and unnecessary equipment at all times.

8.3.2 Chamber depth indicators (gauges) shall be dead weight tested or calibrated against a master reference gauge every six months, whenever the chamber is moved, or whenever a malfunction is suspected. Calibration sheets shall be maintained on file and correction tags or labels attached to the gauge.

8.4 Chamber references and supplies

8.4.1 Treatment tables, treatment gas appropriate to the diving mode, appropriate first aid supplies and timekeeping devices shall be available at the chamber station.
SECTION 9: Recordkeeping Requirements

9.1 Personnel records

9.1.1 Personnel records shall be maintained by the employer.

9.1.1.1 Personnel records shall contain the following information:

9.1.1.2 Complete personal and employment history of all divers and diving support personnel.

9.1.1.3 Technical training records including:

9.1.1.3.1 Federal service qualification certificates;

9.1.1.3.2 Diving school certificate of completion; and/or

9.1.1.3.3 Employer training program completion statements or equivalent of proof of competency.

9.1.1.4 Field experience records including:

9.1.1.4.1 Employment records;

9.1.1.4.2 Written statements from other employers;

9.1.1.4.3 Written statements from commanding officers or diving officers;

9.1.1.4.4 Field operation records; and/or

9.1.1.4.5 Individual personal diving records.

9.1.1.5 Proficiency dive records including:

9.1.1.5.1 Company field operations records; and/or

9.1.1.5.2 Federal service operations records.

9.1.2 Personnel records shall be retained for a minimum period of five years after termination of employment.

9.2 Medical records

9.2.1 The examining physician shall provide a complete report of the medical examination and associated tests to the employer.

9.2.2 The medical records shall be retained by the employer for a minimum of five years.
9.3 Diving record retention

9.3.1 Diving records (Section 5.4.3) shall be retained by the employer for a minimum of one year, except five years where there has been an incident of decompression sickness.

9.4 Decompression procedure assessment evaluation retention

9.4.1 Decompression procedure assessment evaluations shall be retained by the employer for five years.

9.5 Diving equipment records

9.5.1 Diving equipment inspection, testing, maintenance, and repair records shall be retained in accordance with the following unless otherwise specified:

9.5.2 Helmets and masks shall have:

9.5.2.1 Specifications and test procedures supplied by the manufacturer on file for each unit.

9.5.2.2 A record of all test, modifications, and maintenance for each unit.

9.5.3 Pressure test records shall be maintained for all breathing air hoses and fittings (Section 7.3.3.4.2).

9.5.4 Records shall be maintained on all compressors maintenance and repairs (Section 7.3.1.9).

9.5.5 Records shall be maintained on all gauge calibrations and correction tags attached to the gauge (Section 7.3.4.3 and 6.3.6.2).

9.5.6 Records of all decompression chamber pressurizations, maintenance, tests and repairs shall be maintained for a minimum of five years.

9.6 Accident recording and reporting

9.6.1 The employer shall record and report occupational injuries and illnesses in accordance with requirements of 29 CFR Part 1904.

9.6.2 The employer shall record the occurrence of any diving related illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of the injuries or illnesses.
9.6.3 Records of hospitalizations shall be retained for five years.

9.7 Availability of records

9.7.1 Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Education and Welfare or their designees, the employer shall make available for inspection and copying any record or document required by this standard.

9.7.2 Upon request of any employee, former employee or authorized representative, the employer shall make available for inspection and copying any record or document required by this standard which pertains to the individual employee or former employee.

9.7.3 After the expiration of the retention period of any record required to be kept for five years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare.

9.7.4 In the event the employer ceases to do business:

9.7.4.1 The successor employer shall receive and retain all dive and employee medical records required by this standard; or

9.7.4.2 If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health, Education and Welfare.