

Chapter 296-37 WAC
STANDARDS FOR COMMERCIAL DIVING OPERATIONS

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WAC

296-37-510 Scope and application.
296-37-512 Variance and procedure.
296-37-515 Definitions.
296-37-520 Qualifications of dive team.
296-37-525 Medical requirements.
296-37-530 Safe practices manual.
296-37-535 Pre-dive procedures.
296-37-540 Procedures during dive.
296-37-545 Post-dive procedures.
296-37-550 Scuba diving.
296-37-555 Surface-supplied air diving.
296-37-560 Mixed-gas diving.
296-37-565 Liveboating.
296-37-570 Equipment.
296-37-575 Recordkeeping requirements.
296-37-580 Reserved.
296-37-585 Appendix A to chapter 296-37 WAC—Examples of conditions which may restrict or limit exposure to hyperbaric conditions.
296-37-590 Appendix B to chapter 296-37 WAC—Guidelines for scientific diving.
296-37-595 Appendix C to chapter 296-37 WAC—Alternative conditions under WAC 296-37-510(7) for recreational diving instructors and diving guides.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-37-010 Scope and application. [Section I, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-020 Purpose. [Section II, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-030 Definitions. [Section III, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-040 Appointment and duties of committees. [Section IV, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-050 Classification of apparatus permitted and air purity. [Section V, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-060 Approval of equipment. [Section VI, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-070 Diver registration—Diver training or experience—Physical exam and medical history record. [Section VII, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-071 Form # 1. [Form # 1, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-072 Form # 2. [Form # 2, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-080 General requirements, procedures and techniques. [Section VIII, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-081 Form # 3. [Form # 3, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-082 Illustrations of flags and shapes. [Illustrations, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-090 Recompression chamber—Tables—Attendant. [Section IX, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-100 Identification. [Section X, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-110 Waiver or variance. [Section XI, effective 2/1/64.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-300 Use of compressors in diving operations. [Rule 101, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-310 Equipment requirements—Divers air line, check valves, etc. [Rules 102 and 103, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-320 Equipment requirements—Barge operations. [Rule 104, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-330 Equipment requirements—Air tools used in underwater operations. [Rule 105, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-340 Equipment requirements—Inspection. [Rule 106, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-350 Safety rules—Generally. [Rule 107, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-360 Safety rules—Suggestions made by diver considered rule to govern. [Rule 108, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-370 Conditions on barge deck. [Rule 109, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-380 Use of two-way telephones. [Rule 110, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-390 Decompression chamber—When used. [Rule 111, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-395 Special stipulation regarding inexperienced divers and workmen. [Rule 112, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-400 Special stipulation regarding inexperienced divers and workmen—Diver may choose tender. [Rule 113, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-410 Judgment of diver to take precedent. [Rule 114, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-420 Requirement on all ship surveys. [Rule 115, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-430 Use of flood lights. [Rule 116, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-440 Rules for compressed air operations applicable to diving operations. [Rule 117, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-450 Availability of life preservers. [Rule 118, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

296-37-460 Care and replacement of equipment. [Rules 119 and 120, filed 3/23/60.] Repealed by WSR 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

WAC 296-37-510 Scope and application. (1) The requirements included in this vertical chapter shall apply throughout the state wherever diving takes place within the jurisdiction of the department of labor and industries. These requirements shall also be applicable to those diving related and supportive work activities not at the diving site but which have a direct effect on the safety of the diving operations. Examples may include but are not limited to: The supply of breathing air or gas; the supply of materials, equipment or supplies required by this chapter; the maintenance of diving equipment.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(a) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

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

(c) Governed by 45 C.F.R. Part 46 (Protection of Human Subjects, United States Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(d) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(i) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(ii) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) This chapter shall augment the requirements of the general safety and health standard, chapter 296-24 WAC, the general occupational health standard, chapter 296-62 WAC, and safety and health core rules, chapter 296-800 WAC. In instances where this chapter is in direct conflict with the requirements of any general horizontal standard, the requirements of this chapter shall apply.

(4) Hoisting gear used in diving operations shall be inspected and certified as required by chapter 296-56 WAC, safety standards for longshore, stevedore and related waterfront operations.

(5) Application 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:

(a) Notifies the assistant director of the department of labor and industries in Olympia or the regional administrator for the region 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

(b) Upon request from the authority notified, submits such information in writing.

(6) Employer obligation. The employer shall be responsible for compliance with:

(a) All provisions of this standard of general applicability; and

(b) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

(7) Alternative requirements for recreational diving instructors and diving guides. Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by WAC 296-37-545 (2)(b) and (3)(c)(iii), and WAC 296-37-560 (2)(a) when they meet all of the following conditions:

(a) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(b) The instructor or guide is diving within the no-decompression limits in these operations;

(c) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(d) The instructor or guide is using an open-circuit, semiclosed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(e) The employer of the instructor or guide is complying with all requirements of Appendix C of this subpart.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 04-18-078, § 296-37-510, filed 8/31/04, effective 11/1/04. Statutory Authority: RCW 49.17.010, [49.17].040, and [49.17].050. WSR 01-11-038, § 296-37-510, filed 5/9/01, effective 9/1/01. Statutory Authority: Chapter 49.17 RCW. WSR 94-15-096 (Order 94-07), § 296-37-510, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-510, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 87-02-002 (Order 86-44), § 296-37-510, filed 12/26/86; WSR 81-07-048 (Order 81-4), § 296-37-510, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-510, filed 10/2/78.]

WAC 296-37-512 Variance and procedure. Realizing that conditions may exist in operations under which certain state standards will not have practical application, the director of the department of labor and industries or his/her authorized representative may, pursuant to this section, RCW 49.17.080 and/or 49.17.090 and appropriate administrative rules of this state and the department of labor and industries and upon receipt of application and after adequate investigation by the department, permit a variation from these requirements when other means of providing an equivalent measure of protection are afforded. Such variation granted shall be limited to the particular case or cases covered in the application for variance and may be revoked for cause. The permit for variance shall be conspicuously posted on the premises and shall remain posted during the time it is in effect. All requests for variances from safety and health standards included in this or any other chapter of Title 296 WAC, shall be made in writing to the director of the department of labor and industries at Olympia, Washington, or his/her duly authorized representative, or the assistant director, Department of Labor and Industries, P.O. Box 44600, Olympia, Washington 98504-4600. Variance application forms may be obtained from the department upon request.

[Statutory Authority: Chapter 49.17 RCW. WSR 94-15-096 (Order 94-07), § 296-37-512, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-512, filed 10/2/78.]

WAC 296-37-515 Definitions. As used in this standard, the listed terms are defined as follows:

- (1) "Acfm": Actual cubic feet per minute.
- (2) "ASME Code or equivalent": ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an

equivalent code which the employer can demonstrate to be equally effective.

(3) "ATA": Atmosphere absolute.

(4) "Bell": An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

(5) "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 ascent.

(6) "Bursting pressure": The pressure at which a pressure containment device would fail structurally.

(7) "Cylinder": A pressure vessel for the storage of gases.

(8) "Recompression/decompression chamber": A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

(9) "Decompression sickness": A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

(10) "Recompression/decompression table": A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

(11) "Dive-guiding operations": The leading of groups of trained sports divers, who use open-circuit, semiclosed-circuit, or closed-circuit SCUBA, to local undersea diving locations for recreational purposes.

(12) "Dive location": A surface or vessel from which a diving operation is conducted.

(13) "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 the planned decompression.

(14) "Dive team": Divers and support employees involved in a diving operation, including the designated person-in-charge.

(15) "Diver": An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

(16) "Diver-carried reserve breathing gas": A diver-carried 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 a standby diver.

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

(18) "Fsw": Feet of seawater (or equivalent static pressure head).

(19) "Heavy gear": Diver-worn deep-sea dress including helmet, breastplate, dry suit, weighted shoes.

(20) "Hyperbaric conditions": Pressure conditions in excess of surface pressure.

(21) "Inwater stage": A suspended underwater platform which supports a diver in the water.

(22) "Liveboating": The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

(23) "Mixed-gas diving": A diving mode in which the diver is supplied in the water with a breathing gas other than air.

(24) "No-decompression limits": The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives," U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

(25) "Psi(g)": Pounds per square inch (gauge).

(26) "Recreational diving instruction": The training of diving students in the use of recreational diving procedures and the safe operation of diving equipment, including open-circuit, semiclosed-circuit, or closed-circuit SCUBA during dives.

(27) "Scientific diving" means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

(28) "SCUBA diving": A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

(29) "Standby diver": A diver at the dive location properly equipped and available to assist a diver in the water.

(30) "Surface-supplied air diving": A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

(31) "Treatment table": A depth-time and breathing gas profile designed to treat decompression sickness.

(32) "Umbilical": The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

(33) "Volume tank": A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

(34) "Working pressure": The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 04-18-078, § 296-37-515, filed 8/31/04, effective 11/1/04. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-515, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 87-02-002 (Order 86-44), § 296-37-515, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-515, filed 10/2/78.]

WAC 296-37-520 Qualifications of dive team. (1) General.

(a) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(b) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode; and

(iii) Diving operations and emergency procedures.

(c) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(d) 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.

(2) Assignments.

(a) Each dive team member shall be assigned tasks in accordance with the employee's experience 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.

(b) 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.

(c) 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) Designated person-in-charge.

(a) 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.

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

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-520, filed 10/2/78.]

WAC 296-37-525 Medical requirements. (1) General.

(a) 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.

(b) 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.

(c) All medical examinations required by this standard shall be performed by, or under the direction of, a physician at no cost to the employee.

(2) Frequency of medical examinations. Medical examinations shall be provided:

(a) 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;

(b) At one year intervals from the date of initial examination or last equivalent examination; and

(c) After an injury or illness requiring in-patient hospitalization.

(3) Information provided to examining physician. The employer shall provide the following information to the examining physician:

(a) A copy of the medical requirements of this standard; and

(b) 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) Content of medical examinations.

(a) Medical examinations conducted initially and annually shall consist of the following:

- (i) Medical history;
- (ii) Diving-related work history;
- (iii) Basic physical examination;
- (iv) The tests required by Table I; and
- (v) Any additional tests the physician considers necessary.

(b) Medical examinations conducted after an injury or illness requiring in-patient hospitalization shall be appropriate to the nature and extent of the injury or illness as determined by the examining physician.

TABLE I

TESTS FOR DIVING MEDICAL EXAMINATION

Test	Initial Examination	Annual Reexamination
Chest X-ray.....	x	
Visual acuity.....	x	x
Color blindness....	x	
EKG: Standard 12L ¹		
Hearing test.....	x	x
Hematocrit or hemoglobin.....	x	x
Sickle cell index...	x	
White blood count.....	x	x
Urinalysis.....	x	x

¹ To be given to the employee once, at age 35 or over.

(5) Physician's written report.

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

- (i) The results of the medical examination; and
- (ii) 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 WAC 296-37-585).

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

(6) Determination of employee fitness.

(a) 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 in the examining physician's report.

(b) If the examining physician has recommended a restriction or limitation on the dive team member's exposure to hyperbaric conditions, and the affected employee does not concur, a second physician selected by the employee shall render a medical opinion on the nature and extent of the restriction or limitation, if any.

(c) If the recommendation of the second opinion differs from that of the examining (first) physician, and if the employer and employee are unable to agree on the nature and extent of the restriction or

limitation, an opinion from a third physician selected by the first two physicians shall be obtained. The employer's determination of the dive team member's fitness shall be consistent with the medical opinion of the third physician, unless the employer and employee reach an agreement which is otherwise consistent with the recommendation or opinion of at least two of the physicians involved.

(d) Nothing in this procedure shall be construed to prohibit either a dive team member from accepting, or an employer from offering, an assignment which is otherwise consistent with at least one medical opinion while a final determination on the employee's fitness is pending.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 09-01-158, § 296-37-525, filed 12/23/08, effective 3/1/09. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-525, filed 10/2/78.]

WAC 296-37-530 Safe practices manual. (1) General. The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(2) Contents.

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

(b) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-530, filed 10/2/78.]

WAC 296-37-535 Pre-dive procedures. (1) General. The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(2) Emergency aid. A list shall be kept at the dive location of the telephone or call numbers of the following:

(a) An operational decompression chamber (if not at the dive location);

(b) Accessible hospitals;

(c) Available physicians;

(d) Available means of transportation; and

(e) The nearest U.S. Coast Guard Rescue Coordination Center.

(3) First-aid supplies.

(a) A first-aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(b) When used in a decompression chamber or bell, the first-aid kit shall be suitable for use under hyperbaric conditions.

(c) In addition to any other first-aid supplies, an American Red Cross standard first-aid handbook or equivalent, and a bag-type manual

resuscitator with transparent mask and tubing shall be available at the dive location.

(4) Planning and assessment. Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

- (a) Diving mode;
- (b) Surface and underwater conditions and hazards;
- (c) Breathing gas supply (including reserves);
- (d) Thermal protection;
- (e) Diving equipment and systems;
- (f) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);
- (g) Repetitive dive designation or residual inert gas status of dive team members;
- (h) Decompression and treatment procedures (including altitude corrections); and
- (i) Emergency procedures.

(5) Hazardous activities. 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.

(6) Employee briefing.

(a) Dive team members shall be briefed on:

- (i) The tasks to be undertaken;
- (ii) Safety procedures for the diving mode;
- (iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and
- (iv) Any modifications to operating procedures necessitated by the specific diving operation.

(b) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(7) Equipment inspection. The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(8) Warning signal. When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-535, filed 10/2/78.]

WAC 296-37-540 Procedures during dive. (1) General. The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(2) Water entry and exit.

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

(b) The means provided for exiting the water shall extend below the water surface.

- (c) A means shall be provided to assist an injured diver from the water or into a bell.
- (3) Communications.
 - (a) An operational two-way voice communication system shall be used between:
 - (i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and
 - (ii) The bell and the dive location.
 - (b) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.
- (4) Decompression tables. Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.
- (5) Dive profiles. A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.
- (6) Hand-held power tools and equipment.
 - (a) Hand-held electrical tools and equipment shall be deenergized before being placed into or retrieved from the water.
 - (b) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.
- (7) Welding and burning.
 - (a) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:
 - (i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and
 - (ii) Kept in the open position except when the diver is welding or burning.
 - (b) The welding machine frame shall be grounded.
 - (c) 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.
 - (d) Insulated gloves shall be provided to divers performing welding and burning operations.
 - (e) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable 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.
- (8) Explosives.
 - (a) Employers shall transport, store, and use explosives in accordance with this section and applicable provisions of chapter 296-52 WAC.
 - (b) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.
 - (c) Explosives shall not be detonated while the diver is in the water.
- (9) Termination of dive. The working interval of a dive shall be terminated when:
 - (a) A diver requests termination;
 - (b) A diver fails to respond correctly to communications or signals from a dive team member;
 - (c) Communications are lost and can not be quickly reestablished between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or
 - (d) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-540, filed 10/2/78.]

WAC 296-37-545 Postdive procedures. (1) General. The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(2) Precautions.

(a) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

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

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(b) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(3) Recompression capability.

(a) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(b) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(c) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within five minutes of the dive location.

(d) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(e) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(f) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(4) Record of dive.

(a) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(b) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification);

and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(c) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

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

(ii) Description and results of treatment.

(5) Decompression procedure assessment. The employer shall:

(a) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(b) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(c) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-545, filed 10/2/78.]

WAC 296-37-550 Scuba diving. (1) General. Employers engaged in scuba diving shall comply with the following requirements, unless otherwise specified.

(2) Limits. SCUBA diving shall not be conducted:

(a) At depths deeper than 130 fsw;

(b) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(c) Against currents exceeding one knot unless line-tended; or

(d) In enclosed or physically confining spaces unless line-tended.

(3) Procedures.

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

(b) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(c) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces

and shall have positive means of communication with the diver or divers within the space.

(d) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(e) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-550, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 81-07-048 (Order 81-4), § 296-37-550, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-550, filed 10/2/78.]

WAC 296-37-555 Surface-supplied air diving. (1) General. Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(2) Limits.

(a) Surface-supplied air diving shall not be conducted 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.

(b) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(c) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(3) Procedures.

(a) Each diver shall be continuously tended while in the water.

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

(c) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(d) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(e) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(f) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be pro-

vided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-555, filed 10/2/78.]

WAC 296-37-560 Mixed-gas diving. (1) General. Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(2) Limits. Mixed-gas diving shall be conducted only when:

(a) A decompression chamber is ready for use at the dive location; and

(b) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(c) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(3) Procedures.

(a) A separate dive team member shall tend each diver in the water.

(b) A standby diver shall be available while a diver is in the water.

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

(d) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(e) Each diving operation shall have a dive-location reserve breathing gas supply.

(f) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(g) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(h) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(i) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-560, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-560, filed 10/2/78.]

WAC 296-37-565 Liveboating. (1) General. Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(2) Limits. Diving operations involving liveboating shall not be conducted:

(a) With an inwater decompression time of greater than 120 minutes;

(b) Using surface-supplied air 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;

(c) Using mixed gas at depths greater than 220 fsw;

(d) In rough seas which significantly impede diver mobility or work function; or

(e) In other than daylight hours.

(3) Procedures.

(a) The propeller of the vessel shall be stopped before the diver enters or exits the water.

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

(c) 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.

(d) A standby diver shall be available while a diver is in the water.

(e) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-565, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 87-02-002 (Order 86-44), § 296-37-565, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-565, filed 10/2/78.]

WAC 296-37-570 Equipment. (1) General.

(a) All employers shall comply with the following requirements, unless otherwise specified.

(b) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(2) Air compressor system.

(a) Compressors used to supply air to the diver shall 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) A compressor shall be constructed and situated so as to avoid entry of contaminated air into the air-supply system and shall be equipped with a suitable in-line particulate filter followed by a bed of activated charcoal and, if necessary, a moisture absorber to further assure breathing air quality. These filters should be placed before any receiver and after the discharge in the compressor. If an oil-lubricated compressor is used, it shall be equipped with a carbon monoxide alarm or an equally as effective alternative if approved by the department.

(i) If a carbon monoxide alarm is used, it shall be calibrated to activate at or below 10 parts per million carbon monoxide at least once per month. A calibration and maintenance log shall be kept and shall be available for review and copying by the director or his or her designee. The log shall identify the test method, date, time of test, results, and the name of the person performing the test. The log shall be retained for at least one year from the date of the test.

(ii) If the use of an alarm at the compressor will not effectively provide warning to the diver or tender of a carbon monoxide problem, a remote alarm or other means of warning the wearer shall be used.

(iii) Breathing air couplings shall be incompatible with outlets for nonrespirable plant air or other gas systems to prevent inadvertent servicing of air-line breathing apparatus with nonrespirable gases.

(c) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 10 ppm;

(ii) A level of carbon dioxide (CO₂) greater than 1,000 ppm;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(d) Compressor systems providing surface air to divers must have a low pressure warning device installed at the air purification system inlet to alert dive tenders of low air pressure.

The minimum alarm setting shall be 45 psi plus an additional 15 psi for each working atmosphere.

1 ATM = 33 fsw or 15 psi

2 ATM = 66 fsw or 30 psi

3 ATM = 99 fsw or 45 psi

4 ATM = 132 fsw or 60 psi

5 ATM = 165 fsw or 75 psi

6 ATM = 198 fsw or 90 psi

(e) The output of air compressor systems shall be tested for air purity every six months by means of samples taken at the connection to the distribution system, except that nonoil lubricated compressors need not be tested for oil mist.

(3) Breathing gas supply hoses.

(a) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to four times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(b) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(c) Umbilicals shall:

(i) Include a safety line which shall be attached in a manner to remove strain from the air supply hose;

(ii) Be marked in 10-foot increments to 100 feet beginning at the diver's end, and in 50 foot increments thereafter;

(iii) Be made of kink-resistant materials; and
(iv) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(4) Buoyancy control.

(a) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

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

(c) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(d) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(5) Compressed gas cylinders. Compressed gas cylinders shall:

(a) Be designed, constructed and maintained in accordance with the applicable provisions of WAC 296-24-295 and 296-24-940 of the General safety and health standards.

(b) Be stored in a ventilated area and protected from excessive heat;

(c) Be secured from falling; and

(d) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(6) Recompression/decompression chambers.

(a) Each recompression/decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(b) Each recompression/decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(c) Each recompression/decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25% oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(7) Gauges and timekeeping devices.

(a) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(b) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every six months, and when there is a discrepancy greater than two percent of full scale between any two equivalent gauges.

(c) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(d) A timekeeping device shall be available at each dive location.

(8) Masks and helmets.

(a) Surface-supplied air and mixed-gas masks and helmets shall have:

- (i) A nonreturn valve at the attachment point between helmet or mask and hose which shall close readily and positively; and
- (ii) An exhaust valve.
- (b) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.
- (9) Oxygen safety.
 - (a) Equipment used with oxygen or mixtures containing over forty percent by volume oxygen shall be designed for oxygen service.
 - (b) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent by volume oxygen shall be cleaned of flammable materials before use.
 - (c) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.
- (10) Weights and harnesses.
 - (a) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.
 - (b) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:
 - (i) A positive buckling device;
 - (ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and
 - (iii) A lifting point to distribute the pull force of the line over the diver's body.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 04-18-078, § 296-37-570, filed 8/31/04, effective 11/1/04. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-570, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 87-02-002 (Order 86-44), § 296-37-570, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-570, filed 10/2/78.]

WAC 296-37-575 Recordkeeping requirements. (1) Recording and reporting. The employer must comply with chapter 296-27 WAC for recording work-related injuries and illnesses and reporting to the department any work-related fatality, inpatient hospitalization, amputation, or the loss of an eye.

(2) Availability of records.

(a) Upon the request of the director of the department of labor and industries or his duly authorized designees, the employer shall make available for inspection and copying any record or document required by this standard.

(b) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the assistant director in accordance with chapter 296-802 WAC. Safe practices manuals (WAC 296-37-530), depth-time profiles (WAC 296-37-540), recording of dives (WAC 296-37-545), decompression procedure assessment evaluations (WAC 296-37-545), and records of hospitalizations (chapter 296-27 WAC) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (WAC

296-37-570) shall also be provided upon request to employees and their designated representatives.

(c) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (WAC 296-37-525) - Five years;

(ii) Safe practices manual (WAC 296-37-530) - Current document only;

(iii) Depth-time profile (WAC 296-37-540) - Until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording dive (WAC 296-37-545) one year, except five years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (WAC 296-37-545) - Five years;

(vi) Equipment inspections and testing records (WAC 296-37-570) - Current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (WAC 296-27-02107) - Five years.

(d) 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 and Human Services. The employer shall also comply with any additional requirements set forth in chapter 296-802 WAC.

[Statutory Authority: RCW 49.17.010, 49.17.040, and 49.17.050. WSR 15-11-066, § 296-37-575, filed 5/19/15, effective 7/1/15. Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060 and chapter 49.17 RCW. WSR 12-24-071, § 296-37-575, filed 12/4/12, effective 1/4/13. Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 08-05-012, § 296-37-575, filed 2/8/08, effective 4/1/08; WSR 07-03-163, § 296-37-575, filed 1/24/07, effective 4/1/07; WSR 04-10-026, § 296-37-575, filed 4/27/04, effective 8/1/04. Statutory Authority: RCW 49.17.010, [49.17].040, and [49.17].050. WSR 01-11-038, § 296-37-575, filed 5/9/01, effective 9/1/01. Statutory Authority: Chapter 49.17 RCW. WSR 94-15-096 (Order 94-07), § 296-37-575, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-575, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 87-02-002 (Order 86-44), § 296-37-575, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. WSR 81-18-029 (Order 81-21), § 296-37-575, filed 8/27/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-575, filed 10/2/78.]

WAC 296-37-580 Reserved.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-580, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-580, filed 10/2/78.]

WAC 296-37-585 Appendix A to chapter 296-37 WAC—Examples of conditions which may restrict or limit exposure to hyperbaric conditions. (1) The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

- (a) History of seizure disorder other than early febrile convulsions.
- (b) Malignancies (active) unless treated and without recurrence for five years.
- (c) Chronic inability to equalize sinus and/or middle ear pressure.
- (d) Cystic or cavitory disease of the lungs.
- (e) Impaired organ function caused by alcohol or drug use.
- (f) Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood altering drugs, or insulin).
- (i) Meniere's disease.
- (ii) Hemoglobinopathies.
- (iii) Obstructive or restrictive lung disease.
- (iv) Vestibular end organ destruction.
- (v) Pneumothorax.
- (vi) 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).
- (vii) Juxta-articular osteonecrosis.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-585, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. WSR 78-10-094 (Order 78-18), § 296-37-585, filed 10/2/78.]

WAC 296-37-590 Appendix B to chapter 296-37 WAC—Guidelines for scientific diving. This appendix contains guidelines that will be used in conjunction with WAC 296-37-510 (2) (e) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

- (1) The diving control board consists of a majority of active scientific divers and has autonomous and absolute authority over scientific diving program's operations.
- (2) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are nonproprietary.
- (3) The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- (4) Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. WSR 92-22-067 (Order 92-06), § 296-37-590, filed 10/30/92, effective 12/8/92.]

WAC 296-37-595 Appendix C to chapter 296-37 WAC—Alternative conditions under WAC 296-37-510(7) for recreational diving instructors and diving guides.

(Mandatory)

WAC 296-37-510(7) specifies that an employer of recreational diving instructors and diving guides (hereafter, "divers" or "employees") who complies with all of the conditions of this appendix need not provide a decompression chamber for these divers as required under WAC 296-37-545 (2)(b) and (3)(c) or WAC 296-37-560 (2)(a).

(1) Equipment requirements for rebreathers.

(a) The employer must ensure that each employee operates the rebreather (i.e., semiclosed-circuit and closed-circuit self-contained underwater breathing apparatuses (hereafter, "SCUBAs")) according to the rebreather manufacturer's instructions.

(b) The employer must ensure that each rebreather has a counterlung that supplies a sufficient volume of breathing gas to their divers to sustain the divers' respiration rates, and contains a baffle system and/or other moisture separating system that keeps moisture from entering the scrubber.

(c) The employer must place a moisture trap in the breathing loop of the rebreather, and ensure that:

(i) The rebreather manufacturer approves both the moisture trap and its location in the breathing loop; and

(ii) Each employee uses the moisture trap according to the rebreather manufacturer's instructions.

(d) The employer must ensure that each rebreather has a continuously functioning moisture sensor, and that:

(i) The moisture sensor connects to a visual (e.g., digital, graphic, analog) or auditory (e.g., voice, pure tone) alarm that is readily detectable by the diver under the diving conditions in which the diver operates, and warns the diver of moisture in the breathing loop in sufficient time to terminate the dive and return safely to the surface; and

(ii) Each diver uses the moisture sensor according to the rebreather manufacturer's instructions.

(e) The employer must ensure that each rebreather contains a continuously functioning CO₂ sensor in the breathing loop, and that:

(i) The rebreather manufacturer approves the location of the CO₂ sensor in the breathing loop;

(ii) The CO₂ sensor is integrated with an alarm that operates in a visual (e.g., digital, graphic, analog) or auditory (e.g., voice, pure tone) mode that is readily detectable by each diver under the diving conditions in which the diver operates; and

(iii) The CO₂ alarm remains continuously activated when the inhaled CO₂ level reaches and exceeds 0.005 atmospheres absolute (ATA).

(f) Before each day's diving operations, and more often when necessary, the employer must calibrate the CO₂ sensor according to the sensor manufacturer's instructions, and ensure that:

(i) The equipment and procedures used to perform this calibration are accurate to within 10% of a CO₂ concentration of 0.005 ATA or less;

(ii) The equipment and procedures maintain this accuracy as required by the sensor manufacturer's instructions; and

(iii) The calibration of the CO₂ sensor is accurate to within 10% of a CO₂ concentration of 0.005 ATA or less.

(g) The employer must replace the CO₂ sensor when it fails to meet the accuracy requirements specified in (f)(iii) of this subsection, and ensure that the replacement CO₂ sensor meets the accuracy requirements specified in (f)(iii) of this subsection before placing the rebreather in operation.

(h) As an alternative to using a continuously functioning CO₂ sensor, the employer may use a schedule for replacing CO₂-sorbent material provided by the rebreather manufacturer. The employer may use such a schedule only when the rebreather manufacturer has developed it according to the canister-testing protocol specified below in Condition 11, and must use the canister within the temperature range for which the manufacturer conducted its scrubber canister tests following that protocol. Variations above or below the range are acceptable only after the manufacturer adds that lower or higher temperature to the protocol.

(i) When using CO₂-sorbent replacement schedules, the employer must ensure that each rebreather uses a manufactured (i.e., commercially prepacked), disposable scrubber cartridge containing a CO₂-sorbent material that:

(i) Is approved by the rebreather manufacturer;

(ii) Removes CO₂ from the diver's exhaled gas; and

(iii) Maintains the CO₂ level in the breathable gas (i.e., the gas that a diver inhales directly from the regulator) below a partial pressure of 0.01 ATA.

(j) As an alternative to manufactured, disposable scrubber cartridges, the employer may fill CO₂ scrubber cartridges manually with CO₂-sorbent material when:

(i) The rebreather manufacturer permits manual filling of scrubber cartridges;

(ii) The employer fills the scrubber cartridges according to the rebreather manufacturer's instructions;

(iii) The employer replaces the CO₂-sorbent material using a replacement schedule developed under (h) of this subsection; and

(iv) The employer demonstrates that manual filling meets the requirements specified in (i) of this subsection.

(k) The employer must ensure that each rebreather has an information module that provides:

(i) A visual (e.g., digital, graphic, analog) or auditory (e.g., voice, pure tone) display that effectively warns the diver of solenoid failure (when the rebreather uses solenoids) and other electrical weaknesses or failures (e.g., low battery voltage);

(ii) For a semiclosed-circuit rebreather, a visual display for the partial pressure of CO₂, or deviations above and below a preset CO₂ partial pressure of 0.005 ATA; and

(iii) For a closed-circuit rebreather, a visual display for: Partial pressures of O₂ and CO₂, or deviations above and below a preset CO₂ partial pressure of 0.005 ATA and a preset O₂ partial pressure of

1.40 ATA or lower; gas temperature in the breathing loop; and water temperature.

(1) Before each day's diving operations, and more often when necessary, the employer must ensure that the electrical power supply and electrical and electronic circuits in each rebreather are operating as required by the rebreather manufacturer's instructions.

(2) Special requirements for closed-circuit rebreathers.

(a) The employer must ensure that each closed-circuit rebreather uses supply-pressure sensors for the O₂ and diluent (i.e., air or nitrogen) gases and continuously functioning sensors for detecting temperature in the inhalation side of the gas-loop and the ambient water.

(b) The employer must ensure that:

(i) At least two O₂ sensors are located in the inhalation side of the breathing loop; and

(ii) The O₂ sensors are: Functioning continuously; temperature compensated; and approved by the rebreather manufacturer.

(c) Before each day's diving operations, and more often when necessary, the employer must calibrate O₂ sensors as required by the sensor manufacturer's instructions. In doing so, the employer must:

(i) Ensure that the equipment and procedures used to perform the calibration are accurate to within 1% of the O₂ fraction by volume;

(ii) Maintain this accuracy as required by the manufacturer of the calibration equipment;

(iii) Ensure that the sensors are accurate to within 1% of the O₂ fraction by volume;

(iv) Replace O₂ sensors when they fail to meet the accuracy requirements specified in (c)(iii) of this subsection; and

(v) Ensure that the replacement O₂ sensors meet the accuracy requirements specified in (c)(iii) of this subsection before placing a rebreather in operation.

(d) The employer must ensure that each closed-circuit rebreather has:

(i) A gas-controller package with electrically operated solenoid O₂-supply valves;

(ii) A pressure-activated regulator with a second-stage diluent-gas addition valve;

(iii) A manually operated gas-supply bypass valve to add O₂ or diluent gas to the breathing loop; and

(iv) Separate O₂ and diluent-gas cylinders to supply the breathing-gas mixture.

(3) O₂ concentration in the breathing gas.

The employer must ensure that the fraction of O₂ in the nitrox breathing-gas mixture:

(a) Is greater than the fraction of O₂ in compressed air (i.e., exceeds 22% by volume);

(b) For open-circuit SCUBA, never exceeds a maximum fraction of breathable O₂ of 40% by volume or a maximum O₂ partial pressure of 1.40 ATA, whichever exposes divers to less O₂; and

(c) For a rebreather, never exceeds a maximum O₂ partial pressure of 1.40 ATA.

(4) Regulating O₂ exposures and diving depth.

(a) Regarding O₂ exposure, the employer must:

(i) Ensure that the exposure of each diver to partial pressures of O₂ between 0.60 and 1.40 ATA does not exceed the 24-hour single-ex-

posure time limits specified either by the *2001 National Oceanic and Atmospheric Administration Diving Manual* (the 2001 NOAA Diving Manual), or by the report entitled *Enriched Air Operations and Resource Guide* published in 1995 by the Professional Association of Diving Instructors (known commonly as the "1995 DSAT Oxygen Exposure Table"); and

(ii) Determine a diver's O₂-exposure duration using the diver's maximum O₂ exposure (partial pressure of O₂) during the dive and the total dive time (i.e., from the time the diver leaves the surface until the diver returns to the surface).

(b) Regardless of the diving equipment used, the employer must ensure that no diver exceeds a depth of 130 feet of sea water (fsw) or a maximum O₂ partial pressure of 1.40 ATA, whichever exposes the diver to less O₂.

(5) Use of no-decompression limits.

(a) For diving conducted while using nitrox breathing-gas mixtures, the employer must ensure that each diver remains within the no-decompression limits specified for single and repetitive air diving and published in the 2001 NOAA Diving Manual or the report entitled "Development and Validation of No-Stop Decompression Procedures for Recreational Diving: The DSAT Recreational Dive Planner," published in 1994 by Hamilton Research Ltd. (known commonly as the "1994 DSAT No-Decompression Tables").

(b) An employer may permit a diver to use a dive-decompression computer designed to regulate decompression when the dive-decompression computer uses the no-decompression limits specified in (a) of this subsection, and provides output that reliably represents those limits.

(6) Mixing and analyzing the breathing gas.

(a) The employer must ensure that:

(i) Properly trained personnel mix nitrox-breathing gases, and that nitrogen is the only inert gas used in the breathing-gas mixture; and

(ii) When mixing nitrox-breathing gases, they mix the appropriate breathing gas before delivering the mixture to the breathing-gas cylinders, using the continuous-flow or partial-pressure mixing techniques specified in the 2001 NOAA Diving Manual, or using a filter-membrane system.

(b) Before the start of each day's diving operations, the employer must determine the O₂ fraction of the breathing-gas mixture using an O₂ analyzer. In doing so, the employer must:

(i) Ensure that the O₂ analyzer is accurate to within 1% of the O₂ fraction by volume.

(ii) Maintain this accuracy as required by the manufacturer of the analyzer.

(c) When the breathing gas is a commercially supplied nitrox breathing-gas mixture, the employer must ensure that the O₂ meets the medical USP specifications (Type I, Quality Verification Level A) or aviator's breathing-oxygen specifications (Type I, Quality Verification Level E) of CGA G-4.3-2000 (Commodity Specification for Oxygen). In addition, the commercial supplier must:

(i) Determine the O₂ fraction in the breathing-gas mixture using an analytic method that is accurate to within 1% of the O₂ fraction by volume;

(ii) Make this determination when the mixture is in the charged tank and after disconnecting the charged tank from the charging apparatus;

(iii) Include documentation of the O₂-analysis procedures and the O₂ fraction when delivering the charged tanks to the employer.

(d) Before producing nitrox breathing-gas mixtures using a compressor in which the gas pressure in any system component exceeds 125 pounds per square inch (psi), the:

(i) Compressor manufacturer must provide the employer with documentation that the compressor is suitable for mixing high-pressure air with the highest O₂ fraction used in the nitrox breathing-gas mixture when operated according to the manufacturer's operating and maintenance specifications;

(ii) Employer must comply with (e) of this subsection, unless the compressor is rated for O₂ service and is oil-less or oil-free; and

(iii) Employer must ensure that the compressor meets the requirements specified in paragraphs (i)(1) and (i)(2) of § 1910.430 whenever the highest O₂ fraction used in the mixing process exceeds 40%.

(e) Before producing nitrox breathing-gas mixtures using an oil-lubricated compressor to mix high-pressure air with O₂, and regardless of the gas pressure in any system component, the:

(i) Employer must use only uncontaminated air (i.e., air containing no hydrocarbon particulates) for the nitrox breathing-gas mixture;

(ii) Compressor manufacturer must provide the employer with documentation that the compressor is suitable for mixing the high-pressure air with the highest O₂ fraction used in the nitrox breathing-gas mixture when operated according to the manufacturer's operating and maintenance specifications;

(iii) Employer must filter the high-pressure air to produce O₂-compatible air;

(iv) The filter-system manufacturer must provide the employer with documentation that the filter system used for this purpose is suitable for producing O₂-compatible air when operated according to the manufacturer's operating and maintenance specifications; and

(v) Employer must continuously monitor the air downstream from the filter for hydrocarbon contamination.

(f) The employer must ensure that diving equipment using nitrox breathing-gas mixtures or pure O₂ under high pressure (i.e., exceeding 125 psi) conforms to the O₂-service requirements specified in paragraphs (i)(1) and (i)(2) of § 1910.430.

(7) Emergency egress.

(a) Regardless of the type of diving equipment used by a diver (i.e., open-circuit SCUBA or rebreathers), the employer must ensure that the equipment contains (or incorporates) an open-circuit emergency-egress system (a "bail-out" system) in which the second stage of the regulator connects to a separate supply of emergency breathing gas, and the emergency breathing gas consists of air or the same nitrox breathing-gas mixture used during the dive.

(b) As an alternative to the "bail-out" system specified in (a) of this subsection, the employer may use:

(i) For open-circuit SCUBA, an emergency-egress system as specified in § 1910.424 (c)(4); or

(ii) For a semiclosed-circuit and closed-circuit rebreather, a system configured so that the second stage of the regulator connects to a reserve supply of emergency breathing gas.

(c) The employer must obtain from the rebreather manufacturer sufficient information to ensure that the bail-out system performs reliably and has sufficient capacity to enable the diver to terminate the dive and return safely to the surface.

(8) Treating diving-related medical emergencies.

(a) Before each day's diving operations, the employer must:

(i) Verify that a hospital, qualified health care professionals, and the nearest Coast Guard Coordination Center (or an equivalent rescue service operated by a state, county, or municipal agency) are available to treat diving-related medical emergencies;

(ii) Ensure that each dive site has a means to alert these treatment resources in a timely manner when a diving-related medical emergency occurs; and

(iii) Ensure that transportation to a suitable decompression chamber is readily available when no decompression chamber is at the dive site, and that this transportation can deliver the injured diver to the decompression chamber within four hours travel time from the dive site.

(b) The employer must ensure that portable O₂ equipment is available at the dive site to treat injured divers. In doing so, the employer must ensure that:

(i) The equipment delivers medical-grade O₂ that meets the requirements for medical USP oxygen (Type I, Quality Verification Level A) of CGA G-4.3-2000 (Commodity Specification for Oxygen);

(ii) The equipment delivers this O₂ to a transparent mask that covers the injured diver's nose and mouth; and

(iii) Sufficient O₂ is available for administration to the injured diver from the time the employer recognizes the symptoms of a diving-related medical emergency until the injured diver reaches a decompression chamber for treatment.

(c) Before each day's diving operations, the employer must:

(i) Ensure that at least two attendants, either employees or non-employees, qualified in first-aid and administering O₂ treatment, are available at the dive site to treat diving-related medical emergencies; and

(ii) Verify their qualifications for this task.

(9) Diving logs and no-decompression table.

(a) Before starting each day's diving operations, the employer must:

(i) Designate an employee or a nonemployee to make entries in a diving log; and

(ii) Verify that this designee understands the diving and medical terminology, and proper procedures, for making correct entries in the diving log.

(b) The employer must:

(i) Ensure that the diving log conforms to the requirements specified by paragraph (d) (Record of dive) of § 1910.423; and

(ii) Maintain a record of the dive according to § 1910.440 (Recordkeeping requirements).

(c) The employer must ensure that a hard copy of the no-decompression tables used for the dives (as specified in subsection (6)(a) of this section) is readily available at the dive site, whether or not the divers use dive-decompression computers.

(10) Diver training.

The employer must ensure that each diver receives training that enables the diver to perform work safely and effectively while using

open-circuit SCUBAs or rebreathers supplied with nitrox breathing-gas mixtures. Accordingly, each diver must be able to demonstrate the ability to perform critical tasks safely and effectively, including, but not limited to: Recognizing the effects of breathing excessive CO₂ and O₂; taking appropriate action after detecting excessive levels of CO₂ and O₂; and properly evaluating, operating, and maintaining their diving equipment under the diving conditions they encounter.

(11) Testing protocol for determining the CO₂ limits of rebreather canisters.

(a) The employer must ensure that the rebreather manufacturer has used the following procedures for determining that the CO₂-sorber material meets the specifications of the sorber material's manufacturer:

(i) The North Atlantic Treating Organization CO₂ absorbent-activity test;

(ii) The RoTap shaker and nested-sieves test;

(iii) The Navy Experimental Diving Unit (NEDU)-derived Schlegel test; and

(iv) The NEDU MeshFit software.

(b) The employer must ensure that the rebreather manufacturer has applied the following canister-testing materials, methods, procedures, and statistical analyses:

(i) Use of a nitrox breathing-gas mixture that has an O₂ fraction maintained at 0.28 (equivalent to 1.4 ATA of O₂ at 130 fsw, the maximum O₂ concentration permitted at this depth);

(ii) While operating the rebreather at a maximum depth of 130 fsw, use of a breathing machine to continuously ventilate the rebreather with breathing gas that is at 100% humidity and warmed to a temperature of 98.6 degrees F (37 degrees C) in the heating-humidification chamber;

(iii) Measurement of the O₂ concentration of the inhalation breathing gas delivered to the mouthpiece;

(iv) Testing of the canisters using the three ventilation rates listed in Table I below (with the required breathing-machine tidal volumes and frequencies, and CO₂-injection rates, provided for each ventilation rate):

Table I — Canister Testing Parameters

Ventilation rates (Lpm, ATPS ⁽¹⁾)	Breathing machine tidal volumes (L)	Breathing machine frequencies (breaths per min.)	CO ₂ injection rates (Lpm, STPD ⁽²⁾)
22.5	1.5	15	0.90
40.0	2.0	20	1.35
62.5	2.5	25	2.25

(1) ATPS means ambient temperature and pressure, saturated with water.

(2) STPD means standard temperature and pressure, dry; the standard temperature is 32 degrees F (0 degrees C).

(v) When using a work rate (i.e., breathing-machine tidal volume and frequency) other than the work rates listed in the table above, addition of the appropriate combinations of ventilation rates and CO₂-injection rates;

(vi) Performance of the CO₂ injection at a constant (steady) and continuous rate during each testing trial;

(vii) Determination of canister duration using a minimum of four water temperatures, including 40, 50, 70, and 90 degrees F (4.4, 10.0, 21.1, and 32.2 degrees C, respectively);

(viii) Monitoring of the breathing-gas temperature at the rebreather mouthpiece (at the "chrome T" connector), and ensuring that this temperature conforms to the temperature of a diver's exhaled breath at the water temperature and ventilation rate used during the testing trial;⁽¹⁾

(ix) Implementation of at least eight testing trials for each combination of temperature and ventilation-CO₂-injection rates (for example, eight testing trials at 40 degrees F using a ventilation rate of 22.5 Lpm at a CO₂-injection rate of 0.90 Lpm);

(x) Allowing the water temperature to vary no more than 2.0 degrees F (1.0 degree C) *between* each of the eight testing trials, and no more than 1.0 degree F (0.5 degree C) within each testing trial;

(xi) Use of the average temperature for each set of eight testing trials in the statistical analysis of the testing-trial results, with the testing-trial results being the time taken for the inhaled breathing gas to reach 0.005 ATA of CO₂ (i.e., the canister-duration results);

(xii) Analysis of the canister-duration results using the repeated-measures statistics described in NEDU Report 2-99;

(xiii) Specification of the replacement schedule for the CO₂-sorbent materials in terms of the lower prediction line (or limit) of the 95% confidence interval; and

(xiv) Derivation of replacement schedules only by interpolating among, but not by extrapolating beyond, the depth, water temperatures, and exercise levels used during canister testing.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 04-18-078, § 296-37-595, filed 8/31/04, effective 11/1/04.]